Report No. 010920-01

Automatic Dependent Surveillance – Broadcast (ADS-B)

Final Draft

Design Analysis Report: ADS-B Preliminary Hazard Analysis

Preliminary Hazard Analysis Tables

August 21, 2001

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II A. High Risk Hazard Scenarios

II.A.1 Catastrophic/Extremely Remote (1C)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
181	**SR-01**	Loss of separation assurance and collision during terminal approach due to intentional security intrusion, i.e., intentional "jamming" of ADS-B signal.	Intentional "jamming" of ADS-B signal. Aircraft on collision course.	Pilot/flight crew loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. See and avoid unsuccessful.	Terminal Approach	Loss of separation assurance results in collision.	1C	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 9c Require alternate means of detecting other aircraft, e.g., TCAS, ATC warning, etc. 2a Require warning lights on other aircraft to enhance "see and avoid" separation. 16 Design ADS-B system to minimize the risk of security intrusion, including detectability, auditing and software protection. 15 Provide message authority verification in the design.
182	SR-01.1	Loss of separation assurance and collision during terminal approach due to intentional security intrusion, i.e., intentional "jamming" of ADS-B signal.	Intentional "jamming" of ADS-B signal. Aircraft on collision course.	Pilot/flight crew loss of situational awareness. Aircraft identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Terminal Approach	Loss of separation assurance results in collision.	1C	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 9c Require alternate means of detecting other aircraft, e.g., TCAS, ATC warning, etc. 2a Require warning lights on other aircraft to enhance "see and avoid" separation 16 Design ADS-B system to minimize the risk of security intrusion, including detectability, auditing and software protection. 15 Provide message authority verification in the design.

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Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
183	SR-01.2	Loss of separation assurance and collision during terminal approach due to intentional security intrusion, i.e., intentional "jamming" of ADS-B signal.	Intentional "jamming" of ADS-B signal. Aircraft on collision course.	Pilot/flight crew loss of situational awareness. Aircraft identified via radar or other sources. ATCT does communicate warning in time. However pilots/ aircrew are unable to respond in time.	Terminal Approach	Loss of separation assurance results in collision.	1C	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 9c Require alternate means of detecting other aircraft, e.g., TCAS, ATC warning, etc. 2a Require warning lights on other aircraft to enhance "see and avoid" separation 16 Design ADS-B system to minimize the risk of security intrusion, including detectability, auditing and software protection. 15 Provide message authority verification in the design.
188	**SR-02**	Loss of separation assurance and collision due to "spoofing", i.e., hackers breach system security.	"Spoofing", i.e., hackers breach system security. Aircraft on collision course.	Pilot/flight crew loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Loss of separation assurance results in collision.	1C	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 9c Require alternate means of detecting other aircraft, e.g., TCAS, ATC warning, etc. 2a Require warning lights on other aircraft to enhance "see and avoid" separation 16 Design ADS-B system to minimize the risk of security intrusion, including detectability, auditing and software protection. 15 Provide message authority verification in the design.

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Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
189	SR-02.1	Loss of separation assurance and collision due to "spoofing", i.e., hackers breach system security.	"Spoofing", i.e., hackers breach system security. Aircraft on collision course.	Pilot/flight crew loss of situational awareness. Aircraft identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Loss of separation assurance results in collision.	1C	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 9c Require alternate means of detecting other aircraft, e.g., TCAS, ATC warning, etc. 2a Require warning lights on other aircraft to enhance "see and avoid" separation 16 Design ADS-B system to minimize the risk of security intrusion, including detectability, auditing and software protection. 15 Provide message authority verification in the design.
190	SR-02.2	Loss of separation assurance and collision due to "spoofing", i.e., hackers breach system security.	"Spoofing", i.e., hackers breach system security. Aircraft on collision course.	Pilot/flight crew loss of situational awareness. Aircraft identified via radar or other sources. ATCT does communicate warning in time. However pilots/ aircrew are unable to respond in time.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Loss of separation assurance results in collision.	1C	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 9c Require alternate means of detecting other aircraft, e.g., TCAS, ATC warning, etc. 2a Require warning lights on other aircraft to enhance "see and avoid" separation 16 Design ADS-B system to minimize the risk of security intrusion, including detectability, auditing and software protection. 15 Provide message authority verification in the design.

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Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
195	**HF-01**	Possible increased collision risk due to excessive controller workload, loss of situation awareness associated with excessive display clutter.	Loss of situation awareness associated with excessive display clutter as a result of: LTA design SW malfunction HW malfunction System malfunction. Increased collision risk due to excessive controller workload. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1C	6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1. 17 Human factors shall evaluate the potential controller loss of situational awareness due to excessive workload. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 16N Define criteria for determining threshold values for ADS-B coverage area to assure controller/pilot adequate situational awareness. 17N Conduct controller/pilot workload assessments to evaluate the potential for excessive workload associated with ADS-B system.

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Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
196	HF-01.1	Possible increased collision risk due to excessive controller workload, loss of situation awareness associated with excessive display clutter.	Loss of situation awareness associated with excessive display clutter as a result of: LTA design SW malfunction HW malfunction System malfunction. Increased collision risk due to excessive controller workload. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1C	6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1. 17 Human factors shall evaluate the potential controller loss of situational awareness due to excessive workload. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 16N Define criteria for determining threshold values for ADS-B coverage area to assure controller/pilot adequate situational awareness. 17N Conduct controller/pilot workload assessments to evaluate the potential for excessive workload associated with ADS-B system.

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Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
197	HF-01.2	Possible increased collision risk due to excessive controller workload, loss of situation awareness associated with excessive display clutter.	Loss of situation awareness associated with excessive display clutter as a result of: LTA design SW malfunction HW malfunction System malfunction. Increased collision risk due to excessive controller workload. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does communicate warning in time. However pilots/ aircrew are unable to respond in time.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1C	6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1. 17 Human factors shall evaluate the potential controller loss of situational awareness due to excessive workload. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 16N Define criteria for determining threshold values for ADS-B coverage area to assure controller/pilot adequate situational awareness. 17N Conduct controller/pilot workload assessments to evaluate the potential for excessive workload associated with ADS-B system.

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202	**HF-02**	Increased collision risk due to pilot workload, loss of situation awareness associated with excessive display clutter, i.e., and too much information.	Excessive display clutter, i.e., and too much information due to LTA design. Increased collision risk due to excessive pilot workload associated with excessive display clutter. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1C	6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1. 17 Human factors shall evaluate the potential controller loss of situational awareness due to excessive workload. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 16N Define criteria for determining threshold values for ADS-B coverage area to assure controller/pilot adequate situational awareness. 17N Conduct controller/pilot workload assessments to evaluate the potential for excessive workload associated with ADS-B system.

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203	HF-02.1	Increased collision risk due to pilot workload, loss of situation awareness associated with excessive display clutter, i.e., and too much information.	Excessive display clutter, i.e., and too much information due to LTA design. Increased collision risk due to excessive pilot workload associated with excessive display clutter. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1C	6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1. 17 Human factors shall evaluate the potential controller loss of situational awareness due to excessive workload. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 16N Define criteria for determining threshold values for ADS-B coverage area to assure controller/pilot adequate situational awareness. 17N Conduct controller/pilot workload assessments to evaluate the potential for excessive workload associated with ADS-B system.

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Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
204	HF-02.2	Increased collision risk due to pilot workload, loss of situation awareness associated with excessive display clutter, i.e., and too much information.	Excessive display clutter, i.e., and too much information due to LTA design. Increased collision risk due to excessive pilot workload associated with excessive display clutter. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does communicate warning in time. However pilots/ aircrew are unable to respond in time.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1C	6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1. 17 Human factors shall evaluate the potential controller loss of situational awareness due to excessive workload. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 16N Define criteria for determining threshold values for ADS-B coverage area to assure controller/pilot adequate situational awareness. 17N Conduct controller/pilot workload assessments to evaluate the potential for excessive workload associated with ADS-B system.
219	**HF-03**	Loss of separation assurance and collision due to erroneous "future intent" messages, due pilot input error.	Erroneous "future intent" messages, due pilot input error. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1C	18 Design ADS-B CHI to minimize the potential for human error. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 16N Define criteria for determining threshold values for ADS-B coverage area to assure controller/pilot adequate situational awareness. 17N Conduct controller/pilot workload assessments to evaluate the potential for excessive workload associated with ADS-B system.

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Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
210	HF-03.1	Loss of separation assurance and collision due to erroneous "future intent" messages, due pilot input error.	Erroneous "future intent" messages, due pilot input error. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1C	18 Design ADS-B CHI to minimize the potential for human error. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 16N Define criteria for determining threshold values for ADS-B coverage area to assure controller/pilot adequate situational awareness. 17N Conduct controller/pilot workload assessments to evaluate the potential for excessive workload associated with ADS-B system.
211	HF-03.2	Loss of separation assurance and collision due to erroneous "future intent" messages, due pilot input error.	Erroneous "future intent" messages, due pilot input error. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does communicate warning in time. However pilots/ aircrew are unable to respond in time.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1C	18 Design ADS-B CHI to minimize the potential for human error. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 16N Define criteria for determining threshold values for ADS-B coverage area to assure controller/pilot adequate situational awareness. 17N Conduct controller/pilot workload assessments to evaluate the potential for excessive workload associated with ADS-B system.

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Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
215	**HF-04**	Inappropriate or erroneous communication due to language barrier results in loss of situational awareness and increased collision risk.	Inappropriate communication or erroneous communication associated with ADS-B due to: LTA design LTA procedure LTA consideration of language use. Miss communication occurs. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1C	70 Design ADS-B for use in international communication in accordance with acceptable human factors design practices (e.g., IACO standard symbology??) 75 Provide alternate means of communication, i.e., Voice backup. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS.
216	HF-04.1	Inappropriate or erroneous communication due to language barrier results in loss of situational awareness and increased collision risk.	Inappropriate communication or erroneous communication associated with ADS-B due to: LTA design LTA procedure LTA consideration of language use. Miss communication occurs. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1C	70 Design ADS-B for use in international communication in accordance with acceptable human factors design practices (e.g., IACO standard symbology??) 75 Provide alternate means of communication, i.e., Voice backup. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS.

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Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
217	HF-04.2	Inappropriate or erroneous communication due to language barrier results in loss of situational awareness and increased collision risk.	Inappropriate communication or erroneous communication associated with ADS-B due to: LTA design LTA procedure LTA consideration of language use. Miss communication occurs. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does communicate warning in time. However pilots/ aircrew are unable to respond in time.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1C	70 Design ADS-B for use in international communication in accordance with acceptable human factors design practices (e.g., IACO standard symbology??) 75 Provide alternate means of communication, i.e., Voice backup. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS.
222	**HF-05**	Inappropriate or erroneous communication due to language barrier results in loss of situational awareness and increased collision risk between aircraft and ground vehicle.	Inappropriate communication or erroneous communication associated with ADS-B due to: LTA design LTA procedure LTA consideration of language use. Miss communication occurs. Aircraft and ground vehicle on collision course.	Initial pilot/flight crew/controller/driver loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. See and avoid unsuccessful.	Airport surface, Emergency.	Collision	1C	70 Design ADS-B for use in international communication in accordance with acceptable human factors design practices (e.g., IACO standard symbology??) 75 Provide alternate means of communication, i.e., Voice backup. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 8N Require alternate means of detecting ground vehicles, i.e. ASDE-X. 7N Require all ground vehicles that can become hazards to ground navigation be equipped with ADS-B transmitters, or other appropriate means of identification.

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Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
223	HF-05.1	Inappropriate or erroneous communication due to language barrier results in loss of situational awareness and increased collision risk between aircraft and ground vehicle.	Inappropriate communication or erroneous communication associated with ADS-B due to: LTA design LTA procedure LTA consideration of language use. Miss communication occurs. Aircraft and ground vehicle on collision course.	Initial pilot/flight crew/controller/driver loss of situational awareness. Aircraft identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Airport surface, Emergency.	Collision	1C	70 Design ADS-B for use in international communication in accordance with acceptable human factors design practices (e.g., IACO standard symbology??) 75 Provide alternate means of communication, i.e., Voice backup. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 8N Require alternate means of detecting ground vehicles, i.e. ASDE-X. 7N Require all ground vehicles that can become hazards to ground navigation be equipped with ADS-B transmitters, or other appropriate means of identification.
224	HF-05.2	Inappropriate or erroneous communication due to language barrier results in loss of situational awareness and increased collision risk between aircraft and ground vehicle.	Inappropriate communication or erroneous communication associated with ADS-B due to: LTA design LTA procedure LTA consideration of language use. Miss communication occurs. Aircraft and ground vehicle on collision course.	Initial pilot/flight crew/controller/driver loss of situational awareness. Aircraft identified via radar or other sources. ATCT does communicate warning in time. However pilots/ aircrew are unable to respond in time.	Airport surface, Emergency.	Collision	1C	70 Design ADS-B for use in international communication in accordance with acceptable human factors design practices (e.g., IACO standard symbology??) 75 Provide alternate means of communication, i.e., Voice backup. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 8N Require alternate means of detecting ground vehicles, i.e. ASDE-X. 7N Require all ground vehicles that can become hazards to ground navigation be equipped with ADS-B transmitters, or other appropriate means of identification.

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799	**ILIS.01**	Unidentified aircraft intruder enters ADS-B airspace and poses collision risk.	Unidentified aircraft intruder enters ADS-B airspace. Aircraft on collision course.	Pilot/flight crew loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1C	7 Provide for appropriate ATC/Aircrew contingency procedures. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 44N Design and integrate ADS-B to enable (TBD) aircraft intruder detection within NAS.
801	**ILIS.02**	Incremental risks not adequately addressed presents increased risk of accident.	Incremental risks not adequately addressed: LTA design LTA analysis LTA risk assessment LTA risk management Oversight and omissions. Aircraft on collision course.	Pilot/flight crew loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1C	40N Apply risk-based approach in the determination of resources associated with ADS-B implementation throughout the NAS, in order to assure ADS-B coverage priority in higher risk airspace. 7 Provide for appropriate ATC/Aircrew contingency procedures. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 45N Conduct analysis, studies, simulations and/or flight tests to develop engineering requirements to eliminate or control the ADS-B system risks to an acceptable level.

Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
802	**ILIS.03**	Mixed-equipage airspace presents confusion and loss of situational awareness to controllers.	Mixed-equipage airspace. Aircraft on collision course. Confusion and loss of situational awareness of controller due to: LTA design LTA analysis LTA risk assessment LTA risk management Oversight and omissions.	Pilot/flight crew loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1C	40N Apply risk-based approach in the determination of resources associated with ADS-B implementation throughout the NAS, in order to assure ADS-B coverage priority in higher risk airspace. 7 Provide for appropriate ATC/Aircrew contingency procedures. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 45N Conduct analysis, studies, simulations and/or flight tests to develop engineering requirements to eliminate or control the ADS-B system risks to an acceptable level. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS.
803	ILIS.03.1	Mixed-equipage airspace presents confusion and loss of situational awareness to pilots/aircrew.	Mixed-equipage airspace. Aircraft on collision course. Confusion and loss of situational awareness pilot/aircrew due to: LTA design LTA analysis LTA risk assessment LTA risk management Oversight and omissions.	Pilot/flight crew loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1C	40N Apply risk-based approach in the determination of resources associated with ADS-B implementation throughout the NAS, in order to assure ADS-B coverage priority in higher risk airspace. 7 Provide for appropriate ATC/Aircrew contingency procedures. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 45N Conduct analysis, studies, simulations and/or flight tests to develop engineering requirements to eliminate or control the ADS-B system risks to an acceptable level. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
805	**ILIS.05**	Unsuccessful conflict resolution between controllers and pilots results in increased collision risks.	Unsuccessful conflict resolution between controllers and pilots due to: LTA procedures Human error Miscommunication Loss of situational awareness. Aircraft on collision course.	Pilot/flight crew loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1C	7 Provide for appropriate ATC/Aircrew contingency procedures. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 45N Conduct analysis, studies, simulations and/or flight tests to develop engineering requirements to eliminate or control the ADS-B system risks to an acceptable level. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS.
806	**ILIS.06**	LTA visual identification of other aircraft by subject aircraft pilots/aircrew results in inappropriate communication with ATCT and increased collision risks.	LTA visual identification of other aircraft by subject aircraft pilots/aircrew due to: LTA procedure LTA design Human error Poor visability. Inappropriate communication occures betweeb pilot/aircraew and controller. Aircraft on collision course.	Pilot/flight crew loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1C	7 Provide for appropriate ATC/Aircrew contingency procedures. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 45N Conduct analysis, studies, simulations and/or flight tests to develop engineering requirements to eliminate or control the ADS-B system risks to an acceptable level. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS.

Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
807	ILIS.06.1	LTA visual identification of other aircraft by subject aircraft pilots/aircrew results in subject aircraft following wrong target.	LTA visual identification of other aircraft by subject aircraft pilots/aircrew due to: LTA procedure LTA design Human error Poor visability. Subject aircraft follows wrong target. Aircraft on collision course.	Pilot/flight crew loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1C	7 Provide for appropriate ATC/Aircrew contingency procedures. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 45N Conduct analysis, studies, simulations and/or flight tests to develop engineering requirements to eliminate or control the ADS-B system risks to an acceptable level. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS.
809	**ILIS.08**	Inappropriate use of call sign or other language results in mis-communication and increased collision risks.	Inappropriate use of call sign or other language results in mis-communication due to: LTA training LTA design LTA procedure Human error. Subject aircraft follows wrong target or takes wrong clearance. Aircraft on collision course.	Pilot/flight crew loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1C	7 Provide for appropriate ATC/Aircrew contingency procedures. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 45N Conduct analysis, studies, simulations and/or flight tests to develop engineering requirements to eliminate or control the ADS-B system risks to an acceptable level. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS.

Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
810	ILIS.08.1	Inappropriate use of new terminology or phraseology results in mis-communication and increased collision risk.	Inappropriate use of new terminology or phraseology results in mis-communication due to: LTA training LTA design LTA procedure Human error. Subject aircraft follows wrong target or takes wrong clearance. Aircraft on collision course.	Pilot/flight crew loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1C	7 Provide for appropriate ATC/Aircrew contingency procedures. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 45N Conduct analysis, studies, simulations and/or flight tests to develop engineering requirements to eliminate or control the ADS-B system risks to an acceptable level. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS.
811	**ILIS.09**	System inaccuracies between ADS-B and other subsystem results in inadvertent contact with wake vortex and increased accident risks.	System inaccuracies between ADS-B and other subsystem result in inadvertent contact with wake vortex. Loss of aircraft control occurs.	Pilot/flight crew unable to regain aircraft control in time.	Takeoff, Approach Landing, Flight, Emergency.	Collision with terrain.	1C	7 Provide for appropriate ATC/Aircrew contingency procedures. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 45N Conduct analysis, studies, simulations and/or flight tests to develop engineering requirements to eliminate or control the ADS-B system risks to an acceptable level. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
812	**ILIS.10**	Communication delay as a result of LTA mixed equipage procedural integration results in increased collision risks.	Communication delay as a result of LTA mixed equipage procedural integration due to: LTA procedure LTA training Human error. Subject aircraft follows wrong target or takes wrong clearance. Aircraft on collision course.	Pilot/flight crew loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1C	7 Provide for appropriate ATC/Aircrew contingency procedures. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 45N Conduct analysis, studies, simulations and/or flight tests to develop engineering requirements to eliminate or control the ADS-B system risks to an acceptable level. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS.
813	**ILIS.11**	Conflicts between subsystems (ADS_B, TCAS, TAWS, TIS) state data results in inaccurate assumptions associated with separation and increased accident risks.	Conflicts between subsystems (ADS_B, TCAS, TAWS, TIS) state data due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Inaccurate assumptions associated with aircraft separation occur. Subject aircraft follows wrong target or takes wrong clearance. Aircraft on collision course.	Pilot/flight crew loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1C	7 Provide for appropriate ATC/Aircrew contingency procedures. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 45N Conduct analysis, studies, simulations and/or flight tests to develop engineering requirements to eliminate or control the ADS-B system risks to an acceptable level. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 47N Design and integrate new NAS subsystems with no conflicts between subsystems (ADS_B, TCAS, TAWS, TIS) state data which results in inaccurate separation of aircraft.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
814	**ILIS.12**	LTA integration of audible alerts issued by ADS-B, TCAS, TAWS, TIS, and results in confusion and increased collision risks.	LTA integration of audible alerts issued by ADS-B, TCAS, TAWS, TIS due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course.	Pilot/flight crew loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1C	19N Design TIS to integrate with ADS-B and provide redundant alert against collision risk. 19Na Design TCAS-I to integrate with ADS-B and provide redundant alert against collision risk. 19Nc Design TAWS to integrate with ADS-B and provide redundant alert against collision risk. 28Na Design MFD or CDTI, TAWS, TCAS, and TIS to integrate with ADS-B, provide redundancy, maximize system alert capability, and minimize alert delay or malfunction. 28Nb Design MFD or CDTI, TAWS, TCAS, and TIS to integrate with ADS-B, provide redundancy, maximize system alert capability, and minimize alert delay or masking of alert. 28Nd Design MFD or CDTI, TAWS, and TCAS to integrate with ADS-B, provide redundancy, maximize system alert capability, and minimize alert delay or masking of alert. 28Ne Design MFD or CDTI, TAWS, and TCAS to integrate with ADS-B, provide redundancy, maximize system alert capability, and integration of audible alerts. 7 Provide for appropriate ATC/Aircrew contingency procedures. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 45N Conduct analysis, studies, simulations and/or flight tests to develop engineering requirements to eliminate or control the ADS-B system risks to an acceptable level. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 47N Design and integrate new NAS subsystems with no conflicts between subsystems (ADS_B, TCAS, TAWS, TIS) state data which results in inaccurate separation of aircraft.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
815	ILIS.12.1	LTA integration of Airborne Conflict Management (ACM) results in increased collision risks.	LTA integration of Airborne Conflict Management (ACM) due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course.	Pilot/flight crew loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1C	36N Design MFD or CDTI, TAWS, TCAS, and TIS to integrate with ADS-B airborne and ground systems, provide redundancy, and maximize integration of Airborne Conflict Management (ACM) in order to decrease collision risks. 7 Provide for appropriate ATC/Aircrew contingency procedures. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 45N Conduct analysis, studies, simulations and/or flight tests to develop engineering requirements to eliminate or control the ADS-B system risks to an acceptable level. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 47N Design and integrate new NAS subsystems with no conflicts between subsystems (ADS_B, TCAS, TAWS, TIS) state data which results in inaccurate separation of aircraft.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
817	**ILIS.14**	Time from when a hazardous situation develops to the time the pilot takes corrective action is insufficient due to ADS-B malfunction, failure, or anomally.	ADS-B malfunction, failure, or anomally due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design System latency. Time to safety alert is insufficient. Controller time from situation recognition to pilot notification is inadequate. Pilot response time is too long to prevent accident. Frequency congestion contributes to delay in communication. Unsuccessful collision avoidance maneuver by aircrew.	Pilot/flight crew loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1C	22Nb Design system to minimize the potential of erroneous sequencing of aircraft. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 49N Evaluate, design, and integrate ADS-B system within NAS to minimize latency errors/malfunctions.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
818	**ILIS.15**	System (Integrated System) time source is unsynchronized resulting in inaccurate position, velocity and time.	Situation occurs due to : System malfunction Design error LTA design. Inaccurate position indication pilot/driver/controller. Situation results in Aircraft/vehicles on collision path.	Pilot/driver/controller loss of situational awareness. Aircraft/ vehicles not identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	All	Collision	1C	37N Design MFD or CDTI, TAWS, TCAS, and TIS to integrate with ADS-B airborne and ground systems, and assure that time source is synchronized resulting in accurate position, velocity and time. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 9d Provide alternate means of detection and collision avoidance. 12a Require alternate means of detecting aircraft and informing ground vehicle operator of position, e.g., AMASS. 12c Require alternate means of detecting aircraft and informing non-airborne aircraft crew of position, e.g., AMASS, ATC controllers. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 21 Alternate means of separation assurance must be provided.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
820	**ILIS.17**	LTA tarining assocciated with ADS-B design, maintainance, or operation results in increased collision risk.	LTA tarining occurs due to: LTA training tecniques Incomplete tarining Errors associated with training LTA training materials Management oversight LTA training resources. LTA training results in: Maintenance error Software error Design error Decreased availability Operational error Procedure error Deviations associated with ADS-B result in increased collision risks.	Pilot/driver/controller loss of situational awareness. Aircraft/ vehicles not identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Maintenance and Operation	Collision	1C	43 Provide contingency training to assure situational awareness and acclimation of ADS-B during terminal phase descent. 68 Develop appropriate training materials and training programs to ensure that all participants in a shared responsibility environment understand their role and safe operation procedures. 50N Provide Controller and maintenance procedures (proactive and reactive) and training are for ground system equipment failures/malfunctions. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 7 Provide for appropriate ATC/Aircrew contingency procedures.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
821	ILIS.17.1	LTA tarining assocciated with ADS-B design, maintainance, or operation results in increased risk of injury.	LTA tarining occurs due to: LTA training tecniques Incomplete tarining Errors associated with training LTA training materials Management oversight LTA training resources. LTA training results in: Maintenance error Software error Design error Decreased availability Operational error Procedure error Deviations associated with ADS-B result in increased risks of accident.	Deviations result in injury and/ or damage to ADS-B equipment.	Maintenance and Personnel Operation	Major damage to ADS-B system and/or fatal injury.	1C	51 N Provide ADS-B avionics/ground maintenance and training procedures with controls developed from Job Safety Analysis IAW FAA Order xxx. 52 Design ADS-B system to meet FAA –G-2100g.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
822	**ILIS.18**	Collision with terrain or aircraft or fixed object or flying object, or vehicle during approach or landing or takeoff as a result of ADS-B malfunction, failure, or anomally due to close proximity.	ADS-B malfunction, failure, or anomally due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Situation results in aircraft in close proximity to terrain or other aircraft, or fixed object, or flying object or vehicle.	Pilot/driver/controller loss of situational awareness. Aircraft/ vehicles/ objects/ terrain not identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Approach or Landing. Or Takeoff	Collision	1C	53 Design, develop and implement risk controls which are site adaptable, redundant, safety subsystems, equipment, devices, and procedures to enable close proximity (TBD) takeoff, approach, and landing utilizing ADS-B. 43 Provide contingency training to assure situational awareness and acclimation of ADS-B during terminal phase descent. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 7 Provide for appropriate ATC/Aircrew contingency procedures.

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Automatic Dependent Surveillance Broadcast (ADS-B)

II.A.2 Hazardous /Remote (2B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
187	SR-01.6	Loss of separation assurance and Near Midair Collision (NMAC) during terminal approach due to intentional security intrusion, i.e., intentional "jamming" of ADS-B signal.	Intentional "jamming" of ADS-B signal. Aircraft on collision course.	Pilot/flight crew initially loses of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Terminal Approach	Near Midair Collision (NMAC), W/ Fatal Injury.	IIB	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 9c Require alternate means of detecting other aircraft, e.g., TCAS, ATC warning, etc. 2a Require warning lights on other aircraft to enhance "see and avoid" separation 16 Design ADS-B system to minimize the risk of security intrusion, including detectability, auditing and software protection. 15 Provide message authority verification in the design.

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II B. Medium Risk Scenarios

II.B.1 Catastrophic/Extremely Improbable (1D)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
1	**AFXO-01**	Collision of subject aircraft with fixed object due to failure to identify fixed object. Fixed object not equipped with ADS-B.	Fixed object not equipped with ADS-B.	Pilot/flight crew loss of situational awareness, and/or fixed object not properly indicated on charts. Object not identified via radar or other sources. Aircraft on collision course. ATCT does not communicate warning. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision of subject aircraft with fixed object and consequent loss of aircraft.	1D	1 Develop ADS-B ATC/Aircrew procedures to accommodate transitional risks. 2d Require fixed objects to be equipped with appropriate lighting, i.e., "see and avoid". 3 Aircrew "see and avoid" procedures. 1N Require all fixed objects that are evaluated as hazardous to be equipped with ADS-B transmitters. 2N Provide updated information on fixed objects in appropriate data sources. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude.
2	AFXO-01.1	Collision of subject aircraft with fixed object due to failure to identify fixed object. Fixed object not equipped with ADS-B.	Fixed object not equipped with ADS-B. Aircraft on collision course.	Pilot/flight crew loss of situational awareness, and/or fixed object not properly indicated on charts. Object not identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision of subject aircraft with fixed object and consequent loss of aircraft.	1D	1 Develop ADS-B ATC/Aircrew procedures to accommodate transitional risks. 2d Require fixed objects to be equipped with appropriate lighting, i.e., "see and avoid". 3 Aircrew "see and avoid" procedures. 1N Require all fixed objects that are evaluated as hazardous to be equipped with ADS-B transmitters. 2N Provide updated information on fixed objects in appropriate data sources. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude.
3	AFXO-01.2	Collision of subject aircraft with fixed object due to failure to identify fixed object. Fixed object not equipped with ADS-B.	Fixed object not equipped with ADS-B. Aircraft on collision course.	Pilot/flight crew loss of situational awareness, and/or fixed object not properly indicated on charts. Object not identified via radar or other sources. ATCT does communicate warning in time. However pilots/ aircrew are unable to respond in time.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision of subject aircraft with fixed object and consequent loss of aircraft.	1D	1 Develop ADS-B ATC/Aircrew procedures to accommodate transitional risks. 2d Require fixed objects to be equipped with appropriate lighting, i.e., "see and avoid". 3 Aircrew "see and avoid" procedures. 1N Require all fixed objects that are evaluated as hazardous to be equipped with ADS-B transmitters. 2N Provide updated information on fixed objects in appropriate data sources. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude.

8	AFXO-02	Collision of subject aircraft with fixed object due to failure of ADS-B on fixed object.	Failure of ADS-B on fixed object, due to: SW malfunction HW malfunction Inappropriate placement Electromagnetic environmental effects Inadvertent damage Vandalism LTA design. Aircraft on collision course.	Pilot/flight crew loss of situational awareness, and/or fixed object not properly indicated on charts. Object not identified via radar or other sources. ATCT does not communicate warning. See and avoid not successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision of subject aircraft with fixed object and consequent loss of aircraft.	1D	5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1. 7 Provide for appropriate ATC/Aircrew contingency procedures. 8 Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 2N Provide updated information on fixed objects in appropriate data sources. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 26 Design the system such that no single software anomaly, common software malfunctions or design feature shall result in a catastrophic event, (severity 1 or 2). 4N Design ADS-B external equipment for physical protection and security to minimize the potential for damage as a result of vandalism. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations

9	AFXO-02.1	Collision of subject aircraft with fixed object due to failure of ADS-B on fixed object.	Failure of ADS-B on fixed object, due to: SW malfunction HW malfunction Inappropriate placement Electromagnetic environmental effects Inadvertent damage Vandalism LTA design. Aircraft on collision course.	Pilot/flight crew loss of situational awareness, and/or fixed object not properly indicated on charts. Object not identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision of subject aircraft with fixed object and consequent loss of aircraft.	1D	5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1. 7 Provide for appropriate ATC/Aircrew contingency procedures. 8 Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 2N Provide updated information on fixed objects in appropriate data sources. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 26 Design the system such that no single software anomaly, common software malfunctions or design feature shall result in a catastrophic event, (severity 1 or 2). 4N Design ADS-B external equipment for physical protection and security to minimize the potential for damage as a result of vandalism. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

10	AFXO-02.2	Collision of subject aircraft with fixed object due to failure of ADS-B on fixed object.	Failure of ADS-B on fixed object, due to: SW malfunction HW malfunction Inappropriate placement Electromagnetic environmental effects Inadvertent damage Vandalism LTA design. Aircraft on collision course.	Pilot/flight crew loss of situational awareness, and/or fixed object not properly indicated on charts. Object identified via radar or other sources. ATCT does communicate warning in time. However pilots/ aircrew are unable to respond in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision of subject aircraft with fixed object and consequent loss of aircraft.	1D	5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1. 7 Provide for appropriate ATC/Aircrew contingency procedures. 8 Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 2N Provide updated information on fixed objects in appropriate data sources. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 26 Design the system such that no single software anomaly, common software malfunctions or design feature shall result in a catastrophic event, (severity 1 or 2). 4N Design ADS-B external equipment for physical protection and security to minimize the potential for damage as a result of vandalism. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

15	AFXO-03	Collision of subject aircraft with fixed object due to failure of ADS-B on aircraft. Fixed object is equipped with ADS-B.	Failure of ADS-B on aircraft due to: SW malfunction HW malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Failure of ADS-B on aircraft not detected. Aircraft on collision course.	Pilot/flight crew loss of situational awareness, and/or fixed object not properly indicated on charts. Object not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision of subject aircraft with fixed object and consequent loss of aircraft.	1D	5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1. 7 Provide for appropriate ATC/Aircrew contingency procedures. 8 Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 2N Provide updated information on fixed objects in appropriate data sources. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 26 Design the system such that no single software anomaly, common software malfunctions or design feature shall result in a catastrophic event, (severity 1 or 2). 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 5N Avionics certification, installation, and approval process established for ADS-B.

16	AFXO-03.1	Collision of subject aircraft with fixed object due to failure of ADS-B on aircraft. Fixed object is equipped with ADS-B.	Failure of ADS-B on aircraft due to: SW malfunction HW malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Failure of ADS-B on aircraft not detected. Aircraft on collision course.	Pilot/flight crew loss of situational awareness, and/or fixed object not properly indicated on charts. Object not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision of subject aircraft with fixed object and consequent loss of aircraft.	1D	5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1. 7 Provide for appropriate ATC/Aircrew contingency procedures. 8 Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 2N Provide updated information on fixed objects in appropriate data sources. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 26 Design the system such that no single software anomaly, common software malfunctions or design feature shall result in a catastrophic event, (severity 1 or 2). 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 5N Avionics certification, installation, and approval process established for ADS-B.

Automatic Dependent Surveillance Broadcast (ADS-B)

17	AFXO-03.2	Collision of subject aircraft with fixed object due to failure of ADS-B on aircraft. Fixed object is equipped with ADS-B.	Failure of ADS-B on aircraft due to: SW malfunction HW malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Failure of ADS-B on aircraft not detected.	Both Pilot/flight crew loss of situational awareness. Object identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision of subject aircraft with fixed object and consequent loss of aircraft.	1D	5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1. 7 Provide for appropriate ATC/Aircrew contingency procedures. 8 Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 2N Provide updated information on fixed objects in appropriate data sources. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 26 Design the system such that no single software anomaly, common software malfunctions or design feature shall result in a catastrophic event, (severity 1 or 2). 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 5N Avionics certification, installation, and approval process established for ADS-B.
22	AFLO-01	Collision of subject aircraft with flying object due to failure to identify flying object. Flying object not equipped with ADS-B.	Flying object in collision path. Flying object not equipped with ADS-B.	Pilot/flight crew loses situational awareness Pilot/aircrew unaware of flying object. Flying object not identified via radar or other sources ATCT does not communicate warning. Pilot/flight crew does not regain situational awareness. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision of subject aircraft with flying object and consequent loss of both aircraft.	1D	7 Provide for appropriate ATC/Aircrew contingency procedures. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 6N Require all flying objects that can become hazards to navigation be equipped with ADS-B transmitters, or other appropriate means of identification. 9A Require alternate means of detecting flying object, e.g., TCAS, ATC warning, etc.

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23	AFLO-01.1	Collision of subject aircraft with flying object due to failure to identify flying object. Flying object not equipped with ADS-B.	Flying object in collision path. Flying object not equipped with ADS-B.	Pilot/flight crew loses situational awareness Pilot/aircrew unaware of flying object. Flying object identified via radar or other sources ATCT does not communicate warning. Pilot/flight crew does not regain situational awareness. See and avoid unsuccessful..	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision of subject aircraft with flying object and consequent loss of both aircraft.	1D	7 Provide for appropriate ATC/Aircrew contingency procedures. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 6N Require all flying objects that can become hazards to navigation be equipped with ADS-B transmitters, or other appropriate means of identification. 9A Require alternate means of detecting flying object, e.g., TCAS, ATC warning, etc.
24	AFLO-01.2	Collision of subject aircraft with flying object due to failure to identify flying object. Flying object not equipped with ADS-B.	Flying object in collision path. Flying object not equipped with ADS-B.	Pilot/flight crew loses situational awareness Pilot/aircrew unaware of flying object. Flying object identified via radar or other sources ATCT does communicate warning. Pilot/flight crew does not regain situational awareness. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision of subject aircraft with flying object and consequent loss of both aircraft.	1D	7 Provide for appropriate ATC/Aircrew contingency procedures. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 6N Require all flying objects that can become hazards to navigation be equipped with ADS-B transmitters, or other appropriate means of identification. 9A Require alternate means of detecting flying object, e.g., TCAS, ATC warning, etc.

29	AFLO-02	Collision of subject aircraft with flying object due to failure of ADS-B on flying object.	Failure of ADS-B on flying object due to: SW malfunction HW malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Failure of ADS-B on flying object not detected. Aircraft on collision course.	Pilot/flight crew loses situational awareness Pilot/aircrew unaware of flying object. Flying object not identified via radar or other sources ATCT does not communicate warning. Pilot/flight crew does not regain situational awareness. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision of subject aircraft with flying object and consequent loss of both aircraft.	1D	7 Provide for appropriate ATC/Aircrew contingency procedures. 9a Require alternate means of detecting flying object, e.g., TCAS, ATC warning, etc. 77 Require warning lights on flying object to enhance "see and avoid" separation. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 8 Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 26 Design the system such that no single software anomaly, common software malfunctions or design feature shall result in a catastrophic event, (severity 1 or 2). 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 5N Avionics certification, installation, and approval process established for ADS-B.

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30	AFLO-02.1	Collision of subject aircraft with flying object due to failure of ADS-B on flying object.	Failure of ADS-B on flying object due to: SW malfunction HW malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Failure of ADS-B on flying object not detected. Aircraft on collision course.	Pilot/flight crew loses situational awareness Pilot/aircrew unaware of flying object. Flying object identified via radar or other sources ATCT does not communicate warning. Pilot/flight crew does not regain situational awareness. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision of subject aircraft with flying object and consequent loss of both aircraft.	1D	7 Provide for appropriate ATC/Aircrew contingency procedures. 9a Require alternate means of detecting flying object, e.g., TCAS, ATC warning, etc. 77 Require warning lights on flying object to enhance "see and avoid" separation. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 8 Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 26 Design the system such that no single software anomaly, common software malfunctions or design feature shall result in a catastrophic event, (severity 1 or 2). 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 5N Avionics certification, installation, and approval process established for ADS-B.

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31	AFLO-02.2	Collision of subject aircraft with flying object due to failure of ADS-B on flying object.	Failure of ADS-B on flying object due to: SW malfunction HW malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Failure of ADS-B on flying object not detected. Aircraft on collision course.	Pilot/flight crew loses situational awareness Pilot/aircrew unaware of flying object. Flying object identified via radar or other sources ATCT does communicate warning. Pilot/flight crew does not regain situational awareness. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision of subject aircraft with flying object and consequent loss of both aircraft.	1D	7 Provide for appropriate ATC/Aircrew contingency procedures. 9a Require alternate means of detecting flying object, e.g., TCAS, ATC warning, etc. 77 Require warning lights on flying object to enhance "see and avoid" separation. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 8 Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 26 Design the system such that no single software anomaly, common software malfunctions or design feature shall result in a catastrophic event, (severity 1 or 2). 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 5N Avionics certification, installation, and approval process established for ADS-B.

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36	AFLO-03	Collision of subject aircraft with flying object due to failure of ADS-B on subject aircraft.	Failure of ADS-B on subject aircraft due to: SW malfunction HW malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Failure of ADS-B on subject object not detected. Aircraft on collision course.	Pilot/flight crew loses situational awareness Pilot/aircrew unaware of subject aircraft. Flying object not identified via radar or other sources ATCT does not communicate warning. Pilot/flight crew does not regain situational awareness. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision of subject aircraft with flying object and consequent loss of both aircraft.	1D	8a Design ADS-B airborne system to assure that system failures/malfunctions are detected and reported automatically. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 4 Design ADS-B Airborne System to automatically report system failure/malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1. 7 Provide for appropriate ATC/Aircrew contingency procedures. 9a Require alternate means of detecting flying object, e.g., TCAS, ATC warning, etc. 77 Require warning lights on flying object to enhance “see and avoid” separation. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 26 Design the system such that no single software anomaly, common software malfunctions or design feature shall result in a catastrophic event, (severity 1 or 2). 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 5N Avionics certification, installation, and approval process established for ADS-B.

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Automatic Dependent Surveillance Broadcast (ADS-B)

37	AFLO-03.1	Collision of subject aircraft with flying object due to failure of ADS-B on subject aircraft.	Failure of ADS-B on subject aircraft object due to: SW malfunction HW malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Failure of ADS-B on subject object not detected. Aircraft on collision course.	Pilot/flight crew loses situational awareness Pilot/aircrew unaware of subject aircraft. Flying object identified via radar or other sources ATCT does not communicate warning. Pilot/flight crew does not regain situational awareness. See and avoid unsuccessful..	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision of subject aircraft with flying object and consequent loss of both aircraft.	1D	8a Design ADS-B airborne system to assure that system failures/malfunctions are detected and reported automatically. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 4 Design ADS-B Airborne System to automatically report system failure/malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1. 7 Provide for appropriate ATC/Aircrew contingency procedures. 9a Require alternate means of detecting flying object, e.g., TCAS, ATC warning, etc. 77 Require warning lights on flying object to enhance “see and avoid” separation. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 26 Design the system such that no single software anomaly, common software malfunctions or design feature shall result in a catastrophic event, (severity 1 or 2). 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 5N Avionics certification, installation, and approval process established for ADS-B.

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38	AFLO-03.2	Collision of subject aircraft with flying object due to failure of ADS-B on subject aircraft.	Failure of ADS-B on subject aircraft object due to: SW malfunction HW malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Failure of ADS-B on subject object not detected. Aircraft on collision course.	Pilot/flight crew loses situational awareness Pilot/aircrew unaware of subject aircraft. Flying object identified via radar or other sources ATCT does communicate warning. Pilot/flight crew does not regain situational awareness. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision of subject aircraft with flying object and consequent loss of both aircraft.	1D	8a Design ADS-B airborne system to assure that system failures/malfunctions are detected and reported automatically. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 4 Design ADS-B Airborne System to automatically report system failure/malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1. 7 Provide for appropriate ATC/Aircrew contingency procedures. 9a Require alternate means of detecting flying object, e.g., TCAS, ATC warning, etc. 77 Require warning lights on flying object to enhance “see and avoid” separation. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 26 Design the system such that no single software anomaly, common software malfunctions or design feature shall result in a catastrophic event, (severity 1 or 2). 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 5N Avionics certification, installation, and approval process established for ADS-B.

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Automatic Dependent Surveillance Broadcast (ADS-B)

42	AGV-01	Collision of subject aircraft with ground vehicle due to failure to identify ground vehicle. Ground vehicle not equipped with ADS-B.	Ground vehicle not equipped with ADS-B Aircraft on collision course.	Pilot/flight crew loses situational awareness Pilot/aircrew unaware of ground vehicle. Ground vehicle not identified via radar or other sources ATCT does not communicate warning. Pilot/flight crew does not regain situational awareness. See and avoid unsuccessful.	Airport surface, Taxi, Takeoff, Landing.	Collision of subject aircraft with vehicle and consequent loss of aircraft and / or vehicle.	1D	1 Develop ADS-B ATC/Aircrew procedures to accommodate transitional risks. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 7N Require all ground vehicles that can become hazards to ground navigation be equipped with ADS-B transmitters, or other appropriate means of identification. 10 Require ground vehicles to be equipped with appropriate lighting and color indication to enhance "see and avoid" separation. 8N Require alternate means of detecting ground vehicles, i.e. ASDE-X. 11 Aircrew/ground operator "see and avoid" procedures. 12a Require alternate means of detecting aircraft and informing ground vehicle operator of position, e.g., AMASS
43	AGV-01.1	Collision of subject aircraft with ground vehicle due to failure to identify ground vehicle. Ground vehicle not equipped with ADS-B.	Ground vehicle not equipped with ADS-B Aircraft on collision course.	Pilot/flight crew loses situational awareness Pilot/aircrew unaware of ground vehicle. Ground vehicle identified via radar or other sources ATCT does not communicate warning. Pilot/flight crew does not regain situational awareness. See and avoid unsuccessful.	Airport surface, Taxi, Takeoff, Landing.	Collision of subject aircraft with vehicle and consequent loss of aircraft and / or vehicle.	1D	1 Develop ADS-B ATC/Aircrew procedures to accommodate transitional risks. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 7N Require all ground vehicles that can become hazards to ground navigation be equipped with ADS-B transmitters, or other appropriate means of identification. 10 Require ground vehicles to be equipped with appropriate lighting and color indication to enhance "see and avoid" separation. 8N Require alternate means of detecting ground vehicles, i.e. ASDE-X. 11 Aircrew/ground operator "see and avoid" procedures. 12a Require alternate means of detecting aircraft and informing ground vehicle operator of position, e.g., AMASS.

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Automatic Dependent Surveillance Broadcast (ADS-B)

44	AGV-01.2	Collision of subject aircraft with ground vehicle due to failure to identify ground vehicle. Ground vehicle not equipped with ADS-B.	Ground vehicle not equipped with ADS-B Aircraft on collision course.	Pilot/flight crew loses situational awareness Pilot/aircrew unaware of ground vehicle. Ground vehicle identified via radar or other sources ATCT does communicate warning. Pilot/flight crew does not regain situational awareness. See and avoid unsuccessful.	Airport surface, Taxi, Takeoff, Landing.	Collision of subject aircraft with vehicle and consequent loss of aircraft and / or vehicle.	1D	1 Develop ADS-B ATC/Aircrew procedures to accommodate transitional risks. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 7N Require all ground vehicles that can become hazards to ground navigation be equipped with ADS-B transmitters, or other appropriate means of identification. 10 Require ground vehicles to be equipped with appropriate lighting and color indication to enhance "see and avoid" separation. 8N Require alternate means of detecting ground vehicles, i.e. ASDE-X. 11 Aircrew/ground operator "see and avoid" procedures. 12a Require alternate means of detecting aircraft and informing ground vehicle operator of position, e.g., AMASS.

48	AGV-02	Collision of subject aircraft with ground vehicles due to failure of ADS-B on ground vehicles.	Ground vehicle equipped with ADS-B. Failure of ADS-B due to: SW malfunction HW malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course.	Pilot/flight crew loses situational awareness Pilot/aircrew unaware of ground vehicle. Ground vehicle not identified via radar or other sources ATCT does not communicate warning. Pilot/flight crew does not regain situational awareness. See and avoid unsuccessful.	Airport surface, Taxi, Takeoff, Landing.	Collision of subject aircraft with vehicle and consequent loss of aircraft and / or vehicle.	1D	8 Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 7 Provide for appropriate ATC/Aircrew contingency procedures. 10 Require ground vehicles to be equipped with appropriate lighting and color indication to enhance “see and avoid” separation. 12a Require alternate means of detecting aircraft and informing ground vehicle operator of position, e.g., AMASS. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 26 Design the system such that no single software anomaly, common software malfunctions or design feature shall result in a catastrophic event, (severity 1 or 2). 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

49	AGV-02.1	Collision of subject aircraft with ground vehicles due to failure of ADS-B on ground vehicles.	Ground vehicle equipped with ADS-B. Failure of ADS-B due to: SW malfunction HW malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course.	Pilot/flight crew loses situational awareness Pilot/aircrew unaware of ground vehicle. Ground vehicle identified via radar or other sources ATCT does not communicate warning. Pilot/flight crew does not regain situational awareness. See and avoid unsuccessful.	Airport surface, Taxi, Takeoff, Landing.	Collision of subject aircraft with vehicle and consequent loss of aircraft and / or vehicle.	1D	8 Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 7 Provide for appropriate ATC/Aircrew contingency procedures. 10 Require ground vehicles to be equipped with appropriate lighting and color indication to enhance “see and avoid” separation. 12a Require alternate means of detecting aircraft and informing ground vehicle operator of position, e.g., AMASS. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 26 Design the system such that no single software anomaly, common software malfunctions or design feature shall result in a catastrophic event, (severity 1 or 2). 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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50	AGV-02.2	Collision of subject aircraft with ground vehicles due to failure of ADS-B on ground vehicles.	Ground vehicle equipped with ADS-B. Failure of ADS-B due to: SW malfunction HW malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course.	Pilot/flight crew loses situational awareness Pilot/aircrew unaware of ground vehicle. Ground vehicle identified via radar or other sources ATCT does communicate warning. Pilot/flight crew does not regain situational awareness. See and avoid unsuccessful.	Airport surface, Taxi, Takeoff, Landing.	Collision of subject aircraft with vehicle and consequent loss of aircraft and / or vehicle.	1D	8 Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 7 Provide for appropriate ATC/Aircrew contingency procedures. 10 Require ground vehicles to be equipped with appropriate lighting and color indication to enhance “see and avoid” separation. 12a Require alternate means of detecting aircraft and informing ground vehicle operator of position, e.g., AMASS. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 26 Design the system such that no single software anomaly, common software malfunctions or design feature shall result in a catastrophic event, (severity 1 or 2). 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

Automatic Dependent Surveillance Broadcast (ADS-B)

55	AGV-03	Collision of subject aircraft with ground vehicles due to failure of ADS-B on own aircraft	Aircraft equipped with ADS-B. Failure of ADS-B due to: SW malfunction HW malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Ground vehicle equipped with ADS-B. Both aircraft and vehicle on collision course.	Pilot/flight crew loses situational awareness Pilot/aircrew unaware of ground vehicle. Ground vehicle not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew does not regains situational awareness. See and avoid unsuccessful.	Airport surface, Taxi, Takeoff, Landing.	Collision of subject aircraft with vehicle and consequent loss of aircraft and / or vehicle.	1D	8 Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1. 7 Provide for appropriate ATC/Aircrew contingency procedures. 10 Require ground vehicles to be equipped with appropriate lighting and color indication to enhance “see and avoid” separation. 11 Aircrew and ground personnel “see and avoid” procedures. 12a Require alternate means of detecting aircraft and informing ground vehicle operator of position, e.g., AMASS. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 26 Design the system such that no single software anomaly, common software malfunctions or design feature shall result in a catastrophic event, (severity 1 or 2). 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 5N Avionics certification, installation, and approval process established for ADS-B.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

56	AGV-03.1	Collision of subject aircraft with ground vehicles due to failure of ADS-B on own aircraft	Aircraft equipped with ADS-B. Failure of ADS-B due to: SW malfunction HW malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Ground vehicle equipped with ADS-B. Both aircraft and vehicle on collision course.	Pilot/flight crew and ground vehicle driver loses situational awareness and is not aware of collision potential. Pilot/aircrew unaware of ground vehicle. Ground vehicle identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew does not regain situational awareness. See and avoid unsuccessful.	Airport surface, Taxi, Takeoff, Landing.	Collision of subject aircraft with vehicle and consequent loss of aircraft and / or vehicle.	1D	8 Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1. 7 Provide for appropriate ATC/Aircrew contingency procedures. 10 Require ground vehicles to be equipped with appropriate lighting and color indication to enhance “see and avoid” separation. 11 Aircrew and ground personnel “see and avoid” procedures. 12a Require alternate means of detecting aircraft and informing ground vehicle operator of position, e.g., AMASS. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 26 Design the system such that no single software anomaly, common software malfunctions or design feature shall result in a catastrophic event, (severity 1 or 2). 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 5N Avionics certification, installation, and approval process established for ADS-B.

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57	AGV-03.2	Collision of subject aircraft with ground vehicles due to failure of ADS-B on own aircraft	Aircraft equipped with ADS-B. Failure of ADS-B due to: SW malfunction HW malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Ground vehicle equipped with ADS-B. Both aircraft and vehicle on collision course.	Pilot/flight crew and ground vehicle driver loss of situational awareness and are not aware of collision potential. Pilot/aircrew unaware of ground vehicle. Ground vehicle identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew does not regain situational awareness. See and avoid unsuccessful.	Airport surface, Taxi, Takeoff, Landing.	Collision of subject aircraft with vehicle and consequent loss of aircraft and / or vehicle.	1D	8 Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1. 7 Provide for appropriate ATC/Aircrew contingency procedures. 10 Require ground vehicles to be equipped with appropriate lighting and color indication to enhance “see and avoid” separation. 11 Aircrew and ground personnel “see and avoid” procedures. 12a Require alternate means of detecting aircraft and informing ground vehicle operator of position, e.g., AMASS. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 26 Design the system such that no single software anomaly, common software malfunctions or design feature shall result in a catastrophic event, (severity 1 or 2). 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 5N Avionics certification, installation, and approval process established for ADS-B.
62	**AOAA-01**	Collision of subject aircraft with other airborne aircraft due to failure to identify other airborne aircraft, via ADS-B. Other airborne aircraft not equipped with ADS-B.	Other airborne aircraft not equipped with ADS-B. Either aircraft on collision course.	Pilot/flight crew(s) loss of situational awareness and are not aware of collision potential. Other aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew does regain situational awareness. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision of subject aircraft with other airborne aircraft and consequent loss of one or both aircraft.	1D	1 Develop ADS-B ATC/Aircrew procedures to accommodate transitional risks. 2b Require all aircraft to be equipped with appropriate lighting, i.e., “see and avoid”. 3 Aircrew “see and avoid” procedures. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 10N Require all aircraft that can become hazards to navigation be equipped with ADS-B transmitters, or other appropriate automated means of identification.

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63	AOAA-01.1	Collision of subject aircraft with other airborne aircraft due to failure to identify other airborne aircraft, via ADS-B. Other airborne aircraft not equipped with ADS-B.	Other airborne aircraft not equipped with ADS-B. Either aircraft on collision course.	Pilot/flight crew(s) loss of situational awareness and are not aware of collision potential. Other aircraft is identified via radar or other sources. ATCT does not communicate warning in time. Pilot/flight crew does not regain situational awareness. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision of subject aircraft with other airborne aircraft and consequent loss of one or both aircraft.	1D	1 Develop ADS-B ATC/Aircrew procedures to accommodate transitional risks. 2b Require all aircraft to be equipped with appropriate lighting, i.e., “see and avoid”. 3 Aircrew “see and avoid” procedures. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 10N Require all aircraft that can become hazards to navigation be equipped with ADS-B transmitters, or other appropriate automated means of identification.
64	AOAA-01.2	Collision of subject aircraft with other airborne aircraft due to failure to identify other airborne aircraft, via ADS-B. Other airborne aircraft not equipped with ADS-B.	Other airborne aircraft not equipped with ADS-B. Either aircraft on collision course.	Pilot/flight crew(s) loss of situational awareness and are not aware of collision potential. Other aircraft is identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew does not regain situational awareness. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision of subject aircraft with other airborne aircraft and consequent loss of one or both aircraft.	1D	1 Develop ADS-B ATC/Aircrew procedures to accommodate transitional risks. 2b Require all aircraft to be equipped with appropriate lighting, i.e., “see and avoid”. 3 Aircrew “see and avoid” procedures. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 10N Require all aircraft that can become hazards to navigation be equipped with ADS-B transmitters, or other appropriate automated means of identification.

Automatic Dependent Surveillance Broadcast (ADS-B)

68	AOAA-02	Collision of subject aircraft with other airborne aircraft due to failure of ADS-B on other airborne aircraft	Failure of ADS-B due to: SW malfunction HW malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course.	Pilot/flight crews initially loss situational awareness. Pilot/flight crew(s) are not aware of collision potential. Other aircraft is not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew does not regain situational awareness. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision.	1D	8 Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1. 7 Provide for appropriate ATC/Aircrew contingency procedures. 10 Require ground vehicles to be equipped with appropriate lighting and color indication to enhance "see and avoid" separation. 11 Aircrew and ground personnel "see and avoid" procedures. 12a Require alternate means of detecting aircraft and informing ground vehicle operator of position, e.g., AMASS. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 26 Design the system such that no single software anomaly, common software malfunctions or design feature shall result in a catastrophic event, (severity 1 or 2). 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 5N Avionics certification, installation, and approval process established for ADS-B. 9a Require alternate means of detecting flying object, e.g., TCAS, ATC warning, etc. 2b Require all aircraft to be equipped with appropriate lighting, i.e., "see and avoid".

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69	AOAA-02.1	Collision of subject aircraft with other airborne aircraft due to failure of ADS-B on other airborne aircraft	Other airborne aircraft equipped with ADS-B. Either aircraft on collision course.	Pilot/flight crews initially loss situational awareness. Pilot/flight crew(s) are not aware of collision potential. Other aircraft is identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew does not regain situational awareness. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	8 Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1. 7 Provide for appropriate ATC/Aircrew contingency procedures. 10 Require ground vehicles to be equipped with appropriate lighting and color indication to enhance “see and avoid” separation. 11 Aircrew and ground personnel “see and avoid” procedures. 12a Require alternate means of detecting aircraft and informing ground vehicle operator of position, e.g., AMASS. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 26 Design the system such that no single software anomaly, common software malfunctions or design feature shall result in a catastrophic event, (severity 1 or 2). 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 5N Avionics certification, installation, and approval process established for ADS-B. 9a Require alternate means of detecting flying object, e.g., TCAS, ATC warning, etc. 2b Require all aircraft to be equipped with appropriate lighting, i.e., “see and avoid”.

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70	AOAA-02.2	Collision of subject aircraft with other airborne aircraft due to failure of ADS-B on subject aircraft	Subject aircraft equipped with ADS-B. Failure of ADS-B due to: SW malfunction HW malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Either aircraft on collision course.	Pilot/flight crews initially loss situational awareness. Pilot/flight crew(s) are not aware of collision potential. Other aircraft is identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew does not regain situational awareness. See and avoid unsuccessful.	Takeoff, Flight, Landing.	Collision of subject aircraft with other airborne aircraft and consequent loss of aircraft.	1D	8 Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1. 7 Provide for appropriate ATC/Aircrew contingency procedures. 10 Require ground vehicles to be equipped with appropriate lighting and color indication to enhance “see and avoid” separation. 11 Aircrew and ground personnel “see and avoid” procedures. 12a Require alternate means of detecting aircraft and informing ground vehicle operator of position, e.g., AMASS. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 26 Design the system such that no single software anomaly, common software malfunctions or design feature shall result in a catastrophic event, (severity 1 or 2). 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 5N Avionics certification, installation, and approval process established for ADS-B. 9a Require alternate means of detecting flying object, e.g., TCAS, ATC warning, etc. 2b Require all aircraft to be equipped with appropriate lighting, i.e., “see and avoid”.

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74	**ANAA-01**	Collision of subject aircraft with non-airborne aircraft due to failure to identify non-airborne aircraft. Other aircraft not equipped with ADS-B.	Failure to identify non-airborne aircraft due to: Radar malfunction Electronic masking of aircraft Visual masking of aircraft Loss of signal Procedural error. Either aircraft on collision course.	Pilot/flight crews initially loss situational awareness. Pilot/flight crew(s) are not aware of collision potential. Other aircraft is not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew does not regain situational awareness. See and avoid unsuccessful.	Takeoff, Landing, Airport surface.	Collision.	1D	12c Require alternate means of detecting aircraft and informing non-airborne aircraft crew of position, e.g., AMASS, ATC controllers. 2b Require all aircraft to be equipped with appropriate lighting, i.e., “see and avoid”. 11 Aircrew and ground personnel “see and avoid” procedures. 12a Require alternate means of detecting aircraft and informing ground vehicle operator of position, e.g., AMASS. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 26 Design the system such that no single software anomaly, common software malfunctions or design feature shall result in a catastrophic event, (severity 1 or 2). 8 Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6Failure/malfunction indication shall be designed to conform to FAA CT-96/1. 7 Provide for appropriate ATC/Aircrew contingency procedures.

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75	ANAA-01.1	Collision of subject aircraft with non-airborne aircraft due to failure to identify non-airborne aircraft. Other aircraft not equipped with ADS-B.	Failure to identify non-airborne aircraft due to: Radar malfunction Electronic masking of aircraft Visual masking of aircraft Loss of signal Procedural error. Either aircraft on collision course.	Pilot/flight crews initially loss situational awareness. Pilot/flight crew(s) are not aware of collision potential. Other aircraft is identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew does not regain situational awareness. See and avoid unsuccessful.	Takeoff, Landing, Airport surface.	Collision	1D	12c Require alternate means of detecting aircraft and informing non-airborne aircraft crew of position, e.g., AMASS, ATC controllers. 2b Require all aircraft to be equipped with appropriate lighting, i.e., “see and avoid”. 11 Aircrew and ground personnel “see and avoid” procedures. 12a Require alternate means of detecting aircraft and informing ground vehicle operator of position, e.g., AMASS. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 26 Design the system such that no single software anomaly, common software malfunctions or design feature shall result in a catastrophic event, (severity 1 or 2). 8 Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1. 7 Provide for appropriate ATC/Aircrew contingency procedures.

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76	ANAA-01.2	Collision of subject aircraft with non-airborne aircraft due to failure to identify non-airborne aircraft. Other aircraft not equipped with ADS-B.	Failure to identify non-airborne aircraft due to: Radar malfunction Electronic masking of aircraft Visual masking of aircraft Loss of signal Procedural error. Either aircraft on collision course.	Pilot/flight crews initially loss situational awareness. Pilot/flight crew(s) are not aware of collision potential. Other aircraft is identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew does not regain situational awareness. See and avoid unsuccessful.	Takeoff, Landing, Airport surfaces.	Collision of subject aircraft with other airborne aircraft and consequent loss of aircraft.	1D	12c Require alternate means of detecting aircraft and informing non-airborne aircraft crew of position, e.g., AMASS, ATC controllers. 2b Require all aircraft to be equipped with appropriate lighting, i.e., “see and avoid”. 11 Aircrew and ground personnel “see and avoid” procedures. 12a Require alternate means of detecting aircraft and informing ground vehicle operator of position, e.g., AMASS. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 26 Design the system such that no single software anomaly, common software malfunctions or design feature shall result in a catastrophic event, (severity 1 or 2). 8 Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1. 7 Provide for appropriate ATC/Aircrew contingency procedures.

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81	**ANAA-02**	Collision of subject aircraft with non-airborne aircraft due to failure of ADS-B on non-airborne aircraft	Failure of ADS-B on non-airborne aircraft due to: SW malfunction HW malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Either aircraft on collision course.	Pilot/flight crews initially loss situational awareness. Pilot/flight crew(s) are not aware of collision potential. Other aircraft is not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew does not regain situational awareness. See and avoid unsuccessful.	Takeoff, Landing, Airport surfaces.	Collision	1D	8 Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 2b Require all aircraft to be equipped with appropriate lighting, i.e., “see and avoid”. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1. 7 Provide for appropriate ATC/Aircrew contingency procedures. 10 Require ground vehicles to be equipped with appropriate lighting and color indication to enhance “see and avoid” separation. 11 Aircrew and ground personnel “see and avoid” procedures. 12b Require alternate means of detecting aircraft and informing air crew of position, e.g., AMASS 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 26 Design the system such that no single software anomaly, common software malfunctions or design feature shall result in a catastrophic event, (severity 1 or 2). 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 5N Avionics certification, installation, and approval process established for ADS-B. 2b Require all aircraft to be equipped with appropriate lighting, i.e., “see and avoid”.

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82	ANAA-02.1	Collision of subject aircraft with non-airborne aircraft due to failure of ADS-B on non-airborne aircraft	Failure of ADS-B on non-airborne aircraft due to: SW malfunction HW malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Either aircraft on collision course.	Pilot/flight crews initially loss situational awareness. Pilot/flight crew(s) are not aware of collision potential. Other aircraft is identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew does not regain situational awareness. See and avoid unsuccessful.	Takeoff, Landing, Airport surfaces.	Collision	1D	8 Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 2b Require all aircraft to be equipped with appropriate lighting, i.e., “see and avoid”. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1. 7 Provide for appropriate ATC/Aircrew contingency procedures. 10 Require ground vehicles to be equipped with appropriate lighting and color indication to enhance “see and avoid” separation. 11 Aircrew and ground personnel “see and avoid” procedures. 12b Require alternate means of detecting aircraft and informing air crew of position, e.g., AMASS 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 26 Design the system such that no single software anomaly, common software malfunctions or design feature shall result in a catastrophic event, (severity 1 or 2). 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 5N Avionics certification, installation, and approval process established for ADS-B. 2b Require all aircraft to be equipped with appropriate lighting, i.e., “see and avoid”.

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83	ANAA-01.2	Collision of subject aircraft with non-airborne aircraft due to failure of ADS-B on non-airborne aircraft	Failure of ADS-B on non-airborne aircraft due to: SW malfunction HW malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Either aircraft on collision course.	Pilot/flight crews initially loss situational awareness. Pilot/flight crew(s) are not aware of collision potential. Other aircraft is identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew does not regain situational awareness. See and avoid unsuccessful.	Takeoff, Landing, Airport surfaces.	Collision	1D	8 Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 2b Require all aircraft to be equipped with appropriate lighting, i.e., “see and avoid”. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1. 7 Provide for appropriate ATC/Aircrew contingency procedures. 10 Require ground vehicles to be equipped with appropriate lighting and color indication to enhance “see and avoid” separation. 11 Aircrew and ground personnel “see and avoid” procedures. 12b Require alternate means of detecting aircraft and informing air crew of position, e.g., AMASS 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 26 Design the system such that no single software anomaly, common software malfunctions or design feature shall result in a catastrophic event, (severity 1 or 2). 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 5N Avionics certification, installation, and approval process established for ADS-B. 2b Require all aircraft to be equipped with appropriate lighting, i.e., “see and avoid”.

88	**ANAA-03**	Collision of subject aircraft with non-airborne aircraft due to failure of ADS-B on subject aircraft.	Failure of ADS-B on subject aircraft due to: SW malfunction HW malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Either aircraft on collision course.	Pilot/flight crews initially loss situational awareness. Pilot/flight crew(s) are not aware of collision potential. Other aircraft is not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew does not regain situational awareness. See and avoid unsuccessful.	Takeoff, Landing, Airport surfaces.	Collision	1D	8 Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 2b Require all aircraft to be equipped with appropriate lighting, i.e., “see and avoid”. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1. 7 Provide for appropriate ATC/Aircrew contingency procedures. 10 Require ground vehicles to be equipped with appropriate lighting and color indication to enhance “see and avoid” separation. 11 Aircrew and ground personnel “see and avoid” procedures. 12b Require alternate means of detecting aircraft and informing air crew of position, e.g., AMASS 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 26 Design the system such that no single software anomaly, common software malfunctions or design feature shall result in a catastrophic event, (severity 1 or 2). 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 5N Avionics certification, installation, and approval process established for ADS-B. 2b Require all aircraft to be equipped with appropriate lighting, i.e., “see and avoid”.

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89	ANAA-03.1	Collision of subject aircraft with non-airborne aircraft due to failure of ADS-B on subject aircraft.	Failure of ADS-B on subject aircraft due to: SW malfunction HW malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Either aircraft on collision course.	Pilot/flight crews initially loss situational awareness. Pilot/flight crew(s) are not aware of collision potential. Other aircraft is identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew does not regain situational awareness. See and avoid unsuccessful.	Takeoff, Landing, Airport surfaces.	Collision	1D	8 Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 2b Require all aircraft to be equipped with appropriate lighting, i.e., “see and avoid”. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1. 7 Provide for appropriate ATC/Aircrew contingency procedures. 10 Require ground vehicles to be equipped with appropriate lighting and color indication to enhance “see and avoid” separation. 11 Aircrew and ground personnel “see and avoid” procedures. 12b Require alternate means of detecting aircraft and informing air crew of position, e.g., AMASS 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 26 Design the system such that no single software anomaly, common software malfunctions or design feature shall result in a catastrophic event, (severity 1 or 2). 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 5N Avionics certification, installation, and approval process established for ADS-B. 2b Require all aircraft to be equipped with appropriate lighting, i.e., “see and avoid”.

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90	ANAA-03.2	Collision of subject aircraft with non-airborne aircraft due to failure of ADS-B on subject aircraft.	Failure of ADS-B on subject aircraft due to: SW malfunction HW malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Either aircraft on collision course.	Pilot/flight crews initially loss situational awareness. Pilot/flight crew(s) are not aware of collision potential. Other aircraft is identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew does not regain situational awareness. See and avoid unsuccessful.	Takeoff, Landing, Airport surfaces.	Collision	1D	8 Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 2b Require all aircraft to be equipped with appropriate lighting, i.e., “see and avoid”. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1. 7 Provide for appropriate ATC/Aircrew contingency procedures. 10 Require ground vehicles to be equipped with appropriate lighting and color indication to enhance “see and avoid” separation. 11 Aircrew and ground personnel “see and avoid” procedures. 12b Require alternate means of detecting aircraft and informing air crew of position, e.g., AMASS 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 26 Design the system such that no single software anomaly, common software malfunctions or design feature shall result in a catastrophic event, (severity 1 or 2). 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 5N Avionics certification, installation, and approval process established for ADS-B. 2b Require all aircraft to be equipped with appropriate lighting, i.e., “see and avoid”.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

Automatic Dependent Surveillance Broadcast (ADS-B)

94	**AADF-01**	Collision of subject aircraft with other aircraft due to erroneous position information on subject aircraft cockpit display. Other aircraft transmits erroneous position information.	Erroneous position information on subject aircraft cockpit display. Other aircraft transmits erroneous position information, due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Either aircraft on collision course.	Pilot/flight crews initially loss situational awareness. Pilot/flight crew(s) are not aware of collision potential. Other aircraft is not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew does not regain situational awareness. See and avoid unsuccessful.	Takeoff, Landing, Flight, Airport surfaces.	Collision	1D	8a Design ADS-B airborne system to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 5N Avionics certification, installation, and approval process established for ADS-B. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 9a Require alternate means of detecting flying object, e.g., TCAS, ATC warning, etc. 22a Require periodic recalibration of ADS-B inputs, processing system and displays. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook – 760 and similar requirement FAA-G-2100g. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

Automatic Dependent Surveillance Broadcast (ADS-B)

95	AADF-01.1	Collision of subject aircraft with other aircraft due to erroneous position information on subject aircraft cockpit display. Other aircraft transmits erroneous position information.	Erroneous position information on subject aircraft cockpit display. Other aircraft transmits erroneous position information, due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Either aircraft on collision course.	Pilot/flight crews initially loss situational awareness. Pilot/flight crew(s) are not aware of collision potential. Other aircraft is identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew does not regain situational awareness. See and avoid unsuccessful.	Takeoff, Landing, Flight, Airport surfaces.	Collision	1D	8a Design ADS-B airborne system to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 5N Avionics certification, installation, and approval process established for ADS-B. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 9a Require alternate means of detecting flying object, e.g., TCAS, ATC warning, etc. 22a Require periodic recalibration of ADS-B inputs, processing system and displays. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook – 760 and similar requirement FAA-G-2100g. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

96	AADF-01.2	Collision of subject aircraft with other aircraft due to erroneous position information on subject aircraft cockpit display. Other aircraft transmits erroneous position information.	Erroneous position information on subject aircraft cockpit display. Other aircraft transmits erroneous position information, due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Either aircraft on collision course.	Pilot/flight crews initially loss situational awareness. Pilot/flight crew(s) are not aware of collision potential. Other aircraft is identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew does not regain situational awareness. See and avoid unsuccessful.	Takeoff, Landing, Flight, Airport surfaces.	Collision	1D	8a Design ADS-B airborne system to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 5N Avionics certification, installation, and approval process established for ADS-B. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 9a Require alternate means of detecting flying object, e.g., TCAS, ATC warning, etc. 22a Require periodic recalibration of ADS-B inputs, processing system and displays. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook – 760 and similar requirement FAA-G-2100g. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

Automatic Dependent Surveillance Broadcast (ADS-B)

100	**AADF-02**	Collision of subject aircraft with other aircraft due to erroneous position information on subject aircraft cockpit display. Subject aircraft displays erroneous position information. Source of erroneous information on display is due to failure of on-board display.	Erroneous position information on subject aircraft cockpit display. Source of erroneous information on display is due to failure of on-board display due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Either aircraft on collision course.	Pilot/flight crews initially loss situational awareness. Pilot/flight crew(s) are not aware of collision potential. Other aircraft is not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew does not regain situational awareness. See and avoid unsuccessful.	Takeoff, Landing, Flight, Airport surfaces.	Collision	1D	8a Design ADS-B airborne system to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 5N Avionics certification, installation, and approval process established for ADS-B. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 9a Require alternate means of detecting flying object, e.g., TCAS, ATC warning, etc. 22a Require periodic recalibration of ADS-B inputs, processing system and displays. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook – 760 and similar requirement FAA-G-2100g. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

Automatic Dependent Surveillance Broadcast (ADS-B)

101	AADF-02.1	Collision of subject aircraft with other aircraft due to erroneous position information on subject aircraft cockpit display. Subject aircraft displays erroneous position information. Source of erroneous information on display is due to failure of on-board display.	Erroneous position information on subject aircraft cockpit display. Source of erroneous information on display is due to failure of on-board display due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Either aircraft on collision course.	Pilot/flight crews initially loss situational awareness. Pilot/flight crew(s) are not aware of collision potential. Other aircraft is identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew does not regain situational awareness. See and avoid unsuccessful.	Takeoff, Landing, Flight, Airport surfaces.	Collision	1D	8a Design ADS-B airborne system to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 5N Avionics certification, installation, and approval process established for ADS-B. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 9a Require alternate means of detecting flying object, e.g., TCAS, ATC warning, etc. 22a Require periodic recalibration of ADS-B inputs, processing system and displays. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook – 760 and similar requirement FAA-G-2100g. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

102	AADF-02.2	Collision of subject aircraft with other aircraft due to erroneous position information on subject aircraft cockpit display. Subject aircraft displays erroneous position information. Source of erroneous information on display is due to failure of on-board display.	Erroneous position information on subject aircraft cockpit display. Source of erroneous information on display is due to failure of on-board display due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Either aircraft on collision course.	Pilot/flight crews initially loss situational awareness. Pilot/flight crew(s) are not aware of collision potential. Other aircraft is identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew does not regain situational awareness. See and avoid unsuccessful.	Takeoff, Landing, Flight, Airport surfaces.	Collision	1D	8a Design ADS-B airborne system to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 5N Avionics certification, installation, and approval process established for ADS-B. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 9a Require alternate means of detecting flying object, e.g., TCAS, ATC warning, etc. 22a Require periodic recalibration of ADS-B inputs, processing system and displays. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook – 760 and similar requirement FAA-G-2100g. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

Automatic Dependent Surveillance Broadcast (ADS-B)

107	**AADF-03**	Collision of other aircraft with subject aircraft due to erroneous position information on other aircraft cockpit display. Subject aircraft transmits erroneous position information.	Erroneous position information on other aircraft cockpit display. Subject aircraft transmits erroneous position information due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Either aircraft on collision course.	Pilot/flight crews initially loss situational awareness. Pilot/flight crew(s) are not aware of collision potential. Other aircraft is not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew does not regain situational awareness. See and avoid unsuccessful.	Takeoff, Landing, Flight, Airport surfaces.	Collision	1D	8a Design ADS-B airborne system to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 5N Avionics certification, installation, and approval process established for ADS-B. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 9a Require alternate means of detecting flying object, e.g., TCAS, ATC warning, etc. 22a Require periodic recalibration of ADS-B inputs, processing system and displays. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook – 760 and similar requirement FAA-G-2100g. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

108	AADF-03.1	Collision of other aircraft with subject aircraft due to erroneous position information on other aircraft cockpit display. Subject aircraft transmits erroneous position information.	Erroneous position information on other aircraft cockpit display. Subject aircraft transmits erroneous position information due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Either aircraft on collision course.	Pilot/flight crews initially loss situational awareness. Pilot/flight crew(s) are not aware of collision potential. Other aircraft is identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew does not regain situational awareness. See and avoid unsuccessful.	Takeoff, Landing, Flight, Airport surfaces.	Collision	1D	8a Design ADS-B airborne system to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 5N Avionics certification, installation, and approval process established for ADS-B. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 9a Require alternate means of detecting flying object, e.g., TCAS, ATC warning, etc. 22a Require periodic recalibration of ADS-B inputs, processing system and displays. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook – 760 and similar requirement FAA-G-2100g. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

109	AADF-03.2	Collision of other aircraft with subject aircraft due to erroneous position information on other aircraft cockpit display. Subject aircraft transmits erroneous position information.	Erroneous position information on other aircraft cockpit display. Subject aircraft transmits erroneous position information due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Either aircraft on collision course.	Pilot/flight crews initially loss situational awareness. Pilot/flight crew(s) are not aware of collision potential. Other aircraft is identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew does not regain situational awareness. See and avoid unsuccessful.	Takeoff, Landing, Flight, Airport surfaces.	Collision	1D	8a Design ADS-B airborne system to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 5N Avionics certification, installation, and approval process established for ADS-B. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 9a Require alternate means of detecting flying object, e.g., TCAS, ATC warning, etc. 22a Require periodic recalibration of ADS-B inputs, processing system and displays. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook – 760 and similar requirement FAA-G-2100g. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

Automatic Dependent Surveillance Broadcast (ADS-B)

114	**AADF-04**	Collision of other aircraft with subject aircraft due to erroneous position information on other aircraft cockpit display. Other aircraft displays erroneous position information. Source of erroneous information on display is due to failure of on-board display.	Erroneous position information on other aircraft cockpit display. Other aircraft displays erroneous position information. Source of erroneous information on display is due to failure of on-board display due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Either aircraft on collision course.	Pilot/flight crews initially loss situational awareness. Pilot/flight crew(s) are not aware of collision potential. Other aircraft is not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew does not regain situational awareness. See and avoid unsuccessful.	Takeoff, Landing, Flight, Airport surfaces.	Collision	1D	8a Design ADS-B airborne system to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 5N Avionics certification, installation, and approval process established for ADS-B. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 9a Require alternate means of detecting flying object, e.g., TCAS, ATC warning, etc. 22a Require periodic recalibration of ADS-B inputs, processing system and displays. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook – 760 and similar requirement FAA-G-2100g. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

115	AADF-04.1	Collision of other aircraft with subject aircraft due to erroneous position information on other aircraft cockpit display. Other aircraft displays erroneous position information. Source of erroneous information on display is due to failure of on-board display.	Erroneous position information on other aircraft cockpit display. Other aircraft displays erroneous position information. Source of erroneous information on display is due to failure of on-board display due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Either aircraft on collision course.	Pilot/flight crews initially loss situational awareness. Pilot/flight crew(s) are not aware of collision potential. Other aircraft is identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew does not regain situational awareness. See and avoid unsuccessful.	Takeoff, Landing, Flight, Airport surfaces.	Collision	1D	8a Design ADS-B airborne system to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 5N Avionics certification, installation, and approval process established for ADS-B. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 9a Require alternate means of detecting flying object, e.g., TCAS, ATC warning, etc. 22a Require periodic recalibration of ADS-B inputs, processing system and displays. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook – 760 and similar requirement FAA-G-2100g. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

116	AADF-04.2	Collision of other aircraft with subject aircraft due to erroneous position information on other aircraft cockpit display. Other aircraft displays erroneous position information. Source of erroneous information on display is due to failure of on-board display.	Erroneous position information on other aircraft cockpit display. Other aircraft displays erroneous position information. Source of erroneous information on display is due to failure of on-board display due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Either aircraft on collision course.	Pilot/flight crews initially loss situational awareness. Pilot/flight crew(s) are not aware of collision potential. Other aircraft is identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew does not regain situational awareness. See and avoid unsuccessful.	Takeoff, Landing, Flight, Airport surfaces.	Collision	1D	8a Design ADS-B airborne system to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 5N Avionics certification, installation, and approval process established for ADS-B. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 9a Require alternate means of detecting flying object, e.g., TCAS, ATC warning, etc. 22a Require periodic recalibration of ADS-B inputs, processing system and displays. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook – 760 and similar requirement FAA-G-2100g. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

Automatic Dependent Surveillance Broadcast (ADS-B)

120	**AGDF-01**	Collision of subject aircraft with ground vehicle due to erroneous position information on subject aircraft cockpit display. Ground vehicle transmits erroneous position information.	Erroneous position information on subject aircraft cockpit display. Ground vehicle transmits erroneous position information due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Either aircraft or ground vehicle on collision course.	Pilot/flight crew loses situational awareness Pilot/aircrew unaware of ground vehicle. Ground vehicle not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew does not regains situational awareness. See and avoid unsuccessful.	Airport surface, Taxi, Takeoff, Landing.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 10 Require ground vehicles to be equipped with appropriate lighting and color indication to enhance “see and avoid” separation. 11 Aircrew and ground personnel “see and avoid” procedures. 8N Require alternate means of detecting ground vehicles, i.e. ASDE-X. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 11N Require certification, installation, and approval process established for ADS-B ground system. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

121	AGDF-01.1	Collision of subject aircraft with ground vehicle due to erroneous position information on subject aircraft cockpit display. Ground vehicle transmits erroneous position information.	Erroneous position information on subject aircraft cockpit display. Ground vehicle transmits erroneous position information due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Either aircraft or ground vehicle on collision course.	Pilot/flight crew and ground vehicle driver loses situational awareness and is not aware of collision potential. Pilot/aircrew unaware of ground vehicle. Ground vehicle identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew does not regain situational awareness. See and avoid unsuccessful.	Airport surface, Taxi, Takeoff, Landing.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 10 Require ground vehicles to be equipped with appropriate lighting and color indication to enhance “see and avoid” separation. 11 Aircrew and ground personnel “see and avoid” procedures. 8N Require alternate means of detecting ground vehicles, i.e. ASDE-X. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 11N Require certification, installation, and approval process established for ADS-B ground system. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

122	AGDF-01.2	Collision of subject aircraft with ground vehicle due to erroneous position information on subject aircraft cockpit display. Ground vehicle transmits erroneous position information.	Erroneous position information on subject aircraft cockpit display. Ground vehicle transmits erroneous position information due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Either aircraft or ground vehicle on collision course.	Pilot/flight crew and ground vehicle driver loss of situational awareness and are not aware of collision potential. Pilot/aircrew unaware of ground vehicle. Ground vehicle identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew does not regain situational awareness. See and avoid unsuccessful.	Airport surface, Taxi, Takeoff, Landing.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 10 Require ground vehicles to be equipped with appropriate lighting and color indication to enhance “see and avoid” separation. 11 Aircrew and ground personnel “see and avoid” procedures. 8N Require alternate means of detecting ground vehicles, i.e. ASDE-X. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 11N Require certification, installation, and approval process established for ADS-B ground system. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

126	**AGDF-02**	Collision of subject aircraft with ground vehicle due to erroneous position information on subject aircraft cockpit display. Subject aircraft displays erroneous position information. Source of erroneous information on display is due to failure of on-board display.	Erroneous position information on subject aircraft cockpit display. Subject aircraft displays erroneous position information. Source of erroneous information on display is due to failure of on-board display due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Either aircraft or ground vehicle on collision course.	Pilot/flight crew loses situational awareness Pilot/aircrew unaware of ground vehicle. Ground vehicle not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew does not regains situational awareness. See and avoid unsuccessful.	Airport surface, Taxi, Takeoff, Landing.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 5N Avionics certification, installation, and approval process established for ADS-B. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 10 Require ground vehicles to be equipped with appropriate lighting and color indication to enhance “see and avoid” separation. 11 Aircrew and ground personnel “see and avoid” procedures. 8N Require alternate means of detecting ground vehicles, i.e. ASDE-X. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 11N Require certification, installation, and approval process established for ADS-B ground system. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

127	AGDF-02.1	Collision of subject aircraft with ground vehicle due to erroneous position information on subject aircraft cockpit display. Subject aircraft displays erroneous position information. Source of erroneous information on display is due to failure of on-board display.	Erroneous position information on subject aircraft cockpit display. Subject aircraft displays erroneous position information. Source of erroneous information on display is due to failure of on-board display due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Either aircraft or ground vehicle on collision course.	Pilot/flight crew and ground vehicle driver loses situational awareness and is not aware of collision potential. Pilot/aircrew unaware of ground vehicle. Ground vehicle identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew does not regain situational awareness. See and avoid unsuccessful.	Airport surface, Taxi, Takeoff, Landing.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 5N Avionics certification, installation, and approval process established for ADS-B. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 10 Require ground vehicles to be equipped with appropriate lighting and color indication to enhance “see and avoid” separation. 11 Aircrew and ground personnel “see and avoid” procedures. 8N Require alternate means of detecting ground vehicles, i.e. ASDE-X. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 11N Require certification, installation, and approval process established for ADS-B ground system. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

128	AGDF-02.2	Collision of subject aircraft with ground vehicle due to erroneous position information on subject aircraft cockpit display. Subject aircraft displays erroneous position information. Source of erroneous information on display is due to failure of on-board display.	Erroneous position information on subject aircraft cockpit display. Subject aircraft displays erroneous position information. Source of erroneous information on display is due to failure of on-board display due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Either aircraft or ground vehicle on collision course.	Pilot/flight crew and ground vehicle driver loss of situational awareness and are not aware of collision potential. Pilot/aircrew unaware of ground vehicle. Ground vehicle identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew does not regain situational awareness. See and avoid unsuccessful.	Airport surface, Taxi, Takeoff, Landing.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 5N Avionics certification, installation, and approval process established for ADS-B. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 10 Require ground vehicles to be equipped with appropriate lighting and color indication to enhance “see and avoid” separation. 11 Aircrew and ground personnel “see and avoid” procedures. 8N Require alternate means of detecting ground vehicles, i.e. ASDE-X. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 11N Require certification, installation, and approval process established for ADS-B ground system. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

132	**SSDF-01**	Collision of subject surface aircraft with other surface aircraft due to erroneous position information on subject aircraft cockpit display. Other surface aircraft transmits erroneous position information.	Erroneous position information on subject aircraft cockpit display. Other surface aircraft transmits erroneous position information due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Either aircraft on collision course.	Pilot/flight crews initially loss situational awareness. Pilot/flight crew(s) are not aware of collision potential. Other aircraft is not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew does not regain situational awareness. See and avoid unsuccessful.	Airport surfaces.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 5N Avionics certification, installation, and approval process established for ADS-B. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 2b Require all aircraft to be equipped with appropriate lighting to enhance "see and avoid" separation. 11 Aircrew and ground personnel "see and avoid" procedures. 12b Require alternate means of detecting aircraft and informing air crew of position, e.g., AMASS. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 11N Require certification, installation, and approval process established for ADS-B ground system. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

133	SSDF-01.1	Collision of subject surface aircraft with other surface aircraft due to erroneous position information on subject aircraft cockpit display. Other surface aircraft transmits erroneous position information.	Erroneous position information on subject aircraft cockpit display. Other surface aircraft transmits erroneous position information due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Either aircraft on collision course.	Pilot/flight crews initially loss situational awareness. Pilot/flight crew(s) are not aware of collision potential. Other aircraft is identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew does not regain situational awareness. See and avoid unsuccessful.	Airport surfaces.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 5N Avionics certification, installation, and approval process established for ADS-B. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 2b Require all aircraft to be equipped with appropriate lighting to enhance "see and avoid" separation. 11 Aircrew and ground personnel "see and avoid" procedures. 12b Require alternate means of detecting aircraft and informing air crew of position, e.g., AMASS. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 11N Require certification, installation, and approval process established for ADS-B ground system. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

134	SSDF-01.2	Collision of subject surface aircraft with other surface aircraft due to erroneous position information on subject aircraft cockpit display. Other surface aircraft transmits erroneous position information.	Erroneous position information on subject aircraft cockpit display. Other surface aircraft transmits erroneous position information due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Either aircraft on collision course.	Pilot/flight crews initially loss situational awareness. Pilot/flight crew(s) are not aware of collision potential. Other aircraft is identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew does not regain situational awareness. See and avoid unsuccessful.	Airport surfaces.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 5N Avionics certification, installation, and approval process established for ADS-B. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 2b Require all aircraft to be equipped with appropriate lighting to enhance "see and avoid" separation. 11 Aircrew and ground personnel "see and avoid" procedures. 12b Require alternate means of detecting aircraft and informing air crew of position, e.g., AMASS. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 11N Require certification, installation, and approval process established for ADS-B ground system. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

139	**SSDF-02**	Collision of subject surface aircraft with other surface aircraft due to erroneous position information on subject aircraft cockpit display. Subject aircraft displays erroneous position information. Source of erroneous information on display is due to failure of on-board display.	Erroneous position information on subject aircraft cockpit display. Subject aircraft displays erroneous position information. Source of erroneous information on display is due to failure of on-board display as a result of: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Either aircraft on collision course.	Pilot/flight crews initially loss situational awareness. Pilot/flight crew(s) are not aware of collision potential. Other aircraft is not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew does not regain situational awareness. See and avoid unsuccessful.	Airport surfaces.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 5N Avionics certification, installation, and approval process established for ADS-B. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 2b Require all aircraft to be equipped with appropriate lighting to enhance "see and avoid" separation. 11 Aircrew and ground personnel "see and avoid" procedures. 12b Require alternate means of detecting aircraft and informing air crew of position, e.g., AMASS. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 11N Require certification, installation, and approval process established for ADS-B ground system. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

140	SSDF-02.1	Collision of subject surface aircraft with other surface aircraft due to erroneous position information on subject aircraft cockpit display. Subject aircraft displays erroneous position information. Source of erroneous information on display is due to failure of on-board display.	Erroneous position information on subject aircraft cockpit display. Subject aircraft displays erroneous position information. Source of erroneous information on display is due to failure of on-board display as a result of: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Either aircraft on collision course.	Pilot/flight crews initially loss situational awareness. Pilot/flight crew(s) are not aware of collision potential. Other aircraft is identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew does not regain situational awareness. See and avoid unsuccessful.	Airport surfaces.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 5N Avionics certification, installation, and approval process established for ADS-B. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 2b Require all aircraft to be equipped with appropriate lighting to enhance "see and avoid" separation. 11 Aircrew and ground personnel "see and avoid" procedures. 12b Require alternate means of detecting aircraft and informing air crew of position, e.g., AMASS. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 11N Require certification, installation, and approval process established for ADS-B ground system. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

141	SSDF-02.2	Collision of subject surface aircraft with other surface aircraft due to erroneous position information on subject aircraft cockpit display. Subject aircraft displays erroneous position information. Source of erroneous information on display is due to failure of on-board display.	Erroneous position information on subject aircraft cockpit display. Subject aircraft displays erroneous position information. Source of erroneous information on display is due to failure of on-board display as a result of: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Either aircraft on collision course.	Pilot/flight crews initially loss situational awareness. Pilot/flight crew(s) are not aware of collision potential. Other aircraft is identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew does not regain situational awareness. See and avoid unsuccessful.	Airport surfaces.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 5N Avionics certification, installation, and approval process established for ADS-B. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 2b Require all aircraft to be equipped with appropriate lighting to enhance "see and avoid" separation. 11 Aircrew and ground personnel "see and avoid" procedures. 12b Require alternate means of detecting aircraft and informing air crew of position, e.g., AMASS. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 11N Require certification, installation, and approval process established for ADS-B ground system. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

146	**SSDF-03**	Collision of other surface aircraft with subject surface aircraft due to erroneous position information on other surface aircraft's display due to failure of other surface aircraft's display.	Erroneous position information on other surface aircraft's display. Failure of other surface aircraft's display due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Either aircraft on collision course.	Pilot/flight crews initially loss situational awareness. Pilot/flight crew(s) are not aware of collision potential. Other aircraft is not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew does not regain situational awareness. See and avoid unsuccessful.	Airport surfaces.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 5N Avionics certification, installation, and approval process established for ADS-B. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 2b Require all aircraft to be equipped with appropriate lighting to enhance "see and avoid" separation. 11 Aircrew and ground personnel "see and avoid" procedures. 12b Require alternate means of detecting aircraft and informing aircrew of position, e.g., AMASS. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 11N Require certification, installation, and approval process established for ADS-B ground system. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

147	SSDF-03.1	Collision of other surface aircraft with subject surface aircraft due to erroneous position information on other surface aircraft's display due to failure of other surface SSDF-03.1aircraft's display.	Erroneous position information on other surface aircraft's display. Failure of other surface aircraft's display due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Either aircraft on collision course.	Pilot/flight crews initially loss situational awareness. Pilot/flight crew(s) are not aware of collision potential. Other aircraft is identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew does not regain situational awareness. See and avoid unsuccessful.	Airport surfaces.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 5N Avionics certification, installation, and approval process established for ADS-B. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 2b Require all aircraft to be equipped with appropriate lighting to enhance "see and avoid" separation. 11 Aircrew and ground personnel "see and avoid" procedures. 12b Require alternate means of detecting aircraft and informing air crew of position, e.g., AMASS. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 11N Require certification, installation, and approval process established for ADS-B ground system. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

148	SSDF-03.2	Collision of other surface aircraft with subject surface aircraft due to erroneous position information on other surface aircraft's display due to failure of other surface aircraft's display.	Erroneous position information on other surface aircraft's display. Failure of other surface aircraft's display due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Either aircraft on collision course.	Pilot/flight crews initially loss situational awareness. Pilot/flight crew(s) are not aware of collision potential. Other aircraft is identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew does not regain situational awareness. See and avoid unsuccessful.	Airport surfaces.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 5N Avionics certification, installation, and approval process established for ADS-B. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 2b Require all aircraft to be equipped with appropriate lighting to enhance "see and avoid" separation. 11 Aircrew and ground personnel "see and avoid" procedures. 12b Require alternate means of detecting aircraft and informing air crew of position, e.g., AMASS. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 11N Require certification, installation, and approval process established for ADS-B ground system. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

153	**SSDF-04**	Collision of other surface aircraft with subject aircraft due to erroneous position information on other surface aircraft display. Source of erroneous information on other surface aircraft display is due to erroneous position data from subject aircraft.	Erroneous position information on other surface aircraft display. Source of erroneous information on other surface aircraft display is due to erroneous position data from subject aircraft resulting from: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Either aircraft on collision course.	Pilot/flight crews initially loss situational awareness. Pilot/flight crew(s) are not aware of collision potential. Other aircraft is not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew does not regain situational awareness. See and avoid unsuccessful.	Airport surfaces.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 5N Avionics certification, installation, and approval process established for ADS-B. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 2b Require all aircraft to be equipped with appropriate lighting to enhance "see and avoid" separation. 11 Aircrew and ground personnel "see and avoid" procedures. 12b Require alternate means of detecting aircraft and informing air crew of position, e.g., AMASS. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 11N Require certification, installation, and approval process established for ADS-B ground system. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

154	SSDF-04.1	Collision of other surface aircraft with subject aircraft due to erroneous position information on other surface aircraft display. Source of erroneous information on other surface aircraft display is due to erroneous position data from subject aircraft.	Erroneous position information on other surface aircraft display. Source of erroneous information on other surface aircraft display is due to erroneous position data from subject aircraft resulting from: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Either aircraft on collision course.	Pilot/flight crews initially loss situational awareness. Pilot/flight crew(s) are not aware of collision potential. Other aircraft is identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew does not regain situational awareness. See and avoid unsuccessful.	Airport surfaces.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 5N Avionics certification, installation, and approval process established for ADS-B. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 2b Require all aircraft to be equipped with appropriate lighting to enhance "see and avoid" separation. 11 Aircrew and ground personnel "see and avoid" procedures. 12b Require alternate means of detecting aircraft and informing air crew of position, e.g., AMASS. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 11N Require certification, installation, and approval process established for ADS-B ground system. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

155	SSDF-04.2	Collision of other surface aircraft with subject aircraft due to erroneous position information on other surface aircraft display. Source of erroneous information on other surface aircraft display is due to erroneous position data from subject aircraft.	Erroneous position information on other surface aircraft display. Source of erroneous information on other surface aircraft display is due to erroneous position data from subject aircraft resulting from: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Either aircraft on collision course.	Pilot/flight crews initially loss situational awareness. Pilot/flight crew(s) are not aware of collision potential. Other aircraft is identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew does not regain situational awareness. See and avoid unsuccessful.	Airport surfaces.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 5N Avionics certification, installation, and approval process established for ADS-B. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 2b Require all aircraft to be equipped with appropriate lighting to enhance "see and avoid" separation. 11 Aircrew and ground personnel "see and avoid" procedures. 12b Require alternate means of detecting aircraft and informing air crew of position, e.g., AMASS. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 11N Require certification, installation, and approval process established for ADS-B ground system. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

160	**AFOD-01**	Collision of subject aircraft with fixed object due to display failure on subject aircraft.	Display failure on subject aircraft due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course with fixed object.	Pilot/flight crew loss of situational awareness, and/or fixed object not properly indicated on charts. Aircraft not identified via radar or other sources. ATCT does not communicate warning. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	1N Require all fixed objects that are evaluated as hazardous to be equipped with ADS-B transmitters. 2N Provide updated information on fixed objects in appropriate data sources. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 5N Avionics certification, installation, and approval process established for ADS-B. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 11 Aircrew and ground personnel “see and avoid” procedures. 12b Require alternate means of detecting aircraft and informing aircrew of position, e.g., AMASS. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 11N Require certification, installation, and approval process established for ADS-B ground system. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

161	AFOD-01.1	Collision of subject aircraft with fixed object due to display failure on subject aircraft.	Display failure on subject aircraft due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course with fixed object.	Pilot/flight crew loss of situational awareness, and/or fixed object not properly indicated on charts. Aircraft identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	1N Require all fixed objects that are evaluated as hazardous to be equipped with ADS-B transmitters. 2N Provide updated information on fixed objects in appropriate data sources. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 5N Avionics certification, installation, and approval process established for ADS-B. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 11 Aircrew and ground personnel “see and avoid” procedures. 12b Require alternate means of detecting aircraft and informing aircrew of position, e.g., AMASS. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 11N Require certification, installation, and approval process established for ADS-B ground system. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

162	AFOD-01.2	Collision of subject aircraft with fixed object due to display failure on subject aircraft.	Display failure on subject aircraft due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course with fixed object.	Pilot/flight crew loss of situational awareness, and/or fixed object not properly indicated on charts. Aircraft identified via radar or other sources. ATCT does communicate warning in time. However pilots/ aircrew are unable to respond in time.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	1N Require all fixed objects that are evaluated as hazardous to be equipped with ADS-B transmitters. 2N Provide updated information on fixed objects in appropriate data sources. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 5N Avionics certification, installation, and approval process established for ADS-B. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 11 Aircrew and ground personnel “see and avoid” procedures. 12b Require alternate means of detecting aircraft and informing aircrew of position, e.g., AMASS. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 11N Require certification, installation, and approval process established for ADS-B ground system. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

167	**AFOD-02**	Collision of subject aircraft with fixed object due to erroneous position information on subject aircraft's display due to fixed object transmitting erroneous position data.	Erroneous position information on subject aircraft's display due to fixed object transmitting erroneous position data as a result of: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course with fixed object.	Pilot/flight crew loss of situational awareness, and/or fixed object not properly indicated on charts. Aircraft not identified via radar or other sources. ATCT does not communicate warning. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	1N Require all fixed objects that are evaluated as hazardous to be equipped with ADS-B transmitters. 2N Provide updated information on fixed objects in appropriate data sources. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 5N Avionics certification, installation, and approval process established for ADS-B. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 11 Aircrew and ground personnel "see and avoid" procedures. 12b Require alternate means of detecting aircraft and informing aircrew of position, e.g., AMASS. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 11N Require certification, installation, and approval process established for ADS-B ground system. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

168	AFOD-02.1	Collision of subject aircraft with fixed object due to erroneous position information on subject aircraft's display due to fixed object transmitting erroneous position data.	Erroneous position information on subject aircraft's display due to fixed object transmitting erroneous position data as a result of: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course with fixed object.	Pilot/flight crew loss of situational awareness, and/or fixed object not properly indicated on charts. Aircraft identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	1N Require all fixed objects that are evaluated as hazardous to be equipped with ADS-B transmitters. 2N Provide updated information on fixed objects in appropriate data sources. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 5N Avionics certification, installation, and approval process established for ADS-B. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 11 Aircrew and ground personnel "see and avoid" procedures. 12b Require alternate means of detecting aircraft and informing aircrew of position, e.g., AMASS. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 11N Require certification, installation, and approval process established for ADS-B ground system. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

169	AFOD-02.2	Collision of subject aircraft with fixed object due to erroneous position information on subject aircraft's display due to fixed object transmitting erroneous position data.	Erroneous position information on subject aircraft's display due to fixed object transmitting erroneous position data as a result of: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course with fixed object.	Pilot/flight crew loss of situational awareness, and/or fixed object not properly indicated on charts. Aircraft identified via radar or other sources. ATCT does communicate warning in time. However pilots/ aircrew are unable to respond in time.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	1N Require all fixed objects that are evaluated as hazardous to be equipped with ADS-B transmitters. 2N Provide updated information on fixed objects in appropriate data sources. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 5N Avionics certification, installation, and approval process established for ADS-B. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 11 Aircrew and ground personnel "see and avoid" procedures. 12b Require alternate means of detecting aircraft and informing aircrew of position, e.g., AMASS. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 11N Require certification, installation, and approval process established for ADS-B ground system. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

Automatic Dependent Surveillance Broadcast (ADS-B)

174	**AAAL-01**	Loss of separation assurance and collision during terminal approach due to ADS-B failure. (No other surveillance information available, i.e., no backup)	Failure on ADS-B due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course. No other surveillance information available, i.e., no backup.	Pilot/flight crew loss of situational awareness.. Aircraft not identified via radar or other sources. ATCT does not communicate warning. See and avoid unsuccessful.	Terminal Approach	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 9a Require alternate means of detecting flying object, e.g., TCAS, ATC warning, etc. 2a Require warning lights on other aircraft to enhance “see and avoid” separation 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, malfunctions. 10N Require all aircraft that can become hazards to navigation be equipped with ADS-B transmitters, or other appropriate automated means of identification. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 11N Require certification, installation, and approval process established for ADS-B ground system. 5N Avionics certification, installation, and approval process established for ADS-B.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

Automatic Dependent Surveillance Broadcast (ADS-B)

175	AAAL-01.1	Loss of separation assurance and collision during terminal approach due to ADS-B failure. (No other surveillance information available, i.e., no backup)	Failure on ADS-B due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course. No other surveillance information available, i.e., no backup.	Pilot/flight crew loss of situational awareness. Aircraft identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Terminal Approach	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 9a Require alternate means of detecting flying object, e.g., TCAS, ATC warning, etc. 2a Require warning lights on other aircraft to enhance “see and avoid” separation 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, malfunctions. 10N Require all aircraft that can become hazards to navigation be equipped with ADS-B transmitters, or other appropriate automated means of identification. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 11N Require certification, installation, and approval process established for ADS-B ground system. 5N Avionics certification, installation, and approval process established for ADS-B.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

176	AAAL-01.2	Loss of separation assurance and collision during terminal approach due to ADS-B failure. (No other surveillance information available, i.e., no backup)	Failure on ADS-B due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course. No other surveillance information available, i.e., no backup.	Pilot/flight crew loss of situational awareness. Aircraft identified via radar or other sources. ATCT does communicate warning in time. However pilots/ aircrew are unable to respond in time.	Terminal Approach	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 9a Require alternate means of detecting flying object, e.g., TCAS, ATC warning, etc. 2a Require warning lights on other aircraft to enhance “see and avoid” separation 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, malfunctions. 10N Require all aircraft that can become hazards to navigation be equipped with ADS-B transmitters, or other appropriate automated means of identification. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 11N Require certification, installation, and approval process established for ADS-B ground system. 5N Avionics certification, installation, and approval process established for ADS-B.

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228	**HF-06**	Inappropriate or erroneous communication due to less than adequate CHI design results in loss of situational awareness and increased collision risk between aircraft.	Inappropriate communication or erroneous communication associated with ADS-B due to LTA CHI design. Miss communication occurs. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	6 Design in accordance with FAA CT-96/1 69 Design ADS-B CHI to minimize the potential for human error. 70 Design ADS-B for use in international communication in accordance with acceptable human factors design practices (e.g., IACO standard symbology??) 75 Provide alternate means of communication, i.e., Voice backup. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook – 760 and similar requirement FAA-G-2100g.
229	HF-06.1	Inappropriate or erroneous communication due to less than adequate CHI design results in loss of situational awareness and increased collision risk between aircraft.	Inappropriate communication or erroneous communication associated with ADS-B due to LTA CHI design. Miss communication occurs. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	6 Design in accordance with FAA CT-96/1 69 Design ADS-B CHI to minimize the potential for human error. 70 Design ADS-B for use in international communication in accordance with acceptable human factors design practices (e.g., IACO standard symbology??) 75 Provide alternate means of communication, i.e., Voice backup. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook – 760 and similar requirement FAA-G-2100g.

230	HF-06.2	Inappropriate or erroneous communication due to less than adequate CHI design results in loss of situational awareness and increased collision risk between aircraft.	Inappropriate communication or erroneous communication associated with ADS-B due to LTA CHI design. Miss communication occurs. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does communicate warning in time. However pilots/ aircrew are unable to respond in time.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	6 Design in accordance with FAA CT-96/1 69 Design ADS-B CHI to minimize the potential for human error. 70 Design ADS-B for use in international communication in accordance with acceptable human factors design practices (e.g., IACO standard symbology??) 75 Provide alternate means of communication, i.e., Voice backup. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook – 760 and similar requirement FAA-G-2100g.
235	**HF.07**	Inappropriate or erroneous communication due to less than adequate CHI design results in loss of situational awareness and increased collision risk between aircraft and ground vehicle.	Inappropriate communication or erroneous communication associated with ADS-B due to LTA CHI design. Miss communication occurs. Aircraft and vehicle on collision course.	Initial pilot/flight crew/controller/driver loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. See and avoid unsuccessful.	Airport surface, Emergency.	Collision	1D	6 Design in accordance with FAA CT-96/1 69 Design ADS-B CHI to minimize the potential for human error. 70 Design ADS-B for use in international communication in accordance with acceptable human factors design practices (e.g., IACO standard symbology??) 75 Provide alternate means of communication, i.e., Voice backup. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook – 760 and similar requirement FAA-G-2100g.

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236	HF.07.1	Inappropriate or erroneous communication due to less than adequate CHI design results in loss of situational awareness and increased collision risk between aircraft and ground vehicle.	Inappropriate communication or erroneous communication associated with ADS-B due to LTA CHI design. Miss communication occurs. Aircraft and vehicle on collision course.	Initial pilot/flight crew/controller/driver loss of situational awareness. Aircraft identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Airport surface, Emergency.	Collision	1D	6 Design in accordance with FAA CT-96/1 69 Design ADS-B CHI to minimize the potential for human error. 70 Design ADS-B for use in international communication in accordance with acceptable human factors design practices (e.g., IACO standard symbology??) 75 Provide alternate means of communication, i.e., Voice backup. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook – 760 and similar requirement FAA-G-2100g.
237	HF.07.2	Inappropriate or erroneous communication due to less than adequate CHI design results in loss of situational awareness and increased collision risk between aircraft and ground vehicle.	Inappropriate communication or erroneous communication associated with ADS-B due to LTA CHI design. Miss communication occurs. Aircraft and vehicle on collision course.	Initial pilot/flight crew/controller/driver loss of situational awareness. Aircraft identified via radar or other sources. ATCT does communicate warning in time. However pilots/ aircrew are unable to respond in time.	Airport surface, Emergency.	Collision	1D	6 Design in accordance with FAA CT-96/1 69 Design ADS-B CHI to minimize the potential for human error. 70 Design ADS-B for use in international communication in accordance with acceptable human factors design practices (e.g., IACO standard symbology??) 75 Provide alternate means of communication, i.e., Voice backup. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook – 760 and similar requirement FAA-G-2100g.

Automatic Dependent Surveillance Broadcast (ADS-B)

242	**SA-01**	Inappropriate clearance given as a result of erroneous flight data in Data Block, i.e., ACID, ALTITUDE, POSITION, HEADING, etc caused by loss of data integrity. Scenario results in collision.	Loss of data integrity due to system anomaly. Inappropriate clearance given as a result of erroneous flight data. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	76 Design ADS-B system to include end-to-end data integrity check functionality and provide proper notification if data corruption is detected 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness.
243	SA-01.1	Inappropriate clearance given as a result of erroneous flight data in Data Block, i.e., ACID, ALTITUDE, POSITION, HEADING, etc caused by loss of data integrity. Scenario results in collision.	Loss of data integrity due to system anomaly. Inappropriate clearance given as a result of erroneous flight data. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	76 Design ADS-B system to include end-to-end data integrity check functionality and provide proper notification if data corruption is detected 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness.
244	SA-01.2	Inappropriate clearance given as a result of erroneous flight data in Data Block, i.e., ACID, ALTITUDE, POSITION, HEADING, etc caused by loss of data integrity. Scenario results in collision.	Loss of data integrity due to system anomaly. Inappropriate clearance given as a result of erroneous flight data. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does communicate warning in time. However pilots/ aircrew are unable to respond in time.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	76 Design ADS-B system to include end-to-end data integrity check functionality and provide proper notification if data corruption is detected 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness.
249	**SA-02**	Loss of separation assurance and collision during terminal approach due to frequency saturation i.e., is their sufficient bandwidth to accommodate all aircraft in a terminal environment?	Loss of ADS-B associated with some aircraft as a result of frequency saturation due to LTA bandwidth. Loss of target identification. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	19 Allocate appropriate bandwidth to accommodate current and projected traffic growth. 20 Select transmission frequencies with enough bandwidth to accommodate the allocation. 21 Alternate means of separation assurance must be provided. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness.

250	SA-02.1	Loss of separation assurance and collision during terminal approach due to frequency saturation i.e., is their sufficient bandwidth to accommodate all aircraft in a terminal environment?	Loss of ADS-B associated with some aircraft as a result of frequency saturation due to LTA bandwidth. Loss of target identification. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	19 Allocate appropriate bandwidth to accommodate current and projected traffic growth. 20 Select transmission frequencies with enough bandwidth to accommodate the allocation. 21 Alternate means of separation assurance must be provided. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness.
251	SA-02.2	Loss of separation assurance and collision during terminal approach due to frequency saturation i.e., is their sufficient bandwidth to accommodate all aircraft in a terminal environment?	Loss of ADS-B associated with some aircraft as a result of frequency saturation due to LTA bandwidth. Loss of target identification. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does communicate warning in time. However pilots/ aircrew are unable to respond in time.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	19 Allocate appropriate bandwidth to accommodate current and projected traffic growth. 20 Select transmission frequencies with enough bandwidth to accommodate the allocation. 21 Alternate means of separation assurance must be provided. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness.
256	**SA-03**	Loss of separation assurance and collision due to insufficient range of ADS-B on approaching aircraft.	Insufficient range of ADS-B on approaching aircraft due to LTA design. Loss of target identification. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. See and avoid unsuccessful.	Approach, Landing	Collision	1D	74 Ensure that both aircraft are equipped for the application. 9b Provide alternate means of detection and collision avoidance. 16N Define criteria for determining threshold values for ADS-B coverage area to assure controller/pilot adequate situational awareness. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness.
257	SA-03.1	Loss of separation assurance and collision due to insufficient range of ADS-B on approaching aircraft.	Insufficient range of ADS-B on approaching aircraft due to LTA design. Loss of target identification. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Approach, Landing.	Collision	1D	74 Ensure that both aircraft are equipped for the application. 9b Provide alternate means of detection and collision avoidance. 16N Define criteria for determining threshold values for ADS-B coverage area to assure controller/pilot adequate situational awareness. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness.

258	SA-03.2	Loss of separation assurance and collision due to insufficient range of ADS-B on approaching aircraft.	Insufficient range of ADS-B on approaching aircraft due to LTA design. Loss of target identification. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does communicate warning in time. However pilots/ aircrew are unable to respond in time.	Approach, Landing	Collision	1D	74 Ensure that both aircraft are equipped for the application. 9b Provide alternate means of detection and collision avoidance. 16N Define criteria for determining threshold values for ADS-B coverage area to assure controller/pilot adequate situational awareness. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness.
263	**SA-04**	Possible increased collision risk due to ADS-B system calibration deviation. Scenario addresses many aircraft.	ADS-B system calibration deviation due to LTA design. Deviation results in "ghosting", "masking", inappropriate target identification, or loss of target. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	22a Require periodic recalibration of ADS-B inputs, processing system and displays. 23 Consider automated system for recalibration of ADS-B systems. 24 Provide a design requirement for system –wide calibration of ADS-B. 25 Provide built-in test capability in the system to identify and report when the system is out of calibration. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness.
264	SA-04.1	Possible increased collision risk due to ADS-B system calibration deviation. Scenario addresses many aircraft.	ADS-B system calibration deviation due to LTA design. Deviation results in "ghosting", "masking", inappropriate target identification, or loss of target. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	22a Require periodic recalibration of ADS-B inputs, processing system and displays. 23 Consider automated system for recalibration of ADS-B systems. 24 Provide a design requirement for system –wide calibration of ADS-B. 25 Provide built-in test capability in the system to identify and report when the system is out of calibration. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness.
265	SA-04.2	Possible increased collision risk due to ADS-B system calibration deviation. Scenario addresses many aircraft.	ADS-B system calibration deviation due to LTA design. Deviation results in "ghosting", "masking", inappropriate target identification, or loss of target. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does communicate warning in time. However pilots/ aircrew are unable to respond in time.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	22a Require periodic recalibration of ADS-B inputs, processing system and displays. 23 Consider automated system for recalibration of ADS-B systems. 24 Provide a design requirement for system –wide calibration of ADS-B. 25 Provide built-in test capability in the system to identify and report when the system is out of calibration. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

269	**SA-05**	Common Mode failures in ADS-B that could result in loss of separation assurance and collision.	Common Mode failures due to LTA redundancy within design. Loss of ADS-B associated with some aircraft as a result of Common Mode failures. Loss of target identification. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 27 Design the system to assure that dual independent component failure, dual human errors, or a combination of a component failure and a human error cannot cause a catastrophic event. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 9c Require alternate means of detecting other aircraft, e.g., TCAS, ATC warning, etc. 2a Require warning lights on other aircraft to enhance “see and avoid” separation.

270	SA-05.1	Common Mode failures in ADS-B that could result in loss of separation assurance and collision.	Common Mode failures due to LTA redundancy within design. Loss of ADS-B associated with some aircraft as a result of Common Mode failures. Loss of target identification. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 27 Design the system to assure that dual independent component failure, dual human errors, or a combination of a component failure and a human error cannot cause a catastrophic event. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 9c Require alternate means of detecting other aircraft, e.g., TCAS, ATC warning, etc. 2a Require warning lights on other aircraft to enhance “see and avoid” separation.

271	SA-05.2	Common Mode failures in ADS-B that could result in loss of separation assurance and collision.	Common Mode failures due to LTA redundancy within design. Loss of ADS-B associated with some aircraft as a result of Common Mode failures. Loss of target identification. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does communicate warning in time. However pilots/ aircrew are unable to respond in time.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 27 Design the system to assure that dual independent component failure, dual human errors, or a combination of a component failure and a human error cannot cause a catastrophic event. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 9c Require alternate means of detecting other aircraft, e.g., TCAS, ATC warning, etc. 2a Require warning lights on other aircraft to enhance "see and avoid" separation.
276	**SA-06**	Loss of separation and collision due to common software anomaly.	Common software anomaly due to: LTA design SW malfunction System malfunction Human error. Anomaly results in "ghosting", "masking", inappropriate target identification, or loss of target. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2) 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 18N Design Software in accordance with Advisory Circular 20-115B. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

277	SA-06.1	Loss of separation and collision due to common software anomaly.	Common software anomaly due to: LTA design SW malfunction System malfunction Human error. Anomaly results in “ghosting”, “masking”, inappropriate target identification, or loss of target. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2) 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 18N Design Software in accordance with Advisory Circular 20-115B. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.
278	SA-06.2	Loss of separation and collision due to common software anomaly.	Common software anomaly due to: LTA design SW malfunction System malfunction Human error. Anomaly results in “ghosting”, “masking”, inappropriate target identification, or loss of target. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does communicate warning in time. However pilots/ aircrew are unable to respond in time.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2) 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 18N Design Software in accordance with Advisory Circular 20-115B. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

283	**SA-07**	Common cause failure in ADS-B results in loss of transmission and consequent collision.	Common cause failures due to: LTA design SW malfunction System malfunction Human error. Loss of ADS-B associated with some aircraft as a result of Common cause failures. Loss of target identification. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2) 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

284	SA-07.1	Common cause failure in ADS-B results in loss of transmission and consequent collision.	Common cause failures due to: LTA design SW malfunction System malfunction Human error. Loss of ADS-B associated with some aircraft as a result of Common cause failures. Loss of target identification. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2) 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

285	SA-07.2	Common cause failure in ADS-B results in loss of transmission and consequent collision.	Common cause failures due to: LTA design SW malfunction System malfunction Human error. Loss of ADS-B associated with some aircraft as a result of Common cause failures. Loss of target identification. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does communicate warning in time. However pilots/ aircrew are unable to respond in time.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2) 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.
290	**SA-08**	Loss of separation integrity due to delay in transmitting data results in collision.	Delay in transmitting data as a result of: Latency within design SW bandwidth SW malfunction System malfunction LTA design. Loss of ADS-B associated with some aircraft as a result of transmission delay. Loss of target identification. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	28 Provide for appropriate latency budget for ADS-B system. 29 Design the system to assure that potential for delay is minimized. 30 Design the system to monitor time delays and eliminate bad data. 31 Provide design to identify latency delays and indicate those anomaly. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

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291	SA-08.1	Loss of separation integrity due to delay in transmitting data results in collision.	Delay in transmitting data as a result of: Latency within design SW bandwidth SW malfunction System malfunction LTA design. Loss of ADS-B associated with some aircraft as a result of transmission delay. Loss of target identification. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	28 Provide for appropriate latency budget for ADS-B system. 29 Design the system to assure that potential for delay is minimized. 30 Design the system to monitor time delays and eliminate bad data. 31 Provide design to identify latency delays and indicate those anomaly. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.
292	SA-08.2	Loss of separation integrity due to delay in transmitting data results in collision.	Delay in transmitting data as a result of: Latency within design SW bandwidth SW malfunction System malfunction LTA design. Loss of ADS-B associated with some aircraft as a result of transmission delay. Loss of target identification. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does communicate warning in time. However pilots/ aircrew are unable to respond in time.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	28 Provide for appropriate latency budget for ADS-B system. 29 Design the system to assure that potential for delay is minimized. 30 Design the system to monitor time delays and eliminate bad data. 31 Provide design to identify latency delays and indicate those anomaly. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

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Automatic Dependent Surveillance Broadcast (ADS-B)

297	**SA-09**	Possible increased collision risk due to ADS-B system calibration error.	ADS-B system calibration error. Deviation results in "ghosting", "masking", inappropriate target identification, or loss of target. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	22a Require periodic recalibration of ADS-B inputs, processing system and displays. 23 Consider automated system for recalibration of ADS-B systems. 24 Provide a design requirement for system –wide calibration of ADS-B. 25 Provide built-in test capability in the system to identify and report when the system is out of calibration. 76 Require periodic recalibration of ADS-B inputs, processing system and transmitter.
298	SA-09.1	Possible increased collision risk due to ADS-B system calibration error.	ADS-B system calibration error. Deviation results in "ghosting", "masking", inappropriate target identification, or loss of target. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	22a Require periodic recalibration of ADS-B inputs, processing system and displays. 23 Consider automated system for recalibration of ADS-B systems. 24 Provide a design requirement for system –wide calibration of ADS-B. 25 Provide built-in test capability in the system to identify and report when the system is out of calibration. 76 Require periodic recalibration of ADS-B inputs, processing system and transmitter.
299	SA-09.2	Possible increased collision risk due to ADS-B system calibration error.	ADS-B system calibration error. Deviation results in "ghosting", "masking", inappropriate target identification, or loss of target. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does communicate warning in time. However pilots/ aircrew are unable to respond in time.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	22a Require periodic recalibration of ADS-B inputs, processing system and displays. 23 Consider automated system for recalibration of ADS-B systems. 24 Provide a design requirement for system –wide calibration of ADS-B. 25 Provide built-in test capability in the system to identify and report when the system is out of calibration. 76 Require periodic recalibration of ADS-B inputs, processing system and transmitter.

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Automatic Dependent Surveillance Broadcast (ADS-B)

304	**SA-10**	ADS-B system malfunction occurs and the ground controller does not detect it. Scenario results in collision.	ADS-B system malfunction occurs. Loss of or inappropriate target identification. Maintenance does not detect malfunction, or is unable to communicate malfunction in time to controller. Controller does not detect malfunction. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	72 Design reliable built-in test capability. 73 Design system to determine data validity. 32 Provide alternate means of providing functionality. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.
305	SA-10.1	ADS-B system malfunction occurs and the ground controller does not detect it. Scenario results in collision.	ADS-B system malfunction occurs. Loss of or inappropriate target identification. Maintenance does not detect malfunction, or is unable to communicate malfunction in time to controller. Controller does not detect malfunction. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does communicate warning in time. However pilots/ aircrew are unable to respond in time.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	72 Design reliable built-in test capability. 73 Design system to determine data validity. 32 Provide alternate means of providing functionality. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

306	SA-10.2	ADS-B system malfunction occurs and the ground controller does not detect it. Scenario results in collision.	ADS-B system malfunction occurs. Loss of or inappropriate target identification. Maintenance does not detect malfunction, or is unable to communicate malfunction in time to controller. Controller does not detect malfunction. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid not successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	72 Design reliable built-in test capability. 73 Design system to determine data validity. 32 Provide alternate means of providing functionality. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.
311	**SA-11**	ADS-B system malfunction occurs and the pilot does not detect it. Scenario results in collision.	ADS-B system malfunction occurs. Loss of or inappropriate target identification. Maintenance does not detect malfunction, or is unable to communicate malfunction in time to controller. Pilot/flight crew/ Controller does not detect malfunction. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	72 Design reliable built-in test capability. 73 Design system to determine data validity. 32 Provide alternate means of providing functionality. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

Automatic Dependent Surveillance Broadcast (ADS-B)

312	SA-11.1	ADS-B system malfunction occurs and the pilot does not detect it. Scenario results in collision.	ADS-B system malfunction occurs. Loss of or inappropriate target identification. Maintenance does not detect malfunction, or is unable to communicate malfunction in time to controller. Pilot/flight crew/ Controller does not detect malfunction. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does communicate warning in time. However pilots/ aircrew are unable to respond in time.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	72 Design reliable built-in test capability. 73 Design system to determine data validity. 32 Provide alternate means of providing functionality. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.
313	SA-11.2	ADS-B system malfunction occurs and the pilot does not detect it. Scenario results in collision.	ADS-B system malfunction occurs. Loss of or inappropriate target identification. Maintenance does not detect malfunction, or is unable to communicate malfunction in time to controller. Pilot/flight crew/ Controller does not detect malfunction. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid not successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	72 Design reliable built-in test capability. 73 Design system to determine data validity. 32 Provide alternate means of providing functionality. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

318	**SA-12**	Erroneous malfunction indication to pilot. Scenario results in collision.	ADS-B is functional. Erroneous malfunction indication occurs due to: SW error Human error System error Design error. Aircraft not on collision course. Pilot/flight crew takes inappropriate action as a result of indication. Aircraft now on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	33a Design the system to minimize false alarms. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook – 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.
319	SA-12.1	Erroneous malfunction indication to pilot. Scenario results in collision.	ADS-B is functional. Erroneous malfunction indication occurs due to: SW error Human error System error Design error. Aircraft not on collision course. Pilot/flight crew takes inappropriate action as a result of indication. Aircraft now on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does communicate warning in time. However pilots/ aircrew are unable to respond in time.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	33a Design the system to minimize false alarms. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook – 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.

320	SA-12.2	Erroneous malfunction indication to pilot. Scenario results in collision.	ADS-B is functional. Erroneous malfunction indication occurs due to: SW error Human error System error Design error. Aircraft not on collision course. Pilot/flight crew takes inappropriate action as a result of indication. Aircraft now on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid not successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	33a Design the system to minimize false alarms. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook – 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.
325	**SA-13**	Erroneous malfunction indication to controller. Scenario results in collision.	ADS-B is functional. Erroneous malfunction indication occurs due to: SW error Human error System error Design error. Aircraft not on collision course. Controller takes inappropriate action as a result of indication. Pilot/flight crew takes inappropriate action. Aircraft now on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	33a Design the system to minimize false alarms. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook – 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.

326	SA-13.1	Erroneous malfunction indication to controller. Scenario results in collision.	ADS-B is functional. Erroneous malfunction indication occurs due to: SW error Human error System error Design error. Aircraft not on collision course. Controller takes inappropriate action as a result of indication. Pilot/flight crew takes inappropriate action. Aircraft now on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does communicate warning in time. However pilots/ aircrew are unable to respond in time.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	33a Design the system to minimize false alarms. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook – 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.
327	SA-13.2	Erroneous malfunction indication to controller. Scenario results in collision.	ADS-B is functional. Erroneous malfunction indication occurs due to: SW error Human error System error Design error. Aircraft not on collision course. Controller takes inappropriate action as a result of indication. Pilot/flight crew takes inappropriate action. Aircraft now on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid not successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	33a Design the system to minimize false alarms. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook – 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

332	**SA-14**	Erroneous turn indication due to ADS-B system forecast error. Scenario results in collision. Aircraft initially not on collision course.	Erroneous turn indication due to ADS-B system forecast error. Forecasting error occurs due to: SW malfunction HW malfunction System malfunction LTA design Design error. Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result of turn indication. Aircraft now on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	34 Design forecasting algorithms with sufficient margins of safety. 33b Design the system to minimize the potential for false alarms. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook – 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.

333	SA-14.1	Erroneous turn indication due to ADS-B system forecast error. Scenario results in collision. Aircraft initially not on collision course.	Erroneous turn indication due to ADS-B system forecast error. Forecasting error occurs due to: SW malfunction HW malfunction System malfunction LTA design Design error. Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result of turn indication. Aircraft now on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does communicate warning in time. However pilots/ aircrew are unable to respond in time.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	34 Design forecasting algorithms with sufficient margins of safety. 33b Design the system to minimize the potential for false alarms. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook – 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.

334	SA-14.2	Erroneous turn indication due to ADS-B system forecast error. Scenario results in collision. Aircraft initially not on collision course.	Erroneous turn indication due to ADS-B system forecast error. Forecasting error occurs due to: SW malfunction HW malfunction System malfunction LTA design Design error. Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result of turn indication. Aircraft now on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid not successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	34 Design forecasting algorithms with sufficient margins of safety. 33b Design the system to minimize the potential for false alarms. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook – 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.

338	**SA-15**	Erroneous turn indication due to ADS-B system forecast error. Scenario results in collision. Aircraft initially on collision course.	Erroneous turn indication due to ADS-B system forecast error. Forecasting error occurs due to: SW malfunction HW malfunction System malfunction LTA design Design error. Aircraft on collision course. Pilot/flight crew/controller takes inappropriate action as a result of turn indication. Aircraft remains on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	34 Design forecasting algorithms with sufficient margins of safety. 33b Design the system to minimize the potential for false alarms. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook – 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.

339	SA-15.1	Erroneous turn indication due to ADS-B system forecast error. Scenario results in collision. Aircraft initially on collision course.	Erroneous turn indication due to ADS-B system forecast error. Forecasting error occurs due to: SW malfunction HW malfunction System malfunction LTA design Design error. Aircraft on collision course. Pilot/flight crew/controller takes inappropriate action as a result of turn indication. Aircraft remains on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does communicate warning in time. However pilots/ aircrew are unable to respond in time.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	34 Design forecasting algorithms with sufficient margins of safety. 33b Design the system to minimize the potential for false alarms. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook – 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.

340	SA-15.2	Erroneous turn indication due to ADS-B system forecast error. Scenario results in collision. Aircraft initially on collision course.	Erroneous turn indication due to ADS-B system forecast error. Forecasting error occurs due to: SW malfunction HW malfunction System malfunction LTA design Design error. Aircraft on collision course. Pilot/flight crew/controller takes inappropriate action as a result of turn indication. Aircraft remains on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid not successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	34 Design forecasting algorithms with sufficient margins of safety. 33b Design the system to minimize the potential for false alarms. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook – 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.

345	**SA-16**	Erroneous turn indication due to ADS-B system malfunction. Scenario results in collision. Aircraft initially not on collision course.	Erroneous turn indication due to ADS-B system malfunction. Forecasting error occurs due to: SW malfunction HW malfunction System malfunction LTA design Design error. Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result of turn indication. Aircraft now on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	34 Design forecasting algorithms with sufficient margins of safety. 33b Design the system to minimize the potential for false alarms. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook – 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.

346	SA-16.1	Erroneous turn indication due to ADS-B system malfunction. Scenario results in collision. Aircraft initially not on collision course.	Erroneous turn indication due to ADS-B system malfunction. Forecasting error occurs due to: SW malfunction HW malfunction System malfunction LTA design Design error. Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result of turn indication. Aircraft now on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does communicate warning in time. However pilots/ aircrew are unable to respond in time.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	34 Design forecasting algorithms with sufficient margins of safety. 33b Design the system to minimize the potential for false alarms. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook – 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.

347	SA-16.2	Erroneous turn indication due to ADS-B system malfunction. Scenario results in collision. Aircraft initially not on collision course.	Erroneous turn indication due to ADS-B system forecast error. Forecasting error occurs due to: SW malfunction HW malfunction System malfunction LTA design Design error. Aircraft on collision course. Pilot/flight crew/controller takes inappropriate action as a result of turn indication. Aircraft remains on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid not successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	34 Design forecasting algorithms with sufficient margins of safety. 33b Design the system to minimize the potential for false alarms. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook – 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.

352	**SA-17**	Erroneous turn indication due to ADS-B system malfunction. Scenario results in collision. Aircraft initially on collision course.	Erroneous turn indication due to ADS-B system malfunction. Forecasting error occurs due to: SW malfunction HW malfunction System malfunction LTA design Design error. Aircraft on collision course. Pilot/flight crew/controller takes inappropriate action as a result of turn indication. Aircraft remains on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	34 Design forecasting algorithms with sufficient margins of safety. 33b Design the system to minimize the potential for false alarms. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook – 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.

353	SA-17.1	Erroneous turn indication due to ADS-B system malfunction. Scenario results in collision. Aircraft initially on collision course.	Erroneous turn indication due to ADS-B system malfunction. Forecasting error occurs due to: SW malfunction HW malfunction System malfunction LTA design Design error. Aircraft on collision course. Pilot/flight crew/controller takes inappropriate action as a result of turn indication. Aircraft remains on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does communicate warning in time. However pilots/ aircrew are unable to respond in time.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	34 Design forecasting algorithms with sufficient margins of safety. 33b Design the system to minimize the potential for false alarms. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook – 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.

354	SA-17.2	Erroneous turn indication due to ADS-B system malfunction. Scenario results in collision. Aircraft initially on collision course.	Erroneous turn indication due to ADS-B system malfunction. Forecasting error occurs due to: SW malfunction HW malfunction System malfunction LTA design Design error. Aircraft on collision course. Pilot/flight crew/controller takes inappropriate action as a result of turn indication. Aircraft remains on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid not successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	34 Design forecasting algorithms with sufficient margins of safety. 33b Design the system to minimize the potential for false alarms. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook – 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.
358	**SA-18**	Loss of separation assurance results in collision due to erroneous "future intent" messages, due to system malfunction.	Erroneous "future intent" messages, due to system malfunction. Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result of erroneous "future intent" message. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	34 Design forecasting algorithms with sufficient margins of safety. 33b Design the system to minimize the potential for false alarms. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook – 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

359	SA-18.1	Loss of separation assurance results in collision due to erroneous "future intent" messages, due to system malfunction.	Erroneous "future intent" messages, due to system malfunction. Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result of erroneous "future intent" message. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does communicate warning in time. However pilots/ aircrew are unable to respond in time.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	34 Design forecasting algorithms with sufficient margins of safety. 33b Design the system to minimize the potential for false alarms. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook – 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.
360	SA-18.2	Loss of separation assurance results in collision due to erroneous "future intent" messages, due to system malfunction.	Erroneous "future intent" messages, due to system malfunction. Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result of erroneous "future intent" message. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid not successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	34 Design forecasting algorithms with sufficient margins of safety. 33b Design the system to minimize the potential for false alarms. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook – 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.

365	**SA-19**	Display information conflict between ground displays and airborne displays due to ADS-B system malfunction results in collision.	Display information conflict due to ADS-B system malfunction. Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result of information conflict. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	35 Design the system to minimize the potential for conflict between the ground displays and airborne displays. 36 Design the system to detect and report conflicts in information between ground and airborne displays. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook – 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.
366	SA-19.1	Display information conflict between ground displays and airborne displays due to ADS-B system malfunction results in collision.	Display information conflict due to ADS-B system malfunction. Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result of information conflict. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does communicate warning in time. However pilots/ aircrew are unable to respond in time.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	35 Design the system to minimize the potential for conflict between the ground displays and airborne displays. 36 Design the system to detect and report conflicts in information between ground and airborne displays. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook – 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.

367	SA-19.2	Display information conflict between ground displays and airborne displays due to ADS-B system malfunction results in collision.	Display information conflict due to ADS-B system malfunction. Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result of information conflict. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid not successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	35 Design the system to minimize the potential for conflict between the ground displays and airborne displays. 36 Design the system to detect and report conflicts in information between ground and airborne displays. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook – 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.
372	**SA-20**	Erroneous position data (latitude-longitude) due to system malfunction resulting in loss of separation and collision.	Erroneous position data (latitude-longitude) due to system malfunction. Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result erroneous position data. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	37 Require independent method of validating position data. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook – 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.

Automatic Dependent Surveillance Broadcast (ADS-B)

373	SA-20.1	Erroneous position data (latitude-longitude) due to system malfunction resulting in loss of separation and collision.	Erroneous position data (latitude-longitude) due to system malfunction. Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result erroneous position data. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does communicate warning in time. However pilots/ aircrew are unable to respond in time.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	37 Require independent method of validating position data. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook – 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.
374	SA-20.2	Erroneous position data (latitude-longitude) due to system malfunction resulting in loss of separation and collision.	Erroneous position data (latitude-longitude) due to system malfunction. Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result erroneous position data. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid not successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	37 Require independent method of validating position data. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook – 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

379	**SA-21**	Erroneous position data (latitude-longitude) due to system malfunction resulting in loss of separation and collision.	Erroneous velocity data (speed and direction) due to system malfunction. Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result erroneous position data. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	38 Require independent method of validating velocity data. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook – 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.
380	SA-21.1	Erroneous velocity data (speed and direction) due to system malfunction resulting in loss of separation and collision.	Erroneous velocity data (speed and direction) due to system malfunction. Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result erroneous position data. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does communicate warning in time. However pilots/ aircrew are unable to respond in time.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	38 Require independent method of validating velocity data. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook – 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.

381	SA-21.2	Erroneous velocity data (speed and direction) due to system malfunction resulting in loss of separation and collision.	Erroneous velocity data (speed and direction) due to system malfunction. Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result erroneous position data. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid not successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	38 Require independent method of validating velocity data. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook – 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.
385	**SA-22**	Data conflict between airspeed and velocity data results in erroneous data to be transmitted, (i.e., which one do you believe?), as a result of system malfunction. Scenario results in collision.	Data conflict between airspeed and velocity data results in erroneous data to be transmitted as a result of system malfunction. Erroneous data transmitted to controller or pilot. Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result erroneous position data. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	39 Design the system to minimize the potential for conflict between airspeed and velocity data. 40 Design the system to detect and indicate a discrepancy between airspeed and calculated velocity. 38 Require independent method of validating velocity data. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook – 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.

386	SA-22.1	Data conflict between airspeed and velocity data results in erroneous data to be transmitted, (i.e., which one do you believe?), as a result of system malfunction. Scenario results in collision.	Data conflict between airspeed and velocity data results in erroneous data to be transmitted as a result of system malfunction. Erroneous data transmitted to controller or pilot. Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result erroneous position data. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does communicate warning in time. However pilots/ aircrew are unable to respond in time.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	39 Design the system to minimize the potential for conflict between airspeed and velocity data. 40 Design the system to detect and indicate a discrepancy between airspeed and calculated velocity. 38 Require independent method of validating velocity data. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook – 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.

387	SA-22.2	Data conflict between airspeed and velocity data results in erroneous data to be transmitted, (i.e., which one do you believe?), as a result of system malfunction. Scenario results in collision.	Data conflict between airspeed and velocity data results in erroneous data to be transmitted as a result of system malfunction. Erroneous data transmitted to controller or pilot. Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result erroneous position data. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid not successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	39 Design the system to minimize the potential for conflict between airspeed and velocity data. 40 Design the system to detect and indicate a discrepancy between airspeed and calculated velocity. 38 Require independent method of validating velocity data. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook – 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.
391	**SA-23**	Barometric Altitude Rate error causes loss of separation in terminal approach sequencing. Scenario results in collision.	Barometric Altitude Rate error due to: Instrument malfunction Human error System malfunction. Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result of Barometric Altitude Rate error. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	41 Design system to detect and indicate erroneous barometric altitude rate errors before transmitting through ADS-B. 42 Provide independent means of validating Barometric altitude rate changes. 43 Provide contingency training to assure situational awareness and acclimation of ADS-B during terminal phase descent. 5N Avionics certification, installation, and approval process established for ADS-B. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook – 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.

392	SA-23.1	Barometric Altitude Rate error causes loss of separation in terminal approach sequencing. Scenario results in collision.	Barometric Altitude Rate error due to: Instrument malfunction Human error System malfunction. Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result of Barometric Altitude Rate error. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does communicate warning in time. However pilots/ aircrew are unable to respond in time.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	41 Design system to detect and indicate erroneous barometric altitude rate errors before transmitting through ADS-B. 42 Provide independent means of validating Barometric altitude rate changes. 43 Provide contingency training to assure situational awareness and acclimation of ADS-B during terminal phase descent. 5N Avionics certification, installation, and approval process established for ADS-B. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook – 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.
393	SA-23.2	Barometric Altitude Rate error causes loss of separation in terminal approach sequencing. Scenario results in collision.	Barometric Altitude Rate error due to: Instrument malfunction Human error System malfunction. Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result of Barometric Altitude Rate error. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid not successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	41 Design system to detect and indicate erroneous barometric altitude rate errors before transmitting through ADS-B. 42 Provide independent means of validating Barometric altitude rate changes. 43 Provide contingency training to assure situational awareness and acclimation of ADS-B during terminal phase descent. 5N Avionics certification, installation, and approval process established for ADS-B. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook – 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.

397	**SA-24**	Barometric Altitude Rate error on own aircraft causes false alarm on receiving aircraft. Scenario results in collision.	Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result of false alarm. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	33b Design the system to minimize the potential for false alarms. 41 Design system to detect and indicate erroneous barometric altitude rate errors before transmitting through ADS-B. 42 Provide independent means of validating Barometric altitude rate changes. 43 Provide contingency training to assure situational awareness and acclimation of ADS-B during terminal phase descent. 5N Avionics certification, installation, and approval process established for ADS-B. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook – 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.
398	SA-24.1	Barometric Altitude Rate error on own aircraft causes false alarm on receiving aircraft. Scenario results in collision.	Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result of false alarm. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does communicate warning in time. However pilots/ aircrew are unable to respond in time.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	33b Design the system to minimize the potential for false alarms. 41 Design system to detect and indicate erroneous barometric altitude rate errors before transmitting through ADS-B. 42 Provide independent means of validating Barometric altitude rate changes. 43 Provide contingency training to assure situational awareness and acclimation of ADS-B during terminal phase descent. 5N Avionics certification, installation, and approval process established for ADS-B. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook – 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.

399	SA-24.2	Barometric Altitude Rate error on own aircraft causes false alarm on receiving aircraft. Scenario results in collision.	Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result of false alarm. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid not successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	33b Design the system to minimize the potential for false alarms. 41 Design system to detect and indicate erroneous barometric altitude rate errors before transmitting through ADS-B. 42 Provide independent means of validating Barometric altitude rate changes. 43 Provide contingency training to assure situational awareness and acclimation of ADS-B during terminal phase descent. 5N Avionics certification, installation, and approval process established for ADS-B. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook – 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.
404	**SA-25**	Barometric Altitude error on own aircraft causes false alarm on receiving aircraft. Scenario results in collision.	Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result of false alarm. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	33b Design the system to minimize the potential for false alarms. 46 Provide alternate means of collision avoidance such as TCAS, or MSAW. 41 Design system to detect and indicate erroneous barometric altitude rate errors before transmitting through ADS-B. 42 Provide independent means of validating Barometric altitude rate changes. 43 Provide contingency training to assure situational awareness and acclimation of ADS-B during terminal phase descent. 5N Avionics certification, installation, and approval process established for ADS-B. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook – 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

405	SA-25.1	Barometric Altitude error on own aircraft causes false alarm on receiving aircraft. Scenario results in collision.	Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result of false alarm. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does communicate warning in time. However pilots/ aircrew are unable to respond in time.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	33b Design the system to minimize the potential for false alarms. 46 Provide alternate means of collision avoidance such as TCAS, or MSAW. 41 Design system to detect and indicate erroneous barometric altitude rate errors before transmitting through ADS-B. 42 Provide independent means of validating Barometric altitude rate changes. 43 Provide contingency training to assure situational awareness and acclimation of ADS-B during terminal phase descent. 5N Avionics certification, installation, and approval process established for ADS-B. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook – 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.

406	SA-25.2	Barometric Altitude error on own aircraft causes false alarm on receiving aircraft. Scenario results in collision.	Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result of false alarm. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid not successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	33b Design the system to minimize the potential for false alarms. 46 Provide alternate means of collision avoidance such as TCAS, or MSAW. 41 Design system to detect and indicate erroneous barometric altitude rate errors before transmitting through ADS-B. 42 Provide independent means of validating Barometric altitude rate changes. 43 Provide contingency training to assure situational awareness and acclimation of ADS-B during terminal phase descent. 5N Avionics certification, installation, and approval process established for ADS-B. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook – 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.

411	**SA-26**	Position error on own aircraft causes false alarm on receiving aircraft. Scenario results in collision.	Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result of false alarm. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	4 Design ADS-B airborne system to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 9c Require alternate means of detecting other aircraft, e.g., TCAS, ATC warning, etc. 2a Require warning lights on other aircraft to enhance “see and avoid” separation. 43 Provide contingency training to assure situational awareness and acclimation of ADS-B during terminal phase descent. 5N Avionics certification, installation, and approval process established for ADS-B. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook – 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 33b Design the system to minimize the potential for false alarms.

412	SA-26.1	Position error on own aircraft causes false alarm on receiving aircraft. Scenario results in collision.	Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result of false alarm. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does communicate warning in time. However pilots/ aircrew are unable to respond in time.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	4 Design ADS-B airborne system to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 9c Require alternate means of detecting other aircraft, e.g., TCAS, ATC warning, etc. 2a Require warning lights on other aircraft to enhance “see and avoid” separation. 43 Provide contingency training to assure situational awareness and acclimation of ADS-B during terminal phase descent. 5N Avionics certification, installation, and approval process established for ADS-B. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook – 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 33b Design the system to minimize the potential for false alarms.

413	SA-26.2	Position error on own aircraft causes false alarm on receiving aircraft. Scenario results in collision.	Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result of false alarm. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid not successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	4 Design ADS-B airborne system to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 9c Require alternate means of detecting other aircraft, e.g., TCAS, ATC warning, etc. 2a Require warning lights on other aircraft to enhance “see and avoid” separation. 43 Provide contingency training to assure situational awareness and acclimation of ADS-B during terminal phase descent. 5N Avionics certification, installation, and approval process established for ADS-B. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook – 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 33b Design the system to minimize the potential for false alarms.

Automatic Dependent Surveillance Broadcast (ADS-B)

418	**SA-27**	ADS-B malfunction caused by COTS or NDI results in system anomaly. Scenario results in collision.	ADS-B malfunction occurs due to the integration of COTS or NDI. COTS or NDI introduce anomalies due to: LTA suitability for use LTA reliability LTA availability System malfunction HW malfunction SW malfunction. Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result anomaly. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	47 Design ADS-B system architecture to ensure failure isolation of COTS and NDI hardware, firmware, and software. 48a Design ADS-B system architecture to ensure that COTS and NDI hardware, firmware and software fails safe. 49 Provide COTS and NDI hardware, firmware, and software discriminators TBD. 18N Design Software in accordance with Advisory Circular 20-115B. 5N Avionics certification, installation, and approval process established for ADS-B. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook – 760 and similar requirement FAA-G-2100g.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

Automatic Dependent Surveillance Broadcast (ADS-B)

419	SA-27.1	ADS-B malfunction caused by COTS or NDI results in system anomaly. Scenario results in collision.	ADS-B malfunction occurs due to the integration of COTS or NDI. COTS or NDI introduce anomalies due to: LTA suitability for use LTA reliability LTA availability System malfunction HW malfunction SW malfunction. Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result anomaly. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does communicate warning in time. However pilots/ aircrew are unable to respond in time.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	47 Design ADS-B system architecture to ensure failure isolation of COTS and NDI hardware, firmware, and software. 48a Design ADS-B system architecture to ensure that COTS and NDI hardware, firmware and software fails safe. 49 Provide COTS and NDI hardware, firmware, and software discriminators TBD. 18N Design Software in accordance with Advisory Circular 20-115B. 5N Avionics certification, installation, and approval process established for ADS-B. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook – 760 and similar requirement FAA-G-2100g.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

420	SA-27.2	ADS-B malfunction caused by COTS or NDI results in system anomaly. Scenario results in collision.	ADS-B malfunction occurs due to the integration of COTS or NDI. COTS or NDI introduce anomalies due to: LTA suitability for use LTA reliability LTA availability System malfunction HW malfunction SW malfunction. Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result anomaly. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid not successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	47 Design ADS-B system architecture to ensure failure isolation of COTS and NDI hardware, firmware, and software. 48a Design ADS-B system architecture to ensure that COTS and NDI hardware, firmware and software fails safe. 49 Provide COTS and NDI hardware, firmware, and software discriminators TBD. 18N Design Software in accordance with Advisory Circular 20-115B. 5N Avionics certification, installation, and approval process established for ADS-B. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook – 760 and similar requirement FAA-G-2100g.
424	**SA-28**	Failure propagation results in loss of ADS-B. Scenario results in collision.	Loss of ADS-B associated with some aircraft. Loss of target identification. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	50 Design ADS-B system architecture to ensure failure isolation of hardware. 48b Design ADS-B system architecture to ensure that hardware, firmware and software fails safe. 27 Design the system to assure that dual independent component failure, dual human errors, or a combination of a component failure and a human error cannot cause a catastrophic event. 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

425	SA-28.1	Failure propagation results in loss of ADS-B. Scenario results in collision.	Loss of ADS-B associated with some aircraft. Loss of target identification. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does communicate warning in time. However pilots/ aircrew are unable to respond in time.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	50 Design ADS-B system architecture to ensure failure isolation of hardware. 48b Design ADS-B system architecture to ensure that hardware, firmware and software fails safe. 27 Design the system to assure that dual independent component failure, dual human errors, or a combination of a component failure and a human error cannot cause a catastrophic event. 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.
426	SA-28.2	Failure propagation results in loss of ADS-B. Scenario results in collision.	Loss of ADS-B associated with some aircraft. Loss of target identification. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid not successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	50 Design ADS-B system architecture to ensure failure isolation of hardware. 48b Design ADS-B system architecture to ensure that hardware, firmware and software fails safe. 27 Design the system to assure that dual independent component failure, dual human errors, or a combination of a component failure and a human error cannot cause a catastrophic event. 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.
433	**SA-29**	Failure propagation results in erroneous message indication. Scenario results in collision.	Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result of erroneous message indication. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	52 Design ADS-B system architecture to ensure failure isolation of hardware, firmware, and software. 48b Design ADS-B system architecture to ensure that hardware, firmware and software fails safe. 27 Design the system to assure that dual independent component failure, dual human errors, or a combination of a component failure and a human error cannot cause a catastrophic event. 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

434	SA-29.1	Failure propagation results in erroneous message indication. Scenario results in collision.	Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result of erroneous message indication. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does communicate warning in time. However pilots/ aircrew are unable to respond in time.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	52 Design ADS-B system architecture to ensure failure isolation of hardware, firmware, and software. 48b Design ADS-B system architecture to ensure that hardware, firmware and software fails safe. 27 Design the system to assure that dual independent component failure, dual human errors, or a combination of a component failure and a human error cannot cause a catastrophic event. 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.
435	SA-29.2	Failure propagation results in erroneous message indication. Scenario results in collision.	Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result of erroneous message indication. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid not successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	52 Design ADS-B system architecture to ensure failure isolation of hardware, firmware, and software. 48b Design ADS-B system architecture to ensure that hardware, firmware and software fails safe. 27 Design the system to assure that dual independent component failure, dual human errors, or a combination of a component failure and a human error cannot cause a catastrophic event. 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.
439	**SA-30** Also see SA-04.	Possible increased collision risk due to ADS-B system calibration deviation. Miscalibration is on single aircraft. Scenario results in collision.	ADS-B system calibration deviation due to LTA design. Deviation results in “ghosting”, “masking”, inappropriate target identification, or loss of target. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	22b Require periodic recalibration of all airborne ADS-B systems. 25 Provide built-in test capability in the system to identify and report when the system is out of calibration. 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

Automatic Dependent Surveillance Broadcast (ADS-B)

440	SA-30.1	Possible increased collision risk due to ADS-B system calibration deviation. Miscalibration is on single aircraft. Scenario results in collision.	ADS-B system calibration deviation due to LTA design. Deviation results in "ghosting", "masking", inappropriate target identification, or loss of target. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does communicate warning in time. However pilots/ aircrew are unable to respond in time.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	22b Require periodic recalibration of all airborne ADS-B systems. 25 Provide built-in test capability in the system to identify and report when the system is out of calibration. 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.
441	SA-30.2	Possible increased collision risk due to ADS-B system calibration deviation. Miscalibration is on single aircraft. Scenario results in collision.	ADS-B system calibration deviation due to LTA design. Deviation results in "ghosting", "masking", inappropriate target identification, or loss of target. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid not successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	22b Require periodic recalibration of all airborne ADS-B systems. 25 Provide built-in test capability in the system to identify and report when the system is out of calibration. 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.
446	**LTAD-01**	Loss of data integrity due to delay in transmitting data due to LTA design. Scenario addresses Transmitter Latency. Scenario results in collision.	Delay in transmitting data as a result of: Latency within design LTA design. Loss of ADS-B associated with some aircraft as a result of transmission delay. Loss of target identification. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	54 Design Transmitter/Receiver to meet Latency Requirements of NAS-SR-1000. 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

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447	LTAD-01.1	Loss of data integrity due to delay in transmitting data due to LTA design. Scenario addresses Transmitter Latency. Scenario results in collision.	Delay in transmitting data as a result of: Latency within design LTA design. Loss of ADS-B associated with some aircraft as a result of transmission delay. Loss of target identification. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does communicate warning in time. However pilots/ aircrew are unable to respond in time.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	54 Design Transmitter/Receiver to meet Latency Requirements of NAS-SR-1000. 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.
448	LTAD-01.2	Loss of data integrity due to delay in transmitting data due to LTA design. Scenario addresses Transmitter Latency. Scenario results in collision.	Delay in transmitting data as a result of: Latency within design LTA design. Loss of ADS-B associated with some aircraft as a result of transmission delay. Loss of target identification. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid not successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	54 Design Transmitter/Receiver to meet Latency Requirements of NAS-SR-1000. 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

453	**LTAD-02**	Loss of data integrity due to communication link latency errors between the airborne and ground receiving/processing systems. Scenario results in collision.	Communication link latency errors between the airborne and ground receiving/processing systems due to latency within design: SW bandwidth SW malfunction System malfunction LTA design. Loss of ADS-B associated with some aircraft as a result of transmission delay. Loss of target identification. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	55 Design Communication link to meet latency Requirements of NAS-SR-1000. 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.
454	LTAD-02.1	Loss of data integrity due to communication link latency errors between the airborne and ground receiving/processing systems. Scenario results in collision.	Communication link latency errors between the airborne and ground receiving/processing systems due to latency within design: SW bandwidth SW malfunction System malfunction LTA design. Loss of ADS-B associated with some aircraft as a result of transmission delay. Loss of target identification. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does communicate warning in time. However pilots/ aircrew are unable to respond in time.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	55 Design Communication link to meet latency Requirements of NAS-SR-1000. 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

455	LTAD-02.2	Loss of data integrity due to communication link latency errors between the airborne and ground receiving/processing systems. Scenario results in collision.	Communication link latency errors between the airborne and ground receiving/processing systems due to latency within design: SW bandwidth SW malfunction System malfunction LTA design. Loss of ADS-B associated with some aircraft as a result of transmission delay. Loss of target identification. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid not successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	55 Design Communication link to meet latency Requirements of NAS-SR-1000. 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.
460	**LTAD-03**	Loss of separation due to time delay in ground processing system. (UPDATE RATE). Scenario results in collision.	Time delay in ground processing system, (UPDATE RATE), due to: SW bandwidth SW malfunction System malfunction LTA design. Pilot/flight crew/controller takes inappropriate action as a result of outdated target information, delay in target updating. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	56. Design application processing system to meet Latency Requirements of NAS-SR –1000. 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

461	LTAD-03.1	Loss of separation due to time delay in ground processing system. (UPDATE RATE). Scenario results in collision.	Time delay in ground processing system, (UPDATE RATE), due to: SW bandwidth SW malfunction System malfunction LTA design. Pilot/flight crew/controller takes inappropriate action as a result of outdated target information, delay in target updating. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does communicate warning in time. However pilots/ aircrew are unable to respond in time.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	56. Design application processing system to meet Latency Requirements of NAS-SR –1000. 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.
462	LTAD-03.2	Loss of separation due to time delay in ground processing system. (UPDATE RATE). Scenario results in collision.	Time delay in ground processing system, (UPDATE RATE), due to: SW bandwidth SW malfunction System malfunction LTA design. Pilot/flight crew/controller takes inappropriate action as a result of outdated target information, delay in target updating. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid not successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	56. Design application processing system to meet Latency Requirements of NAS-SR –1000. 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

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467	**EE-01**	Reduced safety margins due to weather effects on ADS-B which cause temporary "blind spots". Scenario results in collision.	"Blind spots" contribute to loss of target information. Pilot/flight crew/controller takes inappropriate action as a result of loss of target information. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	57 Select frequency spectrum to minimize adverse effects of weather on ADS-B transmissions 58 Consider alternative frequency spectrum as backup. 59 Design ground stations to minimize damage due to lightning or other adverse weather effect. 7 Provide for appropriate ATC/Aircrew contingency procedures. 2b Require all aircraft to be equipped with appropriate lighting to enhance "see and avoid" separation. 11 Aircrew and ground personnel "see and avoid" procedures. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness.
468	EE-01.1	Reduced safety margins due to weather effects on ADS-B which cause temporary "blind spots". Scenario results in collision.	"Blind spots" contribute to loss of target information. Pilot/flight crew/controller takes inappropriate action as a result of loss of target information. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does communicate warning in time. However pilots/ aircrew are unable to respond in time.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	57 Select frequency spectrum to minimize adverse effects of weather on ADS-B transmissions 58 Consider alternative frequency spectrum as backup. 59 Design ground stations to minimize damage due to lightning or other adverse weather effect. 7 Provide for appropriate ATC/Aircrew contingency procedures. 2b Require all aircraft to be equipped with appropriate lighting to enhance "see and avoid" separation. 11 Aircrew and ground personnel "see and avoid" procedures. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness.

469	EE-01.2	Reduced safety margins due to weather effects on ADS-B which cause temporary "blind spots". Scenario results in collision.	"Blind spots" contribute to loss of target information. Pilot/flight crew/controller takes inappropriate action as a result of loss of target information. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid not successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	57 Select frequency spectrum to minimize adverse effects of weather on ADS-B transmissions 58 Consider alternative frequency spectrum as backup. 59 Design ground stations to minimize damage due to lightning or other adverse weather effect. 7 Provide for appropriate ATC/Aircrew contingency procedures. 2b Require all aircraft to be equipped with appropriate lighting to enhance "see and avoid" separation. 11 Aircrew and ground personnel "see and avoid" procedures. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness.
475	**LTAD-01 NS**	Less than adequate human factors design integration of NAS Modernization systems, i.e., ADS-B, CPDLC, FIS, etc. results in loss of situation awareness of flight crew and possible increased collision risk. ***See IS Scenario Codes below.***	Due to less than adequate design, there is conflicting information communicated to the aircrew. An emergency condition exists. Pilot/flight crew/controller takes inappropriate action as a result of conflicting information. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	61a Conduct analysis, studies, simulations and/or flight tests to identify system safety related risks associated with human factors in the integration of NAS Modernization systems, i.e., ADS-B, CPDLC, FIS, etc. 62 Conduct analysis, studies, simulations and/or flight tests to develop engineering requirements to eliminate or control the system risks to an acceptable level.

476	**LTAD-02 NS**	Due to less than adequate design, there is conflicting information communicated to the aircrew. This information addresses redundant flight critical information that is associated with an emergency. This can possibly lead to confusion, delayed response to the emergency situation and possible increased collision risk.	Due to less than adequate design, there is conflicting information communicated to the aircrew. An emergency condition exists. Pilot/flight crew/controller takes inappropriate action as a result of conflicting information. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	61b Conduct analysis, studies, simulations and/or flight tests to identify system safety related risks associated with human factors related to possible conflicting communication. 62 Conduct analysis, studies, simulations and/or flight tests to develop engineering requirements to eliminate or control the system risks to an acceptable level. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 16N Define criteria for determining threshold values for ADS-B coverage area to assure controller/pilot adequate situational awareness. 17N Conduct controller/pilot workload assessments to evaluate the potential for excessive workload associated with ADS-B system.
477	LTAD-02.1 NS	Due to less than adequate design, there is conflicting information communicated to the aircrew. This information addresses redundant flight critical information that is associated with an emergency. This can possibly lead to confusion, delayed response to the emergency situation and possible increased collision risk.	Due to less than adequate design, there is conflicting information communicated to the aircrew. An emergency condition exists. Pilot/flight crew/controller takes inappropriate action as a result of conflicting information. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does communicate warning in time. However pilots/ aircrew are unable to respond in time.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	61b Conduct analysis, studies, simulations and/or flight tests to identify system safety related risks associated with human factors related to possible conflicting communication. 62 Conduct analysis, studies, simulations and/or flight tests to develop engineering requirements to eliminate or control the system risks to an acceptable level. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 16N Define criteria for determining threshold values for ADS-B coverage area to assure controller/pilot adequate situational awareness. 17N Conduct controller/pilot workload assessments to evaluate the potential for excessive workload associated with ADS-B system.

478	LTAD-02.2 NS	Due to less than adequate design, there is conflicting information communicated to the aircrew. This information addresses redundant flight critical information that is associated with an emergency. This can possibly lead to confusion, delayed response to the emergency situation and possible increased collision risk.	Due to less than adequate design, there is conflicting information communicated to the aircrew. An emergency condition exists. Pilot/flight crew/controller takes inappropriate action as a result of conflicting information. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid not successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	61b Conduct analysis, studies, simulations and/or flight tests to identify system safety related risks associated with human factors related to possible conflicting communication. 62 Conduct analysis, studies, simulations and/or flight tests to develop engineering requirements to eliminate or control the system risks to an acceptable level. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 16N Define criteria for determining threshold values for ADS-B coverage area to assure controller/pilot adequate situational awareness. 17N Conduct controller/pilot workload assessments to evaluate the potential for excessive workload associated with ADS-B system.
483	**SA-01 NS**	Due to system anomaly, there is conflicting information communicated to the aircrew. This information addresses redundant flight critical information that is associated with an emergency. This can possibly lead to confusion, delayed response to the emergency situation and possible increased collision risk.	Due to system anomaly, there is conflicting information communicated to the aircrew. Pilot/flight crew/controller takes inappropriate action as a result of conflicting information. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	63 Conduct analysis, studies, simulations and/or flight tests to identify system safety related risks associated with system anomalies that could cause conflicting flight critical information to be communicated. 64 Conduct analysis, studies, simulations and/or flight tests to develop engineering requirements to minimize system anomalies that result from conflicting information. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 16N Define criteria for determining threshold values for ADS-B coverage area to assure controller/pilot adequate situational awareness. 17N Conduct controller/pilot workload assessments to evaluate the potential for excessive workload associated with ADS-B system.

484	SA-01.1 NS	Due to system anomaly, there is conflicting information communicated to the aircrew. This information addresses redundant flight critical information that is associated with an emergency. This can possibly lead to confusion, delayed response to the emergency situation and possible increased collision risk.	Due to system anomaly, there is conflicting information communicated to the aircrew. Pilot/flight crew/controller takes inappropriate action as a result of conflicting information. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does communicate warning in time. However pilots/ aircrew are unable to respond in time.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	63 Conduct analysis, studies, simulations and/or flight tests to identify system safety related risks associated with system anomalies that could cause conflicting flight critical information to be communicated. 64 Conduct analysis, studies, simulations and/or flight tests to develop engineering requirements to minimize system anomalies that result from conflicting information. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 16N Define criteria for determining threshold values for ADS-B coverage area to assure controller/pilot adequate situational awareness. 17N Conduct controller/pilot workload assessments to evaluate the potential for excessive workload associated with ADS-B system.
485	SA-01.2 NS	Due to system anomaly, there is conflicting information communicated to the aircrew. This information addresses redundant flight critical information that is associated with an emergency. This can possibly lead to confusion, delayed response to the emergency situation and possible increased collision risk.	Due to system anomaly, there is conflicting information communicated to the aircrew. Pilot/flight crew/controller takes inappropriate action as a result of conflicting information. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid not successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	63 Conduct analysis, studies, simulations and/or flight tests to identify system safety related risks associated with system anomalies that could cause conflicting flight critical information to be communicated. 64 Conduct analysis, studies, simulations and/or flight tests to develop engineering requirements to minimize system anomalies that result from conflicting information. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 16N Define criteria for determining threshold values for ADS-B coverage area to assure controller/pilot adequate situational awareness. 17N Conduct controller/pilot workload assessments to evaluate the potential for excessive workload associated with ADS-B system.

490	**SA-02 NS**	Due to system anomaly, there is conflicting information communicated to the air traffic controller. This information addresses redundant flight critical information that is associated with an emergency. This can possibly lead to confusion, delayed response to the emergency situation and possible increased collision risk.	Aircraft not on collision course. Due to system anomaly, there is conflicting information communicated to the air traffic controller. Pilot/flight crew/controller takes inappropriate action as a result of conflicting information. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	63 Conduct analysis, studies, simulations and/or flight tests to identify system safety related risks associated with system anomalies that could cause conflicting flight critical information to be communicated. 64 Conduct analysis, studies, simulations and/or flight tests to develop engineering requirements to minimize system anomalies that result from conflicting information. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 16N Define criteria for determining threshold values for ADS-B coverage area to assure controller/pilot adequate situational awareness. 17N Conduct controller/pilot workload assessments to evaluate the potential for excessive workload associated with ADS-B system.
491	SA-02.1 NS	Due to system anomaly, there is conflicting information communicated to the air traffic controller. This information addresses redundant flight critical information that is associated with an emergency. This can possibly lead to confusion, delayed response to the emergency situation and possible increased collision risk.	Aircraft not on collision course. Due to system anomaly, there is conflicting information communicated to the air traffic controller. Pilot/flight crew/controller takes inappropriate action as a result of conflicting information. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does communicate warning in time. However pilots/ aircrew are unable to respond in time.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	63 Conduct analysis, studies, simulations and/or flight tests to identify system safety related risks associated with system anomalies that could cause conflicting flight critical information to be communicated. 64 Conduct analysis, studies, simulations and/or flight tests to develop engineering requirements to minimize system anomalies that result from conflicting information. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 16N Define criteria for determining threshold values for ADS-B coverage area to assure controller/pilot adequate situational awareness. 17N Conduct controller/pilot workload assessments to evaluate the potential for excessive workload associated with ADS-B system.

492	SA-02.2 NS	Due to system anomaly, there is conflicting information communicated to the air traffic controller. This information addresses redundant flight critical information that is associated with an emergency. This can possibly lead to confusion, delayed response to the emergency situation and possible increased collision risk.	Aircraft not on collision course. Due to system anomaly, there is conflicting information communicated to the air traffic controller. Pilot/flight crew/controller takes inappropriate action as a result of conflicting information. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid not successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	63 Conduct analysis, studies, simulations and/or flight tests to identify system safety related risks associated with system anomalies that could cause conflicting flight critical information to be communicated. 64 Conduct analysis, studies, simulations and/or flight tests to develop engineering requirements to minimize system anomalies that result from conflicting information. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 16N Define criteria for determining threshold values for ADS-B coverage area to assure controller/pilot adequate situational awareness. 17N Conduct controller/pilot workload assessments to evaluate the potential for excessive workload associated with ADS-B system.
497	**CP-01**	Less than adequate contingency planning results in possible increased collision risk due to confusion over responsibility for separation assurance in a shared responsibility environment.	Less than adequate contingency planning during tests and system development. Responsibility for separation assurance not fully defined between pilot/flight crew/controller for all possible contingencies. Pilot/flight crew/controller takes inappropriate action as result confusion over responsibility. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	65 Develop "rules of the road" 66 Develop appropriate aircrew procedures to accommodate any possible contingency situation 67 Develop appropriate controller procedures to accommodate any possible contingency situation 68 Develop appropriate training materials and training programs to ensure that all participants in a shared responsibility environment understand their role and safe operation procedures.

498	CP-01.1	Less than adequate contingency planning results in possible increased collision risk due to confusion over responsibility for separation assurance in a shared responsibility environment.	Less than adequate contingency planning during tests and system development. Responsibility for separation assurance not fully defined between pilot/flight crew/controller for all possible contingencies. Pilot/flight crew/controller takes inappropriate action as result confusion over responsibility. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft identified via radar or other sources. ATCT does communicate warning in time. However pilots/ aircrew are unable to respond in time.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	65 Develop "rules of the road" 66 Develop appropriate aircrew procedures to accommodate any possible contingency situation 67 Develop appropriate controller procedures to accommodate any possible contingency situation 68 Develop appropriate training materials and training programs to ensure that all participants in a shared responsibility environment understand their role and safe operation procedures.
499	CP-01.2	Less than adequate contingency planning results in possible increased collision risk due to confusion over responsibility for separation assurance in a shared responsibility environment.	Less than adequate contingency planning during tests and system development. Responsibility for separation assurance not fully defined between pilot/flight crew/controller for all possible contingencies. Pilot/flight crew/controller takes inappropriate action as result confusion over responsibility. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid not successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Collision	1D	65 Develop "rules of the road" 66 Develop appropriate aircrew procedures to accommodate any possible contingency situation 67 Develop appropriate controller procedures to accommodate any possible contingency situation 68 Develop appropriate training materials and training programs to ensure that all participants in a shared responsibility environment understand their role and safe operation procedures.

Automatic Dependent Surveillance Broadcast (ADS-B)

505	**ISA1-01**	Collision of subject aircraft due to ADS-B malfunction and TCAS-I malfunction. TIS not helpful.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-I malfunction due to: Above malfunctions. Aircraft on collision course. TIS not helpful in situation.	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 19N Design TIS to integrate with ADS-B and provide redundant alert against collision risk. 19Na Design TCAS-I to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

508	**ISA1-02**	Collision of subject aircraft due to ADS-B malfunction and conflicting information on CDTI, TCAS, or TIS.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Conflicting information on CDTI, TCAS, or TIS, due to LTA design or malfunction. Aircraft on collision course.	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 5Nc Avionics certification, installation, and approval process established for ADS-B with CDTI. 19N Design TIS to integrate with ADS-B and provide redundant alert against collision risk. 19Na Design TCAS-I to integrate with ADS-B and provide redundant alert against collision risk. 20N Design CDTI, TCAS, and TIS to integrate with ADS-B, provide redundancy, and minimize conflicting information communicated in cockpit. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

511	**ISA1-03**	Collision of subject aircraft due to malfunction of Conflict Avoidance.	Malfunction of Conflict Avoidance due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course.	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 5Nc Avionics certification, installation, and approval process established for ADS-B with CDTI. 19Na Design TCAS-I to integrate with ADS-B and provide redundant alert against collision risk. 20N Design CDTI, TCAS, and TIS to integrate with ADS-B, provide redundancy, and minimize conflicting information communicated in cockpit. 21N Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failure of Conflict Avoidance function. 22N Design system to minimize the potential for failure of Conflict Avoidance function. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

Automatic Dependent Surveillance Broadcast (ADS-B)

514	**ISA2.01**	Collision of subject aircraft due to ADS-B malfunction and TCAS-I malfunction.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-I malfunction due to: Above malfunctions. Aircraft on collision course.	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Emergency.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 19Na Design TCAS-I to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

Automatic Dependent Surveillance Broadcast (ADS-B)

517	ISA2.01.3	Collision of subject aircraft due to ADS-B malfunction and conflicting information on CDTI.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Conflicting information on CDTI due to: Above malfunctions. Aircraft on collision course	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Emergency.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 5Nc Avionics certification, installation, and approval process established for ADS-B with CDTI. 19Na Design TCAS-I to integrate with ADS-B and provide redundant alert against collision risk. 20Na Design CDTI to integrate with ADS-B, provide redundancy, and minimize conflicting information communicated in cockpit. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

518	ISA2.01.4	Collision of subject aircraft due to malfunction of Conflict Avoidance.	Malfunction of Conflict Avoidance due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course.	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Emergency.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 5Nc Avionics certification, installation, and approval process established for ADS-B with CDTI. 19Na Design TCAS-I to integrate with ADS-B and provide redundant alert against collision risk. 20Na Design CDTI to integrate with ADS-B, provide redundancy, and minimize conflicting information communicated in cockpit. 21N Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failure of Conflict Avoidance function. 22N Design system to minimize the potential for failure of Conflict Avoidance function. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

519	**ISA3.01**	Collision of subject aircraft due to ADS-B malfunction and TCAS-II malfunction, causing error in recommended vertical escape maneuver indication.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-II malfunction causing error in recommended vertical escape maneuver indication due to: Above malfunctions. Aircraft on collision course.	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Emergency.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 21Na Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failure of, or error in, recommended vertical escape maneuver indication. 22Na Design system to minimize the potential for failure of, or error in, recommended vertical escape maneuver indication. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

Automatic Dependent Surveillance Broadcast (ADS-B)

522	ISA3.01.3	Collision of subject aircraft due to ADS-B malfunction and TCAS-II malfunction.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-II malfunction due to: Above malfunctions. Aircraft on collision course.	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Emergency.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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525	ISA3.01.6	Collision of subject aircraft due to ADS-B malfunction and conflicting information on CDTI, TCAS, or TIS.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Conflicting information on CDTI, TCAS, or TIS due to: Above malfunctions. Aircraft on collision course	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Emergency.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 19N Design TIS to integrate with ADS-B and provide redundant alert against collision risk. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 20N Design CDTI, TCAS, and TIS to integrate with ADS-B, provide redundancy, and minimize conflicting information communicated in cockpit. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

528	**ISA4.01**	Collision of subject aircraft due to ADS-B malfunction and TCAS-II malfunction.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-II malfunction due to: Above malfunctions. Aircraft on collision course.	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Emergency.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

Automatic Dependent Surveillance Broadcast (ADS-B)

531	ISA4.01.3	Collision of subject aircraft due to ADS-B malfunction and conflicting information on CDTI.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Conflicting information on CDTI due to: Above malfunctions. Aircraft on collision course	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Emergency.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 20Na Design CDTI to integrate with ADS-B, provide redundancy, and minimize conflicting information communicated in cockpit. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

537	ISB1.01.3	Erroneous sequencing as a result of ADS-B malfunction results in collision. TCAS –I or TIS or CDTI malfunction contributes to Near Midair Collision (NMAC).	Erroneous sequence indicated as a result of ADS-B malfunction, due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course due to erroneous sequence. TCAS –I or TIS or CDTI malfunction due to the above contributors.	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 5Nc Avionics certification, installation, and approval process established for ADS-B with CDTI. 21Nb Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of erroneous sequencing of aircraft. 22Nb Design system to minimize the potential of erroneous sequencing of aircraft. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

540	**ISB2.01**	Loss of separation assurance due to ADS-B malfunction results in collision. TCAS-I or CDTI malfunction contributes to collision.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-I or CDTI malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs.	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 5Nc Avionics certification, installation, and approval process established for ADS-B with CDTI. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

Automatic Dependent Surveillance Broadcast (ADS-B)

543	ISB2.01.3	Erroneous sequencing as a result of ADS-B malfunction results in collision. TCAS –I or CDTI malfunction contributes to collision.	Erroneous sequence indicated as a result of ADS-B malfunction, due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course due to erroneous sequence. TCAS –I or TIS or CDTI malfunction due to the above contributors.	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1D	22Nb Design system to minimize the potential of erroneous sequencing of aircraft. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 5Nc Avionics certification, installation, and approval process established for ADS-B with CDTI. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

546	**ISB3.01**	Loss of separation assurance due to ADS-B malfunction results in collision. TCAS-II or TIS or CDTI malfunction contributes to collision.	Erroneous sequence indicated as a result of ADS-B malfunction, due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course due to erroneous sequence. TCAS –II or TIS or CDTI malfunction due to the above contributors.	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 5Nc Avionics certification, installation, and approval process established for ADS-B with CDTI. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

549	ISB3.01.3	Erroneous sequencing as a result of ADS-B malfunction results in collision. TCAS –II or TIS or CDTI malfunction contributes to Near Midair Collision (NMAC).	Erroneous sequence indicated as a result of ADS-B malfunction, due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course due to erroneous sequence. TCAS –II or TIS or CDTI malfunction due to the above contributors.	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1D	22Nb Design system to minimize the potential of erroneous sequencing of aircraft. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 5Nc Avionics certification, installation, and approval process established for ADS-B with CDTI. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

Automatic Dependent Surveillance Broadcast (ADS-B)

552	**ISB4.01**	Loss of separation assurance due to ADS-B malfunction results in collision. TCAS-II or CDTI malfunction contributes to collision.	Erroneous sequence indicated as a result of ADS-B malfunction, due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course due to erroneous sequence. TCAS –II or CDTI malfunction due to the above contributors.	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 5Nc Avionics certification, installation, and approval process established for ADS-B with CDTI. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

555	ISB4.01.3	Erroneous sequencing as a result of ADS-B malfunction results in collision. TCAS –II or CDTI malfunction contributes to Near Midair Collision (NMAC).	Erroneous sequence indicated as a result of ADS-B malfunction, due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course due to erroneous sequence. TCAS –II or CDTI malfunction due to the above contributors.	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1D	22Nb Design system to minimize the potential of erroneous sequencing of aircraft. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 5Nc Avionics certification, installation, and approval process established for ADS-B with CDTI. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

Automatic Dependent Surveillance Broadcast (ADS-B)

558	**ISC1.01**	Loss of separation assurance due to ADS-B malfunction results in collision. TCAS-I or TIS or CDTI malfunction contributes to collision.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course due to erroneous sequence. TCAS-I or TIS or CDTI malfunction due to the above contributors.	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 5Nc Avionics certification, installation, and approval process established for ADS-B with CDTI. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

561	ISC1.01.3	Erroneous flight path calculation as a result of ADS-B malfunction results in collision. TCAS –I or TIS or CDTI malfunction contributes to Near Midair Collision (NMAC).	Erroneous sequence indicated as a result of ADS-B malfunction, due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course due to erroneous sequence. TCAS –I or TIS or CDTI malfunction due to the above contributors.	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1D	22Nc Design system to minimize the potential of erroneous flight path. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 5Nc Avionics certification, installation, and approval process established for ADS-B with CDTI. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

564	**ISC2.01**	Loss of separation assurance due to ADS-B malfunction results in collision. TCAS-I or CDTI malfunction contributes to collision.	Erroneous sequence indicated as a result of ADS-B malfunction, due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course due to erroneous sequence. TCAS-I or CDTI malfunction due to the above contributors.	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 5Nc Avionics certification, installation, and approval process established for ADS-B with CDTI. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

Automatic Dependent Surveillance Broadcast (ADS-B)

567	ISC2.01.3	Erroneous flight path calculation as a result of ADS-B malfunction results in collision. TCAS –I or CDTI malfunction contributes to Near Midair Collision (NMAC).	Erroneous sequence indicated as a result of ADS-B malfunction, due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course due to erroneous sequence. TCAS –I or CDTI malfunction due to the above contributors.	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1D	22Nc Design system to minimize the potential of erroneous flight path. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 5Nc Avionics certification, installation, and approval process established for ADS-B with CDTI. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

570	**ISC3.01**	Loss of separation assurance due to ADS-B malfunction results in collision. TCAS-II or TIS or CDTI malfunction contributes to collision.	Erroneous sequence indicated as a result of ADS-B malfunction, due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course due to erroneous sequence. TCAS-II or TIS or CDTI malfunction due to the above contributors.	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 5Nc Avionics certification, installation, and approval process established for ADS-B with CDTI. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

573	ISC3.01.3	Erroneous flight path calculation as a result of ADS-B malfunction results in collision. TCAS –II or TIS or CDTI malfunction contributes to Near Midair Collision (NMAC).	Erroneous sequence indicated as a result of ADS-B malfunction, due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course due to erroneous sequence. TCAS –II or TIS or CDTI malfunction due to the above contributors.	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1D	22Nc Design system to minimize the potential of erroneous flight path. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 5Nc Avionics certification, installation, and approval process established for ADS-B with CDTI. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

576	**ISC4.01**	Loss of separation assurance due to ADS-B malfunction results in collision. TCAS-II or CDTI malfunction contributes to collision.	Erroneous sequence indicated as a result of ADS-B malfunction, due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course due to erroneous sequence. TCAS-II or CDTI malfunction due to the above contributors.	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 5Nc Avionics certification, installation, and approval process established for ADS-B with CDTI. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

Automatic Dependent Surveillance Broadcast (ADS-B)

579	ISC4.01.3	Erroneous flight path calculation as a result of ADS-B malfunction results in collision. TCAS –II or CDTI malfunction contributes to Near Midair Collision (NMAC).	Erroneous sequence indicated as a result of ADS-B malfunction, due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course due to erroneous sequence. TCAS –II or CDTI malfunction due to the above contributors.	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1D	22Nc Design system to minimize the potential of erroneous flight path. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 5Nc Avionics certification, installation, and approval process established for ADS-B with CDTI. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

Automatic Dependent Surveillance Broadcast (ADS-B)

582	**ISD1.01**	Loss of ability of own aircraft to be seen by Class A and Class C users due to ADS-B malfunction on own aircraft. Scenario results in collision with vehicle.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Loss of target on other aircraft display. Loss of target on ground display. Aircraft or vehicle on collision course.	Pilot/flight crew and ground vehicle driver loses situational awareness and is not aware of collision potential. Pilot/aircrew unaware of ground vehicle. Ground vehicle identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew does not regain situational awareness. See and avoid unsuccessful.	Airport surface, Taxi, Takeoff, Landing.	Collision of subject aircraft with vehicle and consequent loss of aircraft and / or vehicle.	1D	50 Design ADS-B system architecture to ensure failure isolation of hardware. 48b Design ADS-B system architecture to ensure that hardware, firmware and software fails safe. 27 Design the system to assure that dual independent component failure, dual human errors, or a combination of a component failure and a human error cannot cause a catastrophic event. 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 23N Design system to minimize the potential of loss of targets. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 10N Require all aircraft that can become hazards to navigation be equipped with ADS-B transmitters, or other appropriate automated means of identification. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

Automatic Dependent Surveillance Broadcast (ADS-B)

585	ISD1.01.3	Loss of ability of own aircraft to be seen by Class A and Class C users due to ADS-B malfunction on own aircraft. Scenario results in collision with other aircraft.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Loss of target on other aircraft display. Loss of target on ground display. Aircraft or vehicle on collision course.	Pilot/flight crew loses situational awareness and is not aware of collision potential. Pilot/aircrew unaware of ground vehicle. Other vehicle identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew does not regain situational awareness. See and avoid unsuccessful.	Airport surface, Taxi, Takeoff, Landing.	Collision of subject aircraft with vehicle and consequent loss of aircraft.	1D	50 Design ADS-B system architecture to ensure failure isolation of hardware. 48b Design ADS-B system architecture to ensure that hardware, firmware and software fails safe. 27 Design the system to assure that dual independent component failure, dual human errors, or a combination of a component failure and a human error cannot cause a catastrophic event. 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 23N Design system to minimize the potential of loss of targets. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 10N Require all aircraft that can become hazards to navigation be equipped with ADS-B transmitters, or other appropriate automated means of identification. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

Automatic Dependent Surveillance Broadcast (ADS-B)

588	**ISD2.01**	Loss of ability of own aircraft to be seen by Class A and Class C users due to ADS-B malfunction on own aircraft. Scenario results in collision with vehicle. MFD not helpful	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Loss of target on other aircraft display. Loss of target on ground display. Aircraft or vehicle on collision course.	Pilot/flight crew and ground vehicle driver loses situational awareness and is not aware of collision potential. Pilot/aircrew unaware of ground vehicle. Ground vehicle identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew does not regain situational awareness. See and avoid unsuccessful.	Airport surface, Taxi, Takeoff, Landing.	Collision of subject aircraft with vehicle and consequent loss of aircraft and / or vehicle.	1D	50 Design ADS-B system architecture to ensure failure isolation of hardware. 48b Design ADS-B system architecture to ensure that hardware, firmware and software fails safe. 27 Design the system to assure that dual independent component failure, dual human errors, or a combination of a component failure and a human error cannot cause a catastrophic event. 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 23N Design system to minimize the potential of loss of targets. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 10N Require all aircraft that can become hazards to navigation be equipped with ADS-B transmitters, or other appropriate automated means of identification. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

Automatic Dependent Surveillance Broadcast (ADS-B)

591	ISD2.01.3	Loss of ability of own aircraft to be seen by Class A and Class C users due to ADS-B malfunction on own aircraft. Scenario results in collision with aircraft. MFD not helpful	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Loss of target on other aircraft display. Loss of target on ground display. Aircraft on collision course.	Pilot/flight crew loses situational awareness and is not aware of collision potential. Pilot/aircrew unaware of ground vehicle. Other vehicle identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew does not regain situational awareness. See and avoid unsuccessful.	Airport surface, Taxi, Takeoff, Landing.	Collision of subject aircraft with vehicle and consequent loss of aircraft.	1D	50 Design ADS-B system architecture to ensure failure isolation of hardware. 48b Design ADS-B system architecture to ensure that hardware, firmware and software fails safe. 27 Design the system to assure that dual independent component failure, dual human errors, or a combination of a component failure and a human error cannot cause a catastrophic event. 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 23N Design system to minimize the potential of loss of targets. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 10N Require all aircraft that can become hazards to navigation be equipped with ADS-B transmitters, or other appropriate automated means of identification. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

Automatic Dependent Surveillance Broadcast (ADS-B)

594	**ISD3.01**	Loss of ability of own aircraft to be seen by Class A and Class C users due to ADS-B malfunction on own aircraft. Scenario results in collision with vehicle if TIS is not useful.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Loss of target on other aircraft display. Loss of target on ground display. Aircraft or vehicle on collision course.	Pilot/flight crew and ground vehicle driver loses situational awareness and is not aware of collision potential. Pilot/aircrew unaware of ground vehicle. Ground vehicle identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew does not regain situational awareness. See and avoid unsuccessful.	Airport surface, Taxi, Takeoff, Landing.	Collision of subject aircraft with vehicle and consequent loss of aircraft and / or vehicle.	1D	50 Design ADS-B system architecture to ensure failure isolation of hardware. 48b Design ADS-B system architecture to ensure that hardware, firmware and software fails safe. 27 Design the system to assure that dual independent component failure, dual human errors, or a combination of a component failure and a human error cannot cause a catastrophic event. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 10N Require all aircraft that can become hazards to navigation be equipped with ADS-B transmitters, or other appropriate automated means of identification. 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 23N Design system to minimize the potential of loss of targets. 19N Design TIS to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

597	ISD3.01.3	Loss of ability of own aircraft to be seen by Class A and Class C users due to ADS-B malfunction on own aircraft. Scenario results in collision with aircraft if TIS is not useful.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Loss of target on other aircraft display. Loss of target on ground display. Aircraft on collision course.	Pilot/flight crew loses situational awareness and is not aware of collision potential. Pilot/aircrew unaware of ground vehicle. Other vehicle identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew does not regain situational awareness. See and avoid unsuccessful.	Airport surface, Taxi, Takeoff, Landing.	Collision of subject aircraft with vehicle and consequent loss of aircraft.	1D	50 Design ADS-B system architecture to ensure failure isolation of hardware. 48b Design ADS-B system architecture to ensure that hardware, firmware and software fails safe. 27 Design the system to assure that dual independent component failure, dual human errors, or a combination of a component failure and a human error cannot cause a catastrophic event. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 10N Require all aircraft that can become hazards to navigation be equipped with ADS-B transmitters, or other appropriate automated means of identification. 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 23N Design system to minimize the potential of loss of targets. 19N Design TIS to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

Automatic Dependent Surveillance Broadcast (ADS-B)

600	**ISD4.01**	Loss of ability of own aircraft to be seen by Class A and Class C users due to ADS-B malfunction on own aircraft. Scenario results in collision with vehicle if TIS is not useful.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Loss of target on other aircraft display. Loss of target on ground display. Aircraft or vehicle on collision course.	Pilot/flight crew and ground vehicle driver loses situational awareness and is not aware of collision potential. Pilot/aircrew unaware of ground vehicle. Ground vehicle identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew does not regain situational awareness. See and avoid unsuccessful.	Airport surface, Taxi, Takeoff, Landing.	Collision of subject aircraft with vehicle and consequent loss of aircraft and / or vehicle.	1D	50 Design ADS-B system architecture to ensure failure isolation of hardware. 48b Design ADS-B system architecture to ensure that hardware, firmware and software fails safe. 27 Design the system to assure that dual independent component failure, dual human errors, or a combination of a component failure and a human error cannot cause a catastrophic event. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 10N Require all aircraft that can become hazards to navigation be equipped with ADS-B transmitters, or other appropriate automated means of identification. 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 23N Design system to minimize the potential of loss of targets. 19N Design TIS to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

Automatic Dependent Surveillance Broadcast (ADS-B)

603	ISD4.01.3	Loss of ability of own aircraft to be seen by Class A and Class C users due to ADS-B malfunction on own aircraft. Scenario results in collision with aircraft if TIS is not useful.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Loss of target on other aircraft display. Loss of target on ground display. Aircraft on collision course.	Pilot/flight crew loses situational awareness and is not aware of collision potential. Pilot/aircrew unaware of ground vehicle. Other vehicle identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew does not regain situational awareness. See and avoid unsuccessful.	Airport surface, Taxi, Takeoff, Landing.	Collision of subject aircraft with vehicle and consequent loss of aircraft.	1D	50 Design ADS-B system architecture to ensure failure isolation of hardware. 48b Design ADS-B system architecture to ensure that hardware, firmware and software fails safe. 27 Design the system to assure that dual independent component failure, dual human errors, or a combination of a component failure and a human error cannot cause a catastrophic event. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 10N Require all aircraft that can become hazards to navigation be equipped with ADS-B transmitters, or other appropriate automated means of identification. 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 23N Design system to minimize the potential of loss of targets. 19N Design TIS to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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Automatic Dependent Surveillance Broadcast (ADS-B)

609	ISE1.01.3	Collision occurs due to degraded surveillance due to ADS-B malfunction on single aircraft.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Loss of target on ground display. Malfunction within sensor fusion system due to the above contributors. Aircraft on collision course.	Pilot/flight crew loses situational awareness and is not aware of collision potential. Pilot/aircrew unaware of ground vehicle. Other vehicle identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew does not regain situational awareness. See and avoid unsuccessful.	En route, Terminal	Collision	1D	24N Design system to minimize the potential of malfunction within sensor fusion system or interface. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. . 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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Automatic Dependent Surveillance Broadcast (ADS-B)

612	ISE1.01.6	Collision occurs due to degraded surveillance due to ADS-B malfunction on many aircraft.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Loss of target (s) on ground display. Malfunction within sensor fusion system due to the above contributors. Aircraft on collision course.	Pilot/flight crew loses situational awareness and is not aware of collision potential. Pilot/aircrew unaware of ground vehicle. Other vehicle identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew does not regain situational awareness. See and avoid unsuccessful.	En route, Terminal	Collision	1D	24N Design system to minimize the potential of malfunction within sensor fusion system or interface. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. . 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

615	**ISF1.01**	Collision occurs during parallel runway operations due to ADS-B malfunction. TCAS – I or II or TIS, not helpful.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course or close proximity. Malfunction within sensor fusion system due to the above contributors. TCAS – I or II or TIS, not helpful.	Pilot/flight crew initially loses situational awareness and is not aware of collision potential. Pilot/aircrew unaware of other aircraft. Other aircraft identified via radar or other sources. ATCT does not communicate warning in time. Pilot/flight crew does not regain situational awareness in time. See and avoid unsuccessful.	Approach	Collision	1D	24N Design system to minimize the potential of malfunction within sensor fusion system or interface. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 19N Design TIS to integrate with ADS-B and provide redundant alert against collision risk. 19Na Design TCAS-I to integrate with ADS-B and provide redundant alert against collision risk. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk.

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616	ISF1.01.1	Collision occurs during parallel runway operations due to ADS-B malfunction. TCAS – I or II or TIS, not helpful, due to malfunction.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course or close proximity. Malfunction within sensor fusion system due to the above contributors. TCAS – I or II or TIS, not helpful due to malfunction, as a result of contributors similar to above.	Pilot/flight crew initially loses situational awareness and is not aware of collision potential. Pilot/aircrew unaware of other aircraft. Other aircraft identified via radar or other sources. ATCT does not communicate warning in time. Pilot/flight crew does not regain situational awareness in time. See and avoid unsuccessful.	Approach	Collision	1D	24N Design system to minimize the potential of malfunction within sensor fusion system or interface. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 19N Design TIS to integrate with ADS-B and provide redundant alert against collision risk. 19Na Design TCAS-I to integrate with ADS-B and provide redundant alert against collision risk. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk.

617	ISF1.01.2	Collision occurs during parallel runway operations due to ADS-B malfunction. TCAS – I or II or TIS, not helpful, due to conflicting information and loss situational awareness.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course or close proximity. Malfunction within sensor fusion system due to the above contributors. TCAS – I or II or TIS, not helpful due to conflicting information, as a result of contributors above.	Pilot/flight crew initially loses situational awareness and is not aware of collision potential. Pilot/aircrew unaware of other aircraft. ATCT does not communicate warning in time. Pilot/flight crew does not regain situational awareness in time. See and avoid unsuccessful.	Approach	Collision	1D	24N Design system to minimize the potential of malfunction within sensor fusion system or interface. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 19N Design TIS to integrate with ADS-B and provide redundant alert against collision risk. 19Na Design TCAS-I to integrate with ADS-B and provide redundant alert against collision risk. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk.

620	ISF1.01.5	Collision occurs during surface operations due to ADS-B malfunction. TCAS – I or II or TIS, not helpful,	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft/vehicle on collision course or close proximity. Malfunction within sensor fusion system due to the above contributors. TCAS – I or II or TIS, not helpful.	Pilot/flight crew initially loses situational awareness and is not aware of collision potential. Pilot/aircrew unaware of other aircraft/vehicle. ATCT does not communicate warning in time. Pilot/flight crew does not regain situational awareness in time. See and avoid unsuccessful.	Surface	Collision	1D	24N Design system to minimize the potential of malfunction within sensor fusion system or interface. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 7N Require all ground vehicles that can become hazards to ground navigation be equipped with ADS-B transmitters, or other appropriate means of identification. 8N Require alternate means of detecting ground vehicles, i.e. ASDE-X. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 19N Design TIS to integrate with ADS-B and provide redundant alert against collision risk. 19Na Design TCAS-I to integrate with ADS-B and provide redundant alert against collision risk. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk.

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621	ISF1.01.6	Collision occurs during surface operations due to ADS-B malfunction. TCAS – I or II or TIS, not helpful, due to malfunction.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft/vehicle on collision course or close proximity. Malfunction within sensor fusion system due to the above contributors. TCAS – I or II or TIS, not helpful due to malfunction, as a result of contributors similar to above.	Pilot/flight crew initially loses situational awareness and is not aware of collision potential. Pilot/aircrew unaware of other aircraft. Other aircraft identified via radar or other sources. ATCT does not communicate warning in time. Pilot/flight crew does not regain situational awareness in time. See and avoid unsuccessful.	Surface	Collision	1D	24N Design system to minimize the potential of malfunction within sensor fusion system or interface. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 7N Require all ground vehicles that can become hazards to ground navigation be equipped with ADS-B transmitters, or other appropriate means of identification. 8N Require alternate means of detecting ground vehicles, i.e. ASDE-X. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 19N Design TIS to integrate with ADS-B and provide redundant alert against collision risk. 19Na Design TCAS-I to integrate with ADS-B and provide redundant alert against collision risk. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk.

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622	ISF1.01.7	Collision occurs during surface operations due to ADS-B malfunction. TCAS – I or II or TIS, not helpful, due to conflicting information and loss situational awareness.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course or close proximity. Malfunction within sensor fusion system due to the above contributors. TCAS – I or II or TIS, not helpful due to conflicting information, as a result of contributors above.	Pilot/flight crew initially loses situational awareness and is not aware of collision potential. Pilot/aircrew unaware of other aircraft. ATCT does not communicate warning in time. Pilot/flight crew does not regain situational awareness in time. See and avoid unsuccessful.	Surface	Collision	1D	24N Design system to minimize the potential of malfunction within sensor fusion system or interface. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 7N Require all ground vehicles that can become hazards to ground navigation be equipped with ADS-B transmitters, or other appropriate means of identification. 8N Require alternate means of detecting ground vehicles, i.e. ASDE-X. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 19N Design TIS to integrate with ADS-B and provide redundant alert against collision risk. 19Na Design TCAS-I to integrate with ADS-B and provide redundant alert against collision risk. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk.

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Automatic Dependent Surveillance Broadcast (ADS-B)

626	ISG1.01.1	Loss of private user flight following surveillance due to ADS-B malfunction results in delayed rescue and recovery after accident. ADS-B fails prior to accident.	ADS-B fails prior to accident due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Accident occurs in remote area. Loss of communication occurs.	Delay in rescue occurs due to loss of flight following surveillance.	Emergency, Accident	Fatality	1D	25N Design system to minimize the potential of loss of flight following surveillance. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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Automatic Dependent Surveillance Broadcast (ADS-B)

628	**ISH1.01**	Loss of separation assurance due to ADS-B malfunction results in collision. TCAS-I or MFD or TIS malfunction contributes to collision.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-I or TIS or MFD malfunction due to similar malfunctions indicated above. Aircraft progress towards loss of separation.	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 19N Design TIS to integrate with ADS-B and provide redundant alert against collision risk. 19Na Design TCAS-I to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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Automatic Dependent Surveillance Broadcast (ADS-B)

631	ISH1.01.3	Erroneous sequencing as a result of ADS-B malfunction results in collision. TCAS – I or MFD or TIS malfunction contributes to Collision.	Erroneous sequence indicated as a result of ADS-B malfunction, due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course due to erroneous sequence. TCAS-I or TIS or MFD malfunction due to similar malfunctions indicated above.	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1D	22Nb Design system to minimize the potential of erroneous sequencing of aircraft. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 19N Design TIS to integrate with ADS-B and provide redundant alert against collision risk. 19Na Design TCAS-I to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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Automatic Dependent Surveillance Broadcast (ADS-B)

634	ISH1.01.6	Loss of separation assurance due to ADS-B malfunction results in collision. TCAS-I or MFD or TIS conflicting information contributes to collision.	ADS-B malfunction, due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course due to erroneous sequence. TCAS-I or TIS or MFD malfunction due to similar malfunctions indicated above.	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 19N Design TIS to integrate with ADS-B and provide redundant alert against collision risk. 19Na Design TCAS-I to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

Automatic Dependent Surveillance Broadcast (ADS-B)

637	**ISH2.01**	Loss of separation assurance due to ADS-B malfunction results in collision. TCAS-I or MFD malfunction contributes to collision.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-I or MFD malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs. TCAS-I or MFD malfunction contributes to collision.	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 19Na Design TCAS-I to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

640	ISH2.01.3	Erroneous sequencing as a result of ADS-B malfunction results in collision. TCAS – I or MFD malfunction contributes to collision.	Erroneous sequence indicated as a result of ADS-B malfunction, due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course due to erroneous sequence. TCAS –I or TIS or MFD malfunction due to the above contributors. TCAS – I or MFD malfunction contributes to collision.	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1D	22Nb Design system to minimize the potential of erroneous sequencing of aircraft. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 19Na Design TCAS-I to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

643	ISH2.01.6	Loss of separation assurance due to ADS-B malfunction results in collision. TCAS-I or MFD conflicting information contributes to collision.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-I or MFD malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs. TCAS-I or MFD conflicting information contributes to collision.	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 20Nb Design MFD to integrate with ADS-B, provides redundancy, and minimizes conflicting information communicated in cockpit. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 19Na Design TCAS-I to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

Automatic Dependent Surveillance Broadcast (ADS-B)

646	**ISH3.01**	Loss of separation assurance due to ADS-B malfunction results in collision. TCAS-II or MFD or TIS malfunction contributes to collision.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-II or MFD or TIS malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs. TCAS-II or MFD or TIS malfunction contributes to collision.	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 21Na Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failure of, or error in, recommended vertical escape maneuver indication. 22Na Design system to minimize the potential for failure of, or error in, recommended vertical escape maneuver indication. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

649	ISH3.01.3	Erroneous sequencing as a result of ADS-B malfunction results in collision. TCAS – II or MFD or TIS malfunction contributes to Collision.	Erroneous sequence indicated as a result of ADS-B malfunction, due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course due to erroneous sequence. TCAS –II or TIS or MFD malfunction due to the above contributors. TCAS – II or MFD malfunction contributes to collision.	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1D	22Nb Design system to minimize the potential of erroneous sequencing of aircraft. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 21Na Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failure of, or error in, recommended vertical escape maneuver indication. 22Na Design system to minimize the potential for failure of, or error in, recommended vertical escape maneuver indication. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.	ID

Automatic Dependent Surveillance Broadcast (ADS-B)

652	ISH3.01.6	Loss of separation assurance due to ADS-B malfunction results in collision. TCAS-II or MFD or TIS conflicting information contributes to collision.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-II or MFD or TIS malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs. TCAS-II or MFD or TIS conflicting information contributes to collision.	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1D	27N Design MFD, TCAS, and TIS to integrate with ADS-B, provide redundancy, and minimize conflicting information communicated in cockpit. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 21Na Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failure of, or error in, recommended vertical escape maneuver indication. 22Na Design system to minimize the potential for failure of, or error in, recommended vertical escape maneuver indication. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

Automatic Dependent Surveillance Broadcast (ADS-B)

655	**ISH4.01**	Loss of separation assurance due to ADS-B malfunction results in collision. TCAS-II or MFD malfunction contributes to collision.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-II or MFD malfunction due to the above contributors. TCAS-II or MFD malfunction contributes to collision. Aircraft on collision course. Loss of separation occurs.	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

Automatic Dependent Surveillance Broadcast (ADS-B)

658	ISH4.01.3	Erroneous sequencing as a result of ADS-B malfunction results in collision. TCAS – II or MFD malfunction contributes to collision.	Erroneous sequence indicated as a result of ADS-B malfunction, due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course due to erroneous sequence. TCAS –II or MFD malfunction due to the above contributors. TCAS – II or MFD malfunction contributes to collision.	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1D	22Nb Design system to minimize the potential of erroneous sequencing of aircraft. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

661	ISH4.01.6	Loss of separation assurance due to ADS-B malfunction results in collision. TCAS-II or MFD conflicting information contributes to collision.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-II or MFD malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs. TCAS-II or MFD conflicting information contributes to collision.	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

664	**ISH5.01**	Loss of separation assurance due to ADS-B malfunction results in collision. TCAS-I or MFD or TIS malfunction contributes to collision.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-I or MFD or TIS malfunction due to the above contributors. TCAS-I or MFD or TIS malfunction contributes to collision. Aircraft on collision course. Loss of separation occurs.	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 19N Design TIS to integrate with ADS-B and provide redundant alert against collision risk. 19Na Design TCAS-I to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

667	ISH5.01.3	Erroneous sequencing as a result of ADS-B malfunction results in collision. TCAS – I or MFD or TIS malfunction contributes to collision.	Erroneous sequence indicated as a result of ADS-B malfunction, due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course due to erroneous sequence. TCAS –I or MFD or TIS malfunction due to the above contributors. TCAS – I or MFD or TIS malfunction contributes to collision.	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1D	22Nb Design system to minimize the potential of erroneous sequencing of aircraft. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 19N Design TIS to integrate with ADS-B and provide redundant alert against collision risk. 19Na Design TCAS-I to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

670	ISH5.01.6	Loss of separation assurance due to ADS-B malfunction results in collision. TCAS-I or MFD or TIS conflicting information contributes to collision.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-I or MFD or TIS malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs. TCAS-I or MFD or TIS conflicting information contributes to collision.	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 19N Design TIS to integrate with ADS-B and provide redundant alert against collision risk. 19Na Design TCAS-I to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

673	ISH5.01.9	Excessive display congestion as a result of FIS integration results in loss of critical information and increased collision risk. TCAS – I or MFD or TIS do not contribute to risk minimization.	Excessive display congestion as a result of FIS integration due to: LTA design LTA Human Factors consideration. Loss of critical information occurs due to masking. Aircraft on collision course. Loss of separation occurs. Collision alert does not occur in time.	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 19N Design TIS to integrate with ADS-B and provide redundant alert against collision risk. 19Na Design TCAS-I to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 26N Design system to minimize the potential of excessive display congestion as a result of FIS integration with ADS-B and cockpit displays.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

674	ISH5.01.10	Excessive display congestion as a result of FIS integration results in loss of situational awareness and increased collision risk. TCAS – I or MFD or TIS do not contribute to risk minimization.	Excessive display congestion as a result of FIS integration due to: LTA design LTA Human Factors consideration. Pilot/flight crew initially loses situational awareness due to masking. Aircraft on collision course. Loss of separation occurs. Collision alert does not occur in time.	Pilot/flight crew does not regain situational awareness in time. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 19N Design TIS to integrate with ADS-B and provide redundant alert against collision risk. 19Na Design TCAS-I to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 26N Design system to minimize the potential of excessive display congestion as a result of FIS integration with ADS-B and cockpit displays.

n State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum
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Automatic Dependent Surveillance Broadcast (ADS-B)

679	**ISH6.01**	Loss of separation assurance due to ADS-B malfunction results in collision. TCAS-I or MFD malfunction contributes to collision.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-I or MFD malfunction due to the above contributors. TCAS-I or MFD malfunction contributes to collision. Aircraft on collision course. Loss of separation occurs.	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 19Na Design TCAS-I to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

682	ISH6.01.3	Erroneous sequencing as a result of ADS-B malfunction results in collision. TCAS – I or MFD malfunction contributes to collision.	Erroneous sequence indicated as a result of ADS-B malfunction, due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course due to erroneous sequence. TCAS –I or MFD malfunction due to the above contributors. TCAS – I or MFD malfunction contributes to collision.	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1D	22Nb Design system to minimize the potential of erroneous sequencing of aircraft. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 19Na Design TCAS-I to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

685	ISH6.01.6	Loss of separation assurance due to ADS-B malfunction results in collision. TCAS-I or MFD conflicting information contributes to collision.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-I or MFD malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs. TCAS-I or MFD conflicting information contributes to collision.	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 19Na Design TCAS-I to integrate with ADS-B and provide redundant alert against collision risk. 27N Design MFD, TCAS, and TIS to integrate with ADS-B, provide redundancy, and minimize conflicting information communicated in cockpit. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

688	ISH6.01.9	Excessive display congestion as a result of FIS integration results in loss of critical information and increased collision risk. TCAS – I or MFD do not contribute to risk minimization.	Excessive display congestion as a result of FIS integration due to: LTA design LTA Human Factors consideration. Loss of critical information occurs due to masking. Aircraft on collision course. Loss of separation occurs. Collision alert does not occur in time.	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 19Na Design TCAS-I to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 26N Design system to minimize the potential of excessive display congestion as a result of FIS integration with ADS-B and cockpit displays.

689	ISH6.01.10	Excessive display congestion as a result of FIS integration results in loss of situational awareness and increased collision risk. TCAS – I or MFD do not contribute to risk minimization.	Excessive display congestion as a result of FIS integration due to: LTA design LTA Human Factors consideration. Pilot/flight crew initially loses situational awareness due to masking. Aircraft on collision course. Loss of separation occurs. Collision alert does not occur in time.	Pilot/flight crew does not regain situational awareness in time. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 19Na Design TCAS-I to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 26N Design system to minimize the potential of excessive display congestion as a result of FIS integration with ADS-B and cockpit displays.

Automatic Dependent Surveillance Broadcast (ADS-B)

694	**ISH7.01**	Loss of separation assurance due to ADS-B malfunction results in collision. TCAS-II or MFD or TIS malfunction contributes to collision.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-II or MFD or TIS malfunction due to the above contributors. TCAS-II or MFD or TIS malfunction contributes to collision. Aircraft on collision course. Loss of separation occurs.	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 21Na Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failure of, or error in, recommended vertical escape maneuver indication. 22Na Design system to minimize the potential for failure of, or error in, recommended vertical escape maneuver indication. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

697	ISH7.01.3	Erroneous sequencing as a result of ADS-B malfunction results in collision. TCAS – II or MFD or TIS malfunction contributes to collision.	Erroneous sequence indicated as a result of ADS-B malfunction, due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course due to erroneous sequence. TCAS-II or MFD or TIS malfunction due to the above contributors. TCAS-II or MFD or TIS malfunction contributes to collision.	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1D	22Nb Design system to minimize the potential of erroneous sequencing of aircraft. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 21Na Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failure of, or error in, recommended vertical escape maneuver indication. 22Na Design system to minimize the potential for failure of, or error in, recommended vertical escape maneuver indication. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

Automatic Dependent Surveillance Broadcast (ADS-B)

700	ISH7.01.6	Loss of separation assurance due to ADS-B malfunction results in collision. TCAS-II or MFD or TIS conflicting information contributes to collision.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-II or MFD or TIS malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs. TCAS-II or MFD or TIS conflicting information contributes to collision.	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 21Na Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failure of, or error in, recommended vertical escape maneuver indication. 22Na Design system to minimize the potential for failure of, or error in, recommended vertical escape maneuver indication. 27N Design MFD, TCAS, and TIS to integrate with ADS-B, provide redundancy, and minimize conflicting information communicated in cockpit. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

703	ISH7.01.9	Excessive display congestion as a result of FIS integration results in loss of critical information and increased collision risk. TCAS – II or MFD or TIS do not contribute to risk minimization.	Excessive display congestion as a result of FIS integration due to: LTA design LTA Human Factors consideration. Loss of critical information occurs due to masking. Aircraft on collision course. Loss of separation occurs. Collision alert does not occur in time.	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 21Na Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failure of, or error in, recommended vertical escape maneuver indication. 22Na Design system to minimize the potential for failure of, or error in, recommended vertical escape maneuver indication. 26N Design system to minimize the potential of excessive display congestion as a result of FIS integration with ADS-B and cockpit displays. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

704	ISH7.01.10	Excessive display congestion as a result of FIS integration results in loss of situational awareness and increased collision risk. TCAS – II or MFD or TIS do not contribute to risk minimization.	Excessive display congestion as a result of FIS integration due to: LTA design LTA Human Factors consideration. Pilot/flight crew initially loses situational awareness due to masking. Aircraft on collision course. Loss of separation occurs. Collision alert does not occur in time.	Pilot/flight crew does not regain situational awareness in time. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 21Na Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failure of, or error in, recommended vertical escape maneuver indication. 22Na Design system to minimize the potential for failure of, or error in, recommended vertical escape maneuver indication. 26N Design system to minimize the potential of excessive display congestion as a result of FIS integration with ADS-B and cockpit displays. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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Automatic Dependent Surveillance Broadcast (ADS-B)

709	**ISH8.01**	Loss of separation assurance due to ADS-B malfunction results in collision. TCAS-II or MFD malfunction contributes to collision.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-II or MFD malfunction due to the above contributors. TCAS-II or MFD malfunction contributes to collision. Aircraft on collision course. Loss of separation occurs.	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

712	ISH8.01.3	Erroneous sequencing as a result of ADS-B malfunction results in collision. TCAS – II or MFD malfunction contributes to collision.	Erroneous sequence indicated as a result of ADS-B malfunction, due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course due to erroneous sequence. TCAS-II or MFD malfunction due to the above contributors. TCAS-II or MFD malfunction contributes to collision.	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1D	22Nb Design system to minimize the potential of erroneous sequencing of aircraft. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

Automatic Dependent Surveillance Broadcast (ADS-B)

714	ISH8.01.5	Erroneous sequencing as a result of ADS-B malfunction results in collision. TCAS – II or MFD malfunction contributes to collision.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-II or MFD malfunction due to the above contributors. TCAS-II or MFD malfunction contributes to Near Midair Collision (NMAC). Aircraft on collision course. Loss of separation occurs.	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1D	22Nb Design system to minimize the potential of erroneous sequencing of aircraft. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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Automatic Dependent Surveillance Broadcast (ADS-B)

715	ISH8.01.6	Loss of separation assurance due to ADS-B malfunction results in collision. TCAS-II or MFD conflicting information contributes to collision.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-II or MFD malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs. TCAS-II or MFD conflicting information contributes to collision.	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

718	ISH8.01.9	Excessive display congestion as a result of FIS integration results in loss of critical information and increased collision risk. TCAS – II or MFD do not contribute to risk minimization.	Excessive display congestion as a result of FIS integration due to: LTA design LTA Human Factors consideration. Loss of critical information occurs due to masking. Aircraft on collision course. Loss of separation occurs. Collision alert does not occur in time.	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 26N Design system to minimize the potential of excessive display congestion as a result of FIS integration with ADS-B and cockpit displays. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

719	ISH8.01.10	Excessive display congestion as a result of FIS integration results in loss of situational awareness and increased collision risk. TCAS – II or MFD do not contribute to risk minimization.	Excessive display congestion as a result of FIS integration due to: LTA design LTA Human Factors consideration. Pilot/flight crew initially loses situational awareness due to masking. Aircraft on collision course. Loss of separation occurs. Collision alert does not occur in time.	Pilot/flight crew does not regain situational awareness in time. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 26N Design system to minimize the potential of excessive display congestion as a result of FIS integration with ADS-B and cockpit displays. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

Automatic Dependent Surveillance Broadcast (ADS-B)

724	**ISI1.01**	Loss of separation assurance due to ADS-B malfunction results in collision. TCAS-I or TIS or MFD malfunction contributes to collision.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-I or TIS or MFD malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs. TCAS-I or TIS or MFD conflicting information contributes to collision.	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 27N Design MFD, TCAS, and TIS to integrate with ADS-B, provide redundancy, and minimize conflicting information communicated in cockpit. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

727	ISI1.01.3	Erroneous flight path calculation as a result of ADS-B malfunction results in collision. TCAS –I or TIS or MFD malfunction contributes to collision.	Erroneous flight path calculation as a result of ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course. Loss of separation occurs TCAS –I or TIS or MFD malfunction contributes to collision.	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1D	22Nc Design system to minimize the potential of erroneous flight path. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

730	ISI1.01.6	Erroneous flight path calculation as a result of ADS-B malfunction results in loss of alert and collision. TCAS –I or TIS or MFD malfunction contributes to collision.	Erroneous flight path calculation as a result of ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course. Loss of separation occurs. Loss of alert occurs. TCAS –I or TIS or MFD malfunction contributes to collision.	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1D	22Nc Design system to minimize the potential of erroneous flight path. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

Automatic Dependent Surveillance Broadcast (ADS-B)

733	**ISI2.01**	Loss of separation assurance due to ADS-B malfunction results in collision. TCAS-I or MFD malfunction contributes to collision.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-I or MFD malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs. TCAS-I or MFD conflicting information contributes to collision.	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 27N Design MFD, TCAS, and TIS to integrate with ADS-B, provide redundancy, and minimize conflicting information communicated in cockpit. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

Automatic Dependent Surveillance Broadcast (ADS-B)

736	ISI2.01.3	Erroneous flight path calculation as a result of ADS-B malfunction results in collision. TCAS –I or MFD malfunction contributes to collision.	Erroneous flight path calculation as a result of ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course. Loss of separation occurs TCAS –I or MFD malfunction contributes to collision.	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1D	22Nc Design system to minimize the potential of erroneous flight path. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 27N Design MFD, TCAS, and TIS to integrate with ADS-B, provide redundancy, and minimize conflicting information communicated in cockpit. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

Automatic Dependent Surveillance Broadcast (ADS-B)

739	**ISI3.01**	Loss of separation assurance due to ADS-B malfunction results in collision. TCAS-II or TIS or MFD malfunction contributes to collision.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS –II or TIS or MFD malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs. TCAS –II or TIS or MFD conflicting information contributes to collision.	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 27N Design MFD, TCAS, and TIS to integrate with ADS-B, provide redundancy, and minimize conflicting information communicated in cockpit. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

742	ISI3.01.3	Erroneous flight path calculation as a result of ADS-B malfunction results in collision. TCAS –II or TIS or MFD malfunction contributes to collision.	Erroneous flight path calculation as a result of ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course. Loss of separation occurs TCAS –II or TIS or MFD malfunction contributes to collision.	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1D	22Nc Design system to minimize the potential of erroneous flight path. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 27N Design MFD, TCAS, and TIS to integrate with ADS-B, provide redundancy, and minimize conflicting information communicated in cockpit. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

Automatic Dependent Surveillance Broadcast (ADS-B)

745	**ISI4.01**	Loss of separation assurance due to ADS-B malfunction results in collision. TCAS-II or MFD malfunction contributes to collision.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS –II or MFD malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs. TCAS –II or MFD conflicting information contributes to collision.	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 27N Design MFD, TCAS, and TIS to integrate with ADS-B, provide redundancy, and minimize conflicting information communicated in cockpit. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

748	ISI4.01.3	Erroneous flight path calculation as a result of ADS-B malfunction results in collision. TCAS –II or MFD malfunction contributes to collision.	Erroneous flight path calculation as a result of ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course. Loss of separation occurs TCAS –II or MFD malfunction contributes to collision.	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1D	22Ne Design system to minimize the potential of erroneous flight path. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

Automatic Dependent Surveillance Broadcast (ADS-B)

751	**ISJ1.01**	Loss of separation assurance due to ADS-B malfunction results in collision. TCAS-I or TIS or MFD malfunction contributes to collision.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS –I or TIS or MFD malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs. TCAS –I or TIS or MFD conflicting information contributes to collision.	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 27N Design MFD, TCAS, and TIS to integrate with ADS-B, provide redundancy, and minimize conflicting information communicated in cockpit. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

754	ISJ1.01.3	Erroneous flight path calculation as a result of ADS-B malfunction results in collision. TCAS –I or TIS or MFD malfunction contributes to collision.	Erroneous flight path calculation as a result of ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course. Loss of separation occurs TCAS –I or TIS or MFD malfunction contributes to collision.	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1D	22Nc Design system to minimize the potential of erroneous flight path. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 27N Design MFD, TCAS, and TIS to integrate with ADS-B, provide redundancy, and minimize conflicting information communicated in cockpit. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

757	ISJ1.01.6	Erroneous navigation information as a result of ADS-B/GPS malfunction contributes to TAWS failure. Collision alert does not occur in time due to the above contributors. Scenario results in collision with terrain.	Erroneous navigation information as a result of ADS-B/GPS malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. ***(and)*** Collision alert does not occur in time due to the above contributors. Aircraft on collision course.	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Emergency.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 27N Design MFD, TCAS, and TIS to integrate with ADS-B, provide redundancy, and minimize conflicting information communicated in cockpit. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 5Nf Avionics certification, installation, and approval process established for ADS-B with TAWS. 19Nc Design TAWS to integrate with ADS-B and provide redundant alert against collision risk. 28N Design MFD or CDTI, TAWS, TCAS, and TIS to integrate with ADS-B, provide redundancy, and minimize conflictive information communicated in cockpit.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

758	ISJ1.01.7	Erroneous navigation information as a result of ADS-B/GPS malfunction contributes to TAWS failure. Error in digital terrain database. Scenario results in collision with terrain.	Erroneous navigation information as a result of ADS-B/GPS malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. ***(and/or)*** Error in digital terrain database due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. ***(and)*** Collision alert does not occur in time, due to above contributors. Aircraft on collision course.	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Emergency.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 27N Design MFD, TCAS, and TIS to integrate with ADS-B, provide redundancy, and minimize conflicting information communicated in cockpit. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 29N Ensure terrain/airfield map accuracy, associated with ADS-B, i.e. fixed object location, data base integrity, runway hold short lines, construction, helipads, etc 30N Establish database update revision cycle requirements for ADS-B, including changes between revision cycles, and annunciation to pilot if outdated.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

759	ISJ1.01.8	Erroneous navigation information as a result of ADS-B/GPS malfunction contributes to TAWS failure. Collision alert does not occur in time due to malfunction. Scenario results in collision with terrain.	Erroneous navigation information as a result of ADS-B/GPS malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. ***(and/or)*** Collision alert does not occur in time due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course.	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Emergency.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 27N Design MFD, TCAS, and TIS to integrate with ADS-B, provide redundancy, and minimize conflicting information communicated in cockpit. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 28Na Design MFD or CDTI, TAWS, TCAS, and TIS to integrate with ADS-B, provide redundancy, maximize system alert capability, and minimize alert delay or malfunction.

760	ISJ1.01.9	Erroneous navigation information as a result of ADS-B/GPS malfunction contributes to TAWS failure. Collision alert does not occur in time as a result of MFD malfunction. Scenario results in collision with terrain.	Erroneous navigation information as a result of ADS-B/GPS malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. ***(and/or)*** Collision alert does not occur in time as a result of MFD malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course.	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Emergency.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 27N Design MFD, TCAS, and TIS to integrate with ADS-B, provide redundancy, and minimize conflicting information communicated in cockpit. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 28Na Design MFD or CDTI, TAWS, TCAS, and TIS to integrate with ADS-B, provide redundancy, maximize system alert capability, and minimize alert delay or malfunction.

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761	ISJ1.01.10	Informational overload as a result of inappropriate integration of ADS-B, MFD, TCAS – I, TIS, with TAWS, results in increased risk of terrain collision.	Pilot/flight crew informational overload as a result of inappropriate system integration due to: LTA design LTA Human Factors consideration LTA training LTA experience Excessive workload LTA cockpit integration Excessive communication. Informational overload results in pilot/flight crew loss of situational awareness. Aircraft on collision course.	Pilot/flight crew does not regain situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Surface, Flight, Emergency.	Collision	1D	17Na Conduct controller/pilot workload assessments to evaluate the potential for informational overload associated with ADS-B and related subsystems MFD or CDTI, TAWS, TCAS, and TIS. 28N Design MFD or CDTI, TAWS, TCAS, and TIS to integrate with ADS-B, provide redundancy, and minimize conflictive information communicated in cockpit. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

762	ISJ1.01.11	Masking and/or delaying of TAWS alert due to conflicting or erroneous data due to inappropriate integration of ADS-B, MFD, TCAS – I, TIS, with TAWS, results in increased risk of terrain collision.	Masking and/or delaying of TAWS alert due to conflicting or erroneous data due to inappropriate integration. Inappropriate system integration due to: LTA design LTA Human Factors consideration LTA training LTA experience Excessive workload LTA cockpit integration Excessive communication. Pilot/flight crew loses situational awareness. Aircraft on collision course. Masking and/or delaying of TAWS alert.	Pilot/flight crew does not regain situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Surface, Flight, Emergency.	Collision	1D	28Nb Design MFD or CDTI, TAWS, TCAS, and TIS to integrate with ADS-B, provide redundancy, maximize system alert capability, and minimize alert delay or masking of alert. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 27N Design MFD, TCAS, and TIS to integrate with ADS-B, provide redundancy, and minimize conflicting information communicated in cockpit. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

Automatic Dependent Surveillance Broadcast (ADS-B)

763	**ISJ2.01**	Loss of separation assurance due to ADS-B malfunction results in collision. TCAS-I or MFD malfunction contributes to collision.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS –I or MFD malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs. TCAS –I or MFD conflicting information contributes to collision.	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 20Nb Design MFD to integrate with ADS-B, provides redundancy, and minimizes conflictive information communicated in cockpit. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 28Nc Design MFD or CDTI, TAWS, and TCAS to integrate with ADS-B, provide redundancy, and minimize conflictive information communicated in cockpit. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

766	ISJ2.01.3	Erroneous flight path calculation as a result of ADS-B malfunction results in collision. TCAS –I or MFD malfunction contributes to collision.	Erroneous flight path calculation as a result of ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course. Loss of separation occurs TCAS –I or MFD malfunction contributes to collision.	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1D	22Nc Design system to minimize the potential of erroneous flight path. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 20Nb Design MFD to integrate with ADS-B, provides redundancy, and minimizes conflictive information communicated in cockpit. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 28Nc Design MFD or CDTI, TAWS, and TCAS to integrate with ADS-B, provide redundancy, and minimize conflictive information communicated in cockpit. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

769	ISJ2.01.6	Erroneous navigation information as a result of ADS-B/GPS malfunction contributes to TAWS failure. Collision alert does not occur in time due to the above contributors. Aircraft equipped with TCAS –I and MFD. Scenario results in collision with terrain.	Erroneous navigation information as a result of ADS-B/GPS malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. ***(and)*** Collision alert does not occur in time due to the above contributors. Aircraft on collision course.	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Emergency.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 20Nb Design MFD to integrate with ADS-B, provides redundancy, and minimizes conflictive information communicated in cockpit. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 28Nc Design MFD or CDTI, TAWS, and TCAS to integrate with ADS-B, provide redundancy, and minimize conflictive information communicated in cockpit. 28Nd Design MFD or CDTI, TAWS, and TCAS to integrate with ADS-B, provide redundancy, maximize system alert capability, and minimize alert delay or masking of alert. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

770	ISJ2.01.7	Erroneous navigation information as a result of ADS-B/GPS malfunction contributes to TAWS failure. Error in digital terrain database. Aircraft equipped with TCAS –I and MFD. Scenario results in collision with terrain.	Erroneous navigation information as a result of ADS-B/GPS malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. ***(and/or)*** Error in digital terrain database due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. ***(and)*** Collision alert does not occur in time, due to above contributors. Aircraft on collision course.	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Emergency.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 20Nb Design MFD to integrate with ADS-B, provides redundancy, and minimizes conflictive information communicated in cockpit. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 29N Ensure terrain/airfield map accuracy, associated with ADS-B, i.e. fixed object location, data base integrity, runway hold short lines, construction, helipads, etc 30N Establish database update revision cycle requirements for ADS-B, including changes between revision cycles, and annunciation to pilot if outdated. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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771	ISJ2.01.8	Erroneous navigation information as a result of ADS-B/GPS malfunction contributes to TAWS failure. Collision alert does not occur in time due to malfunction. Aircraft equipped with TCAS –I and MFD. Scenario results in collision with terrain.	Erroneous navigation information as a result of ADS-B/GPS malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. ***(and/or)*** Collision alert does not occur in time due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course.	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Emergency.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 20Nb Design MFD to integrate with ADS-B, provides redundancy, and minimizes conflictive information communicated in cockpit. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 5Nf Avionics certification, installation, and approval process established for ADS-B with TAWS. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 28Nd Design MFD or CDTI, TAWS, and TCAS to integrate with ADS-B, provide redundancy, maximize system alert capability, and minimize alert delay or masking of alert. 19Nc Design TAWS to integrate with ADS-B and provide redundant alert against collision risk.

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772	ISJ2.01.9	Erroneous navigation information as a result of ADS-B/GPS malfunction contributes to TAWS failure. Collision alert does not occur in time as a result of MFD malfunction. Aircraft equipped with TCAS –I and MFD. Scenario results in collision with terrain.	Erroneous navigation information as a result of ADS-B/GPS malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. ***(and/or)*** Collision alert does not occur in time as a result of MFD malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course.	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Emergency.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 20Nb Design MFD to integrate with ADS-B, provides redundancy, and minimizes conflictive information communicated in cockpit. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 5Nf Avionics certification, installation, and approval process established for ADS-B with TAWS. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 28Nd Design MFD or CDTI, TAWS, and TCAS to integrate with ADS-B, provide redundancy, maximize system alert capability, and minimize alert delay or masking of alert. 19Nc Design TAWS to integrate with ADS-B and provide redundant alert against collision risk.

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773	ISJ2.01.10	Informational overload as a result of inappropriate integration of ADS-B, MFD, TCAS – I, with TAWS, results in increased risk of terrain collision.	Pilot/flight crew informational overload as a result of inappropriate system integration due to: LTA design LTA Human Factors consideration LTA training LTA experience Excessive workload LTA cockpit integration Excessive communication. Informational overload results in pilot/flight crew loss of situational awareness. Aircraft on collision course.	Pilot/flight crew does not regain situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Surface, Flight, Emergency.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 20Nb Design MFD to integrate with ADS-B, provides redundancy, and minimizes conflictive information communicated in cockpit. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 5Nf Avionics certification, installation, and approval process established for ADS-B with TAWS. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 17Na Conduct controller/pilot workload assessments to evaluate the potential for informational overload associated with ADS-B and related subsystems MFD or CDTI, TAWS, TCAS, and TIS. 19Nc Design TAWS to integrate with ADS-B and provide redundant alert against collision risk.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

774	ISJ2.01.11	Masking or delaying of TAWS alert due to conflicting or erroneous data due to inappropriate integration of ADS-B, MFD, TCAS – I, with TAWS, results in increased risk of terrain collision.	Masking and/or delaying of TAWS alert due to conflicting or erroneous data due to inappropriate integration. Inappropriate system integration due to: LTA design LTA Human Factors consideration LTA training LTA experience Excessive workload LTA cockpit integration Excessive communication. Pilot/flight crew loses situational awareness. Aircraft on collision course. Masking and/or delaying of TAWS alert.	Pilot/flight crew does not regain situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Surface, Flight, Emergency.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 20Nb Design MFD to integrate with ADS-B, provides redundancy, and minimizes conflictive information communicated in cockpit. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 5Nf Avionics certification, installation, and approval process established for ADS-B with TAWS. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 28Nd Design MFD or CDTI, TAWS, and TCAS to integrate with ADS-B, provide redundancy, maximize system alert capability, and minimize alert delay or masking of alert. 19Nc Design TAWS to integrate with ADS-B and provide redundant alert against collision risk.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

Automatic Dependent Surveillance Broadcast (ADS-B)

775	**ISJ3.01**	Loss of separation assurance due to ADS-B malfunction results in collision. TCAS-II or TIS or MFD malfunction contributes to collision.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-II or TIS or MFD malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs. TCAS-II or TIS or MFD conflicting information contributes to collision.	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 27N Design MFD, TCAS, and TIS to integrate with ADS-B, provide redundancy, and minimize conflicting information communicated in cockpit. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

778	ISJ3.01.3	Erroneous flight path calculation as a result of ADS-B malfunction results in collision. TCAS –II or TIS or MFD malfunction contributes to Near Midair Collision (NMAC).	Erroneous flight path calculation as a result of ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course. Loss of separation occurs TCAS-II or TIS or MFD malfunction contributes to collision.	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1D	22Ne Design system to minimize the potential of erroneous flight path. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 27N Design MFD, TCAS, and TIS to integrate with ADS-B, provide redundancy, and minimize conflicting information communicated in cockpit. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

781	ISJ3.01.6	Erroneous navigation information as a result of ADS-B/GPS malfunction contributes to TAWS failure. Collision alert does not occur in time due to the above contributors. Aircraft equipped with TCAS-II or TIS and MFD. Scenario results in collision with terrain.	Erroneous navigation information as a result of ADS-B/GPS malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. ***(and)*** Collision alert does not occur in time due to the above contributors. Aircraft on collision course.	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Emergency.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 27N Design MFD, TCAS, and TIS to integrate with ADS-B, provide redundancy, and minimize conflicting information communicated in cockpit. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 5Nf Avionics certification, installation, and approval process established for ADS-B with TAWS. 19Nc Design TAWS to integrate with ADS-B and provide redundant alert against collision risk. 28N Design MFD or CDTI, TAWS, TCAS, and TIS to integrate with ADS-B, provide redundancy, and minimize conflictive information communicated in cockpit.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

782	ISJ3.01.7	Erroneous navigation information as a result of ADS-B/GPS malfunction contributes to TAWS failure. Error in digital terrain database. Aircraft equipped with TCAS-II or TIS and MFD. Scenario results in collision with terrain.	Erroneous navigation information as a result of ADS-B/GPS malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. ***(and/or)*** Error in digital terrain database due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. ***(and)*** Collision alert does not occur in time, due to above contributors. Aircraft on collision course.	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Emergency.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 27N Design MFD, TCAS, and TIS to integrate with ADS-B, provide redundancy, and minimize conflicting information communicated in cockpit. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 29N Ensure terrain/airfield map accuracy, associated with ADS-B, i.e. fixed object location, data base integrity, runway hold short lines, construction, helipads, etc 30N Establish database update revision cycle requirements for ADS-B, including changes between revision cycles, and annunciation to pilot if outdated.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

783	ISJ3.01.8	Erroneous navigation information as a result of ADS-B/GPS malfunction contributes to TAWS failure. Collision alert does not occur in time due to malfunction. Aircraft equipped with TCAS-II or TIS and MFD. Scenario results in collision with terrain.	Erroneous navigation information as a result of ADS-B/GPS malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. ***(and/or)*** Collision alert does not occur in time due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course.	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Emergency.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 27N Design MFD, TCAS, and TIS to integrate with ADS-B, provide redundancy, and minimize conflicting information communicated in cockpit. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 29N Ensure terrain/airfield map accuracy, associated with ADS-B, i.e. fixed object location, data base integrity, runway hold short lines, construction, helipads, etc 30N Establish database update revision cycle requirements for ADS-B, including changes between revision cycles, and annunciation to pilot if outdated.

784	ISJ3.01.9	Erroneous navigation information as a result of ADS-B/GPS malfunction contributes to TAWS failure. Collision alert does not occur in time as a result of MFD malfunction. Aircraft equipped with TCAS-II or TIS and MFD. Scenario results in collision with terrain.	Erroneous navigation information as a result of ADS-B/GPS malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. ***(and/or)*** Collision alert does not occur in time as a result of MFD malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course.	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Emergency.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 27N Design MFD, TCAS, and TIS to integrate with ADS-B, provide redundancy, and minimize conflicting information communicated in cockpit. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 28Na Design MFD or CDTI, TAWS, TCAS, and TIS to integrate with ADS-B, provide redundancy, maximize system alert capability, and minimize alert delay or malfunction.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

785	ISJ3.01.10	Informational overload as a result of inappropriate integration of ADS-B, MFD, TCAS – II, TIS, with TAWS, results in increased risk of terrain collision.	Pilot/flight crew informational overload as a result of inappropriate system integration due to: LTA design LTA Human Factors consideration LTA training LTA experience Excessive workload LTA cockpit integration Excessive communication. Informational overload results in pilot/flight crew loss of situational awareness. Aircraft on collision course.	Pilot/flight crew does not regain situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Surface, Flight, Emergency.	Collision	1D	17Na Conduct controller/pilot workload assessments to evaluate the potential for informational overload associated with ADS-B and related subsystems MFD or CDTI, TAWS, TCAS, and TIS. 28N Design MFD or CDTI, TAWS, TCAS, and TIS to integrate with ADS-B, provide redundancy, and minimize conflictive information communicated in cockpit. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

786	ISJ3.01.11	Masking or delaying of TAWS alert due to conflicting or erroneous data due to inappropriate integration of ADS-B, MFD, TCAS – II, TIS, with TAWS, results in increased risk of terrain collision.	Masking and/or delaying of TAWS alert due to conflicting or erroneous data due to inappropriate integration. Inappropriate system integration due to: LTA design LTA Human Factors consideration LTA training LTA experience Excessive workload LTA cockpit integration Excessive communication. Pilot/flight crew loses situational awareness. Aircraft on collision course. Masking and/or delaying of TAWS alert.	Pilot/flight crew does not regain situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Surface, Flight, Emergency.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 20Nb Design MFD to integrate with ADS-B, provides redundancy, and minimizes conflictive information communicated in cockpit. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 5Nf Avionics certification, installation, and approval process established for ADS-B with TAWS. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 28Nd Design MFD or CDTI, TAWS, and TCAS to integrate with ADS-B, provide redundancy, maximize system alert capability, and minimize alert delay or masking of alert. 19Nc Design TAWS to integrate with ADS-B and provide redundant alert against collision risk.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

Automatic Dependent Surveillance Broadcast (ADS-B)

787	**ISJ4.01**	Loss of separation assurance due to ADS-B malfunction results in collision. TCAS-II or MFD malfunction contributes to collision.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-II or MFD malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs. TCAS-II or MFD conflicting information contributes to collision.	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 20Nb Design MFD to integrate with ADS-B, provides redundancy, and minimizes conflictive information communicated in cockpit. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 28Nc Design MFD or CDTI, TAWS, and TCAS to integrate with ADS-B, provide redundancy, and minimize conflictive information communicated in cockpit. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

790	ISJ4.01.3	Erroneous flight path calculation as a result of ADS-B malfunction results in collision. TCAS –II or MFD malfunction contributes to collision.	Erroneous flight path calculation as a result of ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course. Loss of separation occurs TCAS-II or MFD malfunction contributes to collision.	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1D	22Nc Design system to minimize the potential of erroneous flight path. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 20Nb Design MFD to integrate with ADS-B, provides redundancy, and minimizes conflictive information communicated in cockpit. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

793	ISJ4.01.6	Erroneous navigation information as a result of ADS-B/GPS malfunction contributes to TAWS failure. Collision alert does not occur in time due to the above contributors. Aircraft equipped with TCAS-II and MFD. Scenario results in collision with terrain.	Erroneous navigation information as a result of ADS-B/GPS malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. ***(and)*** Collision alert does not occur in time due to the above contributors. Aircraft on collision course.	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Emergency.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 27N Design MFD, TCAS, and TIS to integrate with ADS-B, provide redundancy, and minimize conflicting information communicated in cockpit. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 5Nf Avionics certification, installation, and approval process established for ADS-B with TAWS. 19Nc Design TAWS to integrate with ADS-B and provide redundant alert against collision risk. 28N Design MFD or CDTI, TAWS, TCAS, and TIS to integrate with ADS-B, provide redundancy, and minimize conflictive information communicated in cockpit.

794	ISJ4.01.7	Erroneous navigation information as a result of ADS-B/GPS malfunction contributes to TAWS failure. Error in digital terrain database. Aircraft equipped with TCAS-II and MFD. Scenario results in collision with terrain.	Erroneous navigation information as a result of ADS-B/GPS malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. ***(and/or)*** Error in digital terrain database due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. ***(and)*** Collision alert does not occur in time, due to above contributors. Aircraft on collision course.	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Emergency.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 27N Design MFD, TCAS, and TIS to integrate with ADS-B, provide redundancy, and minimize conflicting information communicated in cockpit. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 29N Ensure terrain/airfield map accuracy, associated with ADS-B, i.e. fixed object location, data base integrity, runway hold short lines, construction, helipads, etc 30N Establish database update revision cycle requirements for ADS-B, including changes between revision cycles, and annunciation to pilot if outdated.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

795	ISJ4.01.8	Erroneous navigation information as a result of ADS-B/GPS malfunction contributes to TAWS failure. Collision alert does not occur in time due to malfunction. Aircraft equipped with TCAS-II and MFD. Scenario results in collision with terrain.	Erroneous navigation information as a result of ADS-B/GPS malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. ***(and/or)*** Collision alert does not occur in time due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course.	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Emergency.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 27N Design MFD, TCAS, and TIS to integrate with ADS-B, provide redundancy, and minimize conflicting information communicated in cockpit. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 29N Ensure terrain/airfield map accuracy, associated with ADS-B, i.e. fixed object location, data base integrity, runway hold short lines, construction, helipads, etc 30N Establish database update revision cycle requirements for ADS-B, including changes between revision cycles, and annunciation to pilot if outdated.

796	ISJ4.01.9	Erroneous navigation information as a result of ADS-B/GPS malfunction contributes to TAWS failure. Collision alert does not occur in time as a result of MFD malfunction. Aircraft equipped with TCAS-II and MFD. Scenario results in collision with terrain.	Erroneous navigation information as a result of ADS-B/GPS malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. ***(and/or)*** Collision alert does not occur in time as a result of MFD malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course.	Pilot/flight crew loss of situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Emergency.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 27N Design MFD, TCAS, and TIS to integrate with ADS-B, provide redundancy, and minimize conflicting information communicated in cockpit. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 28Na Design MFD or CDTI, TAWS, TCAS, and TIS to integrate with ADS-B, provide redundancy, maximize system alert capability, and minimize alert delay or malfunction.

797	ISJ4.01.10	Informational overload as a result of inappropriate integration of ADS-B, MFD, TCAS – II, with TAWS, results in increased risk of terrain collision.	Pilot/flight crew informational overload as a result of inappropriate system integration due to: LTA design LTA Human Factors consideration LTA training LTA experience Excessive workload LTA cockpit integration Excessive communication. Informational overload results in pilot/flight crew loss of situational awareness. Aircraft on collision course.	Pilot/flight crew does not regain situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Surface, Flight, Emergency.	Collision	1D	17Na Conduct controller/pilot workload assessments to evaluate the potential for informational overload associated with ADS-B and related subsystems MFD or CDTI, TAWS, TCAS, and TIS. 28N Design MFD or CDTI, TAWS, TCAS, and TIS to integrate with ADS-B, provide redundancy, and minimize conflictive information communicated in cockpit. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

798	ISJ4.01.11	Masking or delaying of TAWS alert due to conflicting or erroneous data due to inappropriate integration of ADS-B, MFD, TCAS – II, with TAWS, results in increased risk of terrain collision.	Masking and/or delaying of TAWS alert due to conflicting or erroneous data due to inappropriate integration. Inappropriate system integration due to: LTA design LTA Human Factors consideration LTA training LTA experience Excessive workload LTA cockpit integration Excessive communication. Pilot/flight crew loses situational awareness. Aircraft on collision course. Masking and/or delaying of TAWS alert.	Pilot/flight crew does not regain situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Surface, Flight, Emergency.	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 20Nb Design MFD to integrate with ADS-B, provides redundancy, and minimizes conflictive information communicated in cockpit. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 5Nf Avionics certification, installation, and approval process established for ADS-B with TAWS. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 28Nd Design MFD or CDTI, TAWS, and TCAS to integrate with ADS-B, provide redundancy, maximize system alert capability, and minimize alert delay or masking of alert. 19Nc Design TAWS to integrate with ADS-B and provide redundant alert against collision risk.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

804	**ILIS.04**	LTA cross-checking of barometric altimetry with GPS (ADS-B) fails to identify deviation in altitude, which results in increased collision risk.	LTA cross-checking of barometric altimetry due to: LTA design LTA procedure Human error. GPS fails to identify deviation in altitude due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course.	Pilot/flight crew loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1D	46N Design and integrate ADS-B to enable automatic cross-checking of barometric altimeter to identify and detect accuracy deviation. 7 Provide for appropriate ATC/Aircrew contingency procedures. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 5N Avionics certification, installation, and approval process established for ADS-B.

Automatic Dependent Surveillance Broadcast (ADS-B)

808	**ILIS.07**	Accuracy delta between ADS-B and TIS-B presents difficulty in target identification and increased accident risk.	Accuracy delta between ADS-B and TIS-B presents difficulty in target identification due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Subject aircraft follows wrong target. Aircraft on collision course.	Pilot/flight crew loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	1D	5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 19N Design TIS to integrate with ADS-B and provide redundant alert against collision risk. 20N Design CDTI, TCAS, and TIS to integrate with ADS-B, provide redundancy, and minimize conflictive information communicated in cockpit. 27N Design MFD, TCAS, and TIS to integrate with ADS-B, provide redundancy, and minimize conflictive information communicated in cockpit. 33N Design system to minimize the potential of accuracy delta between ADS-B and TIS-B which presents difficulty in target identification. 7 Provide for appropriate ATC/Aircrew contingency procedures. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object.

Automatic Dependent Surveillance Broadcast (ADS-B)

819	**ILIS.16**	Inadvertent access into SUA due to ADS-B malfunction, failure, or anomally results in collision.	ADS-B malfunction, failure, or anomally due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft inadvertently enters SUA at safety-critical time and is exposed to collision risk.	Pilot/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Flight	Collision	1D	43N An alternate means of communicating SUA to civilian aircrews shall be provided within the NAS. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

825	ISK.01.2	Interface malfunction between FMS and ADS-B results in degraded accuracy of ADS-B. Scenario results in collision.	Interface malfunction due to: Cable chafing Connector short Open conductors Electromagnetic LTA interface design. Degraded accuracy ADS-B due to interface malfunction. Pilot/flight crew loses situational awareness. Aircraft on collision course.	Pilot/flight crew does not regain situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Surface, Flight, Emergency.	Collision	lD	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 28Nd Design MFD or CDTI, TAWS, and TCAS to integrate with ADS-B, provide redundancy, maximize system alert capability, and minimize alert delay or masking of alert. 22Nd Design system to minimize the potential for interface malfunction between FMS and ADS-B.

Automatic Dependent Surveillance Broadcast (ADS-B)

831	**ISK.05**	ADS-B malfunction propagates to other aircraft systems, effecting WAAS. Event occurs during non-critical time.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Loss of WAAS. No existing collision potentials.	Pilot/flight crew detects malfunction. GPS provides backup functions.	Takeoff, Approach Landing, Surface, Flight.	Loss of ADS-B and WAAS on single aircraft.	lD	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 22Nd Design system to minimize the potential for interface malfunction between FMS and ADS-B 22Ne Design system to minimize the potential for degraded FMS input to ADS-B. 31N Design WAAS and LAAS to integrate with ADS-B, provide redundancy, and minimize potential for degraded FMS input to ADS-B. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 50 Design ADS-B system architecture to ensure failure isolation of hardware, firmware, and software. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 50 Design ADS-B system architecture to ensure failure isolation of hardware, firmware, and software.

845	**ISK.11**	ADS-B malfunction propagates to other aircraft systems, effecting WAAS. Event occurs during non-critical time.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Loss of WAAS. No existing collision potentials.	Pilot/flight crew detects malfunction. GPS provides backup functions.	Takeoff, Approach Landing, Surface, Flight.	Loss of ADS-B and WAAS on single aircraft.	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 22Nd Design system to minimize the potential for interface malfunction between FMS and ADS-B 22Ne Design system to minimize the potential for degraded FMS input to ADS-B. 31N Design WAAS and LAAS to integrate with ADS-B, provide redundancy, and minimize potential for degraded FMS input to ADS-B. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 50 Design ADS-B system architecture to ensure failure isolation of hardware, firmware, and software. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 50 Design ADS-B system architecture to ensure failure isolation of hardware, firmware, and software.

846	ISK.11.1	ADS-B malfunction propagates to other aircraft systems, effecting LAAS. Event occurs during non-critical time.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Loss of LAAS. No existing collision potentials.	Pilot/flight crew detects malfunction. GPS provides backup functions.	Takeoff, Approach Landing, Surface, Flight.	Loss of ADS-B and LAAS on single aircraft.	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 22Nd Design system to minimize the potential for interface malfunction between FMS and ADS-B 22Ne Design system to minimize the potential for degraded FMS input to ADS-B. 31N Design WAAS and LAAS to integrate with ADS-B, provide redundancy, and minimize potential for degraded FMS input to ADS-B. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 50 Design ADS-B system architecture to ensure failure isolation of hardware, firmware, and software. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 50 Design ADS-B system architecture to ensure failure isolation of hardware, firmware, and software.

847	ISK.11.2	ADS-B malfunction propagates to other aircraft systems, effecting LAAS. Event occurs during critical time, CAT IIIa, IIIb, or 3C approaches.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Loss of LAAS.	Pilot/flight crew unable to respond in time.	Approach	Collision	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 22Nd Design system to minimize the potential for interface malfunction between FMS and ADS-B 22Ne Design system to minimize the potential for degraded FMS input to ADS-B. 31N Design WAAS and LAAS to integrate with ADS-B, provide redundancy, and minimize potential for degraded FMS input to ADS-B. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 50 Design ADS-B system architecture to ensure failure isolation of hardware, firmware, and software. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 50 Design ADS-B system architecture to ensure failure isolation of hardware, firmware, and software.

Automatic Dependent Surveillance Broadcast (ADS-B)

848	ISK.11.3 May be covered.	ADS-B malfunction propagates to other ground systems.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. ADS-B malfunction propagates to ATCT display, or other associated systems.	Malfunction is detected.	Takeoff, Approach Landing, Surface, Flight emergency.	Loss of local area ADS-B.	1D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 22Nd Design system to minimize the potential for interface malfunction between FMS and ADS-B 22Ne Design system to minimize the potential for degraded FMS input to ADS-B. 31N Design WAAS and LAAS to integrate with ADS-B, provide redundancy, and minimize potential for degraded FMS input to ADS-B. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 50 Design ADS-B system architecture to ensure failure isolation of hardware, firmware, and software. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 50 Design ADS-B system architecture to ensure failure isolation of hardware, firmware, and software.

II.B.2 Hazardous-Extremely Remote (2C)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
7	AFXO-01.6	Near Collision of subject aircraft with fixed object due to failure to identify fixed object. Fixed object not equipped with ADS-B.	Fixed object not equipped with ADS-B. Aircraft on collision course.	Pilot/flight crew initially loses of situational awareness. Object not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Collision W/ Fatal Injury	2C	1 Develop ADS-B ATC/Aircrew procedures to accommodate transitional risks. 2d Require fixed objects to be equipped with appropriate lighting, i.e., “see and avoid”. 3 Aircrew “see and avoid” procedures. 1N Require all fixed objects that are evaluated as hazardous to be equipped with ADS-B transmitters. 2N Provide updated information on fixed objects in appropriate data sources. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
14	AFXO-02.6	Near Collision) of subject aircraft with fixed object due to failure to identify fixed object. Fixed object not equipped with ADS-B.	Failure of ADS-B on fixed object, due to: SW malfunction HW malfunction Inappropriate placement Electromagnetic environmental effects Inadvertent damage Vandalism LTA design. Aircraft on collision course.	Pilot/flight crew initially loses of situational awareness. Object identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Collision W/ Fatal Injury.	2C	5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1. 7 Provide for appropriate ATC/Aircrew contingency procedures. 8 Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 2N Provide updated information on fixed objects in appropriate data sources. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 26 Design the system such that no single software anomaly, common software malfunctions or design feature shall result in a catastrophic event, (severity 1 or 2). 4N Design ADS-B external equipment for physical protection and security to minimize the potential for damage as a result of vandalism. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
21	AFXO-03.6	Near Collision of subject aircraft with fixed object due to failure of ADS-B on aircraft.	Failure of ADS-B on aircraft due to: SW malfunction HW malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Failure of ADS-B on aircraft not detected. Aircraft on collision course.	Near Midair Collision (NMAC) of subject aircraft with fixed object as a result of successful recovery. Pilot/flight crew initially loses of situational awareness. Object identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Collision W/ Fatal Injury.	2C	5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1. 7 Provide for appropriate ATC/Aircrew contingency procedures. 8 Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 2N Provide updated information on fixed objects in appropriate data sources. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 26 Design the system such that no single software anomaly, common software malfunctions or design feature shall result in a catastrophic event, (severity 1 or 2). 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 5N Avionics certification, installation, and approval process established for ADS-B.
28	AFLO-01.6	Near Midair Collision (NMAC) of subject aircraft with flying object due to failure to identify flying object. Flying object not equipped with ADS-B.	Flying object in collision path. Flying object not equipped with ADS-B.	Pilot/flight crew loses situational awareness Pilot/aircrew unaware of flying object. Flying object identified via radar or other sources ATCT does communicate warning. Pilot/flight crew does not regain situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC) W/ Fatal Injury.	2C	7 Provide for appropriate ATC/Aircrew contingency procedures. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 6N Require all flying objects that can become hazards to navigation be equipped with ADS-B transmitters, or other appropriate means of identification. 9A Require alternate means of detecting flying object, e.g., TCAS, ATC warning, etc.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
35	AFLO-02.6	Near Midair Collision (NMAC) of subject aircraft with flying object due to failure of ADS-B on flying object.	Aircraft in collision path. Failure of ADS-B on flying object due to: SW malfunction HW malfunction Electromagnetic environmental effects Inadvertent damage LTA design.	Pilot/flight crew loses situational awareness Pilot/aircrew unaware of flying object. Flying object identified via radar or other sources ATCT doe communicate warning. Pilot/flight crew does not regain situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC) W/ Fatal Injury.	2C	7 Provide for appropriate ATC/Aircrew contingency procedures. 9a Require alternate means of detecting flying object, e.g., TCAS, ATC warning, etc. 77 Require warning lights on flying object to enhance "see and avoid" separation. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 8 Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 26 Design the system such that no single software anomaly, common software malfunctions or design feature shall result in a catastrophic event, (severity 1 or 2). 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 5N Avionics certification, installation, and approval process established for ADS-B.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
39	AFLO-03.3	Near Midair Collision (NMAC) of subject aircraft with flying object due to failure of ADS-B on subject aircraft.	Aircraft on collision path. Failure of ADS-B on fsubject object due to: SW malfunction HW malfunction Electromagnetic environmental effects Inadvertent damage LTA design.	Pilot/flight crew loses situational awareness Pilot/aircrew unaware of subject aircraft. Flying object not identified via radar or other sources ATCT does not communicate warning. Pilot/flight crew does not regain situational awareness. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	2C	8a Design ADS-B airborne system to assure that system failures/malfunctions are detected and reported automatically. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 4 Design ADS-B Airborne System to automatically report system failure/malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1. 7 Provide for appropriate ATC/Aircrew contingency procedures. 9a Require alternate means of detecting flying object, e.g., TCAS, ATC warning, etc. 77 Require warning lights on flying object to enhance “see and avoid” separation. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 26 Design the system such that no single software anomaly, common software malfunctions or design feature shall result in a catastrophic event, (severity 1 or 2). 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 5N Avionics certification, installation, and approval process established for ADS-B.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
40	AFLO-03.4	Near Midair Collision (NMAC) of subject aircraft with flying object due to failure of ADS-B on subject aircraft.	Aircraft on collision path. Failure of ADS-B on subject object due to: SW malfunction HW malfunction Electromagnetic environmental effects Inadvertent damage LTA design.	Pilot/flight crew loses situational awareness Pilot/aircrew unaware of subject aircraft. Flying object identified via radar or other sources ATCT does not communicate warning. Pilot/flight crew does not regain situational awareness. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	2C	8a Design ADS-B airborne system to assure that system failures/malfunctions are detected and reported automatically. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 4 Design ADS-B Airborne System to automatically report system failure/malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1. 7 Provide for appropriate ATC/Aircrew contingency procedures. 9a Require alternate means of detecting flying object, e.g., TCAS, ATC warning, etc. 77 Require warning lights on flying object to enhance “see and avoid” separation. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 26 Design the system such that no single software anomaly, common software malfunctions or design feature shall result in a catastrophic event, (severity 1 or 2). 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 5N Avionics certification, installation, and approval process established for ADS-B.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
41	AFLO-03.5	Near Midair Collision (NMAC) of subject aircraft with flying object due to failure of ADS-B on subject aircraft.	Aircraft on collision path. Failure of ADS-B on subject object due to: SW malfunction HW malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Failure of ADS-B on subject aircraft is detected.	Pilot/flight crew loses situational awareness Pilot/aircrew unaware of subject aircraft. Flying object identified via radar or other sources ATCT does communicate warning. Pilot/flight crew does not regain situational awareness. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	2C	8a Design ADS-B airborne system to assure that system failures/malfunctions are detected and reported automatically. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 4 Design ADS-B Airborne System to automatically report system failure/malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1. 7 Provide for appropriate ATC/Aircrew contingency procedures. 9a Require alternate means of detecting flying object, e.g., TCAS, ATC warning, etc. 77 Require warning lights on flying object to enhance “see and avoid” separation. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 26 Design the system such that no single software anomaly, common software malfunctions or design feature shall result in a catastrophic event, (severity 1 or 2). 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 5N Avionics certification, installation, and approval process established for ADS-B.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
54	AGV-02.6	Near Midair Collision (NMAC) of subject aircraft with ground vehicles due to failure of ADS-B on ground vehicles.	Ground vehicle equipped with ADS-B. Failure of ADS-B due to: SW malfunction HW malfunction Electromagnetic environmental effects Inadvertent damage LTA design.	Pilot/flight crew loses situational awareness Pilot/aircrew unaware of ground vehicle. Ground vehicle identified via radar or other sources ATCT does communicate warning. Pilot/flight crew does regain situational awareness. See and avoid successful.	Airport surface, Taxi, Takeoff, Landing.	Near Midair Collision (NMAC), With Fatal Injury.	2C	8 Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 7 Provide for appropriate ATC/Aircrew contingency procedures. 10 Require ground vehicles to be equipped with appropriate lighting and color indication to enhance "see and avoid" separation. 12a Require alternate means of detecting aircraft and informing ground vehicle operator of position, e.g., AMASS. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 26 Design the system such that no single software anomaly, common software malfunctions or design feature shall result in a catastrophic event, (severity 1 or 2). 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
61	AGV-03.6	Near Midair Collision (NMAC) of subject aircraft with ground vehicles due to failure of ADS-B on aircraft.	Aircraft equipped with ADS-B. Failure of ADS-B due to: SW malfunction HW malfunction Electromagnetic environmental effects Inadvertent damage LTA design.	Pilot/flight crew and ground vehicle driver loss of situational awareness and are not aware of collision potential. Pilot/aircrew unaware of ground vehicle. Ground vehicle is identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew does regain situational awareness. See and avoid successful.	Airport surface, Taxi, Takeoff, Landing.	Near Midair Collision (NMAC), W/ Fatal Injury.	2C	8 Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1. 7 Provide for appropriate ATC/Aircrew contingency procedures. 10 Require ground vehicles to be equipped with appropriate lighting and color indication to enhance “see and avoid” separation. 11 Aircrew and ground personnel “see and avoid” procedures. 12a Require alternate means of detecting aircraft and informing ground vehicle operator of position, e.g., AMASS. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 26 Design the system such that no single software anomaly, common software malfunctions or design feature shall result in a catastrophic event, (severity 1 or 2). 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 5N Avionics certification, installation, and approval process established for ADS-B.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
80	ANAA-01.6	Near Midair Collision (NMAC) of subject aircraft with non-airborne aircraft due to failure to identify non-airborne aircraft. Other aircraft not equipped with ADS-B.	Failure to identify non-airborne aircraft due to: Radar malfunction Electronic masking of aircraft Visual masking of aircraft Loss of signal Procedural error. Either aircraft on collision course.	Pilot/flight crews initially loss situational awareness. Pilot/flight crew(s) are not aware of collision potential. Other aircraft is identified via radar or other sources. ATCT does communicate warning in time. Pilot/flight crew does regain situational awareness. See and avoid successful.	Takeoff, Landing, Airport surfaces.	Near Midair Collision (NMAC), W/ Fatal Injury.	2C	12c Require alternate means of detecting aircraft and informing non-airborne aircraft crew of position, e.g., AMASS, ATC controllers. 2b Require all aircraft to be equipped with appropriate lighting, i.e., “see and avoid”. 11 Aircrew and ground personnel “see and avoid” procedures. 12a Require alternate means of detecting aircraft and informing ground vehicle operator of position, e.g., AMASS. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 26 Design the system such that no single software anomaly, common software malfunctions or design feature shall result in a catastrophic event, (severity 1 or 2). 8 Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1. 7 Provide for appropriate ATC/Aircrew contingency procedures.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
87	ANAA-01.6	Near Midair Collision (NMAC) of subject aircraft with non-airborne aircraft due to failure of ADS-B on non-airborne aircraft	Failure of ADS-B on non-airborne aircraft due to: SW malfunction HW malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Either aircraft on collision course.	Pilot/flight crews initially loss situational awareness. Pilot/flight crew(s) are not aware of collision potential. Other aircraft is identified via radar or other sources. ATCT does not communicate warning in time. Pilot/flight crew does regain situational awareness. See and avoid successful.	Takeoff, Landing, Airport surfaces.	Near Midair Collision (NMAC), W/ Fatal Injury.	2C	8 Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 2b Require all aircraft to be equipped with appropriate lighting, i.e., “see and avoid”. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1. 7 Provide for appropriate ATC/Aircrew contingency procedures. 10 Require ground vehicles to be equipped with appropriate lighting and color indication to enhance “see and avoid” separation. 11 Aircrew and ground personnel “see and avoid” procedures. 12b Require alternate means of detecting aircraft and informing air crew of position, e.g., AMASS 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 26 Design the system such that no single software anomaly, common software malfunctions or design feature shall result in a catastrophic event, (severity 1 or 2). 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 5N Avionics certification, installation, and approval process established for ADS-B. 2b Require all aircraft to be equipped with appropriate lighting, i.e., “see and avoid”.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
106	AADF-02.6	Near Midair Collision (NMAC) of subject aircraft with other aircraft due to erroneous position information on subject aircraft cockpit display. Subject aircraft displays erroneous position information. Source of erroneous information on display is due to failure of on-board display.	Erroneous position information on subject aircraft cockpit display. Source of erroneous information on display is due to failure of on-board display due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Either aircraft on collision course.	Pilot/flight crews initially loss situational awareness. Pilot/flight crew(s) are not aware of collision potential. Other aircraft is identified via radar or other sources. ATCT does communicate warning in time. Pilot/flight crew does regain situational awareness. See and avoid successful.	Takeoff, Landing, Flight, Airport surfaces.	Near Midair Collision (NMAC), W/ Fatal Injury	2C	8a Design ADS-B airborne system to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 5N Avionics certification, installation, and approval process established for ADS-B. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 9a Require alternate means of detecting flying object, e.g., TCAS, ATC warning, etc. 22a Require periodic recalibration of ADS-B inputs, processing system and displays. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
113	AADF-03.6	Near Midair Collision (NMAC) of other aircraft with subject aircraft due to erroneous position information on other aircraft cockpit display. Subject aircraft transmits erroneous position information.	Erroneous position information on other aircraft cockpit display. Subject aircraft transmits erroneous position information due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Either aircraft on collision course.	Pilot/flight crews initially loss situational awareness. Pilot/flight crew(s) are not aware of collision potential. Other aircraft is identified via radar or other sources. ATCT does communicate warning in time. Pilot/flight crew does regain situational awareness. See and avoid successful.	Takeoff, Landing, Flight, Airport surfaces.	Near Midair Collision (NMAC), W/ Fatal Injury.	2C	8a Design ADS-B airborne system to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 5N Avionics certification, installation, and approval process established for ADS-B. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 9a Require alternate means of detecting flying object, e.g., TCAS, ATC warning, etc. 22a Require periodic recalibration of ADS-B inputs, processing system and displays. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
138	SSDF-01.6	Near Midair Collision (NMAC) of subject surface aircraft with other surface aircraft due to erroneous position information on subject aircraft cockpit display. Other surface aircraft transmits erroneous position information.	Erroneous position information on subject aircraft cockpit display. Other surface aircraft transmits erroneous position information due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Either aircraft on collision course.	Pilot/flight crews initially loss situational awareness. Pilot/flight crew(s) are not aware of collision potential. Other aircraft is identified via radar or other sources. ATCT does communicate warning in time. Pilot/flight crew does regain situational awareness. See and avoid successful.	Airport surfaces.	Near Midair Collision (NMAC), W/ Fatal Injury.	2C	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 5N Avionics certification, installation, and approval process established for ADS-B. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 2b Require all aircraft to be equipped with appropriate lighting to enhance "see and avoid" separation. 11 Aircrew and ground personnel "see and avoid" procedures. 12b Require alternate means of detecting aircraft and informing air crew of position, e.g., AMASS. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 11N Require certification, installation, and approval process established for ADS-B ground system. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
145	SSDF-02.6	Near Midair Collision (NMAC) of subject surface aircraft with other surface aircraft due to erroneous position information on subject aircraft cockpit display. Subject aircraft displays erroneous position information. Source of erroneous information on display is due to failure of on-board display.	Erroneous position information on subject aircraft cockpit display. Subject aircraft displays erroneous position information. Source of erroneous information on display is due to failure of on-board display as a result of: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Either aircraft on collision course.	Pilot/flight crews initially loss situational awareness. Pilot/flight crew(s) are not aware of collision potential. Other aircraft is identified via radar or other sources. ATCT does communicate warning in time. Pilot/flight crew does regain situational awareness. See and avoid successful.	Airport surfaces.	Near Midair Collision (NMAC), W/ Fatal Injury.	2C	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 5N Avionics certification, installation, and approval process established for ADS-B. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 2b Require all aircraft to be equipped with appropriate lighting to enhance "see and avoid" separation. 11 Aircrew and ground personnel "see and avoid" procedures. 12b Require alternate means of detecting aircraft and informing air crew of position, e.g., AMASS. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 11N Require certification, installation, and approval process established for ADS-B ground system. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
152	SSDF-03.6	Near Midair Collision (NMAC) of other surface aircraft with subject surface aircraft due to erroneous position information on other surface aircraft's display due to failure of other surface aircraft's display.	Erroneous position information on other surface aircraft's display. Failure of other surface aircraft's display due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Either aircraft on collision course.	Pilot/flight crews initially loss situational awareness. Pilot/flight crew(s) are not aware of collision potential. Other aircraft is identified via radar or other sources. ATCT does communicate warning in time. Pilot/flight crew does regain situational awareness. See and avoid successful.	Airport surfaces.	Near Midair Collision (NMAC), W/ Fatal Injury.	2C	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 5N Avionics certification, installation, and approval process established for ADS-B. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 2b Require all aircraft to be equipped with appropriate lighting to enhance "see and avoid" separation. 11 Aircrew and ground personnel "see and avoid" procedures. 12b Require alternate means of detecting aircraft and informing air crew of position, e.g., AMASS. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 11N Require certification, installation, and approval process established for ADS-B ground system. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
159	SSDF-04.6	Near Midair Collision (NMAC) of other surface aircraft with subject aircraft due to erroneous position information on other surface aircraft display. Source of erroneous information on other surface aircraft display is due to erroneous position data from subject aircraft.	Erroneous position information on other surface aircraft display. Source of erroneous information on other surface aircraft display is due to erroneous position data from subject aircraft resulting from: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Either aircraft on collision course.	Pilot/flight crews initially loss situational awareness. Pilot/flight crew(s) are not aware of collision potential. Other aircraft is identified via radar or other sources. ATCT does communicate warning in time. Pilot/flight crew does regain situational awareness. See and avoid successful.	Airport surfaces.	Near Midair Collision (NMAC), W/ Fatal Injury.	2C	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 5N Avionics certification, installation, and approval process established for ADS-B. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 2b Require all aircraft to be equipped with appropriate lighting to enhance "see and avoid" separation. 11 Aircrew and ground personnel "see and avoid" procedures. 12b Require alternate means of detecting aircraft and informing air crew of position, e.g., AMASS. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 11N Require certification, installation, and approval process established for ADS-B ground system. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
166	AFOD-01.6	Near Collision of subject aircraft with fixed object due to display failure on subject aircraft.	Display failure on subject aircraft due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course with fixed object.	Pilot/flight crew initially loses of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Collision W/ Fatal Injury.	2C	1N Require all fixed objects that are evaluated as hazardous to be equipped with ADS-B transmitters. 2N Provide updated information on fixed objects in appropriate data sources. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 5N Avionics certification, installation, and approval process established for ADS-B. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 11 Aircrew and ground personnel “see and avoid” procedures. 12b Require alternate means of detecting aircraft and informing aircrew of position, e.g., AMASS. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 11N Require certification, installation, and approval process established for ADS-B ground system. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
173	AFOD-02.6	Near Collision of subject aircraft with fixed object due to erroneous position information on subject aircraft's display due to fixed object transmitting erroneous position data.	Erroneous position information on subject aircraft's display due to fixed object transmitting erroneous position data as a result of: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course with fixed object.	Pilot/flight crew initially loses of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Collision W/ Fatal Injury	2C	1N Require all fixed objects that are evaluated as hazardous to be equipped with ADS-B transmitters. 2N Provide updated information on fixed objects in appropriate data sources. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 5N Avionics certification, installation, and approval process established for ADS-B. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 11 Aircrew and ground personnel "see and avoid" procedures. 12b Require alternate means of detecting aircraft and informing aircrew of position, e.g., AMASS. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 11N Require certification, installation, and approval process established for ADS-B ground system. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

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Automatic Dependent Surveillance Broadcast (ADS-B)

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180	AAAL-01.6	Loss of separation assurance and Near Midair Collision (NMAC) during terminal approach due to ADS-B failure. (No other surveillance information available, i.e., no backup)	Failure on ADS-B due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course. No other surveillance information available, i.e., no backup.	Pilot/flight crew initially loses of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Terminal Approach	Near Midair Collision (NMAC), W/ Fatal Injury.	2C	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 9a Require alternate means of detecting flying object, e.g., TCAS, ATC warning, etc. 2a Require warning lights on other aircraft to enhance “see and avoid” separation 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, malfunctions. 10N Require all aircraft that can become hazards to navigation be equipped with ADS-B transmitters, or other appropriate automated means of identification. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 11N Require certification, installation, and approval process established for ADS-B ground system. 5N Avionics certification, installation, and approval process established for ADS-B.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
194	SR-02.6	Loss of separation assurance and Near Midair Collision (NMAC) due to "spoofing", i.e., hackers breach system security.	"Spoofing", i.e., hackers breach system security. Aircraft on collision course.	Pilot/flight crew initially loses of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC), W/ Fatal Injury.	2C	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 9c Require alternate means of detecting other aircraft, e.g., TCAS, ATC warning, etc. 2a Require warning lights on other aircraft to enhance "see and avoid" separation 16 Design ADS-B system to minimize the risk of security intrusion, including detectability, auditing and software protection. 15 Provide message authority verification in the design.
201	HF-01.6	Near Midair Collision (NMAC) due to excessive controller workload, loss of situation awareness associated with excessive display clutter.	Loss of situation awareness associated with excessive display clutter as a result of: LTA design SW malfunction HW malfunction System malfunction. Increased collision risk due to excessive controller workload. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC),W/ Fatal Injury.	2C	6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1. 17 Human factors shall evaluate the potential controller loss of situational awareness due to excessive workload. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 16N Define criteria for determining threshold values for ADS-B coverage area to assure controller/pilot adequate situational awareness. 17N Conduct controller/pilot workload assessments to evaluate the potential for excessive workload associated with ADS-B system.

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208	HF-02.6	Increased Near Midair Collision (NMAC) due to pilot workload, loss of situation awareness associated with excessive display clutter, i.e., and too much information.	Excessive display clutter, i.e., and too much information due to LTA design. Increased collision risk due to excessive pilot workload associated with excessive display clutter. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC), W/ Fatal Injury.	2C	6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1. 17 Human factors shall evaluate the potential controller loss of situational awareness due to excessive workload. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 16N Define criteria for determining threshold values for ADS-B coverage area to assure controller/pilot adequate situational awareness. 17N Conduct controller/pilot workload assessments to evaluate the potential for excessive workload associated with ADS-B system.
221	HF-04.6	Inappropriate or erroneous communication due to language barrier results in loss of situational awareness and near increased Near Midair Collision (NMAC) risk.	Inappropriate communication or erroneous communication associated with ADS-B due to: LTA design LTA procedure LTA consideration of language use. Miss communication occurs. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC), W/ Fatal Injury.	2C	70 Design ADS-B for use in international communication in accordance with acceptable human factors design practices (e.g., IACO standard symbology??) 75 Provide alternate means of communication, i.e., Voice backup. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
234	HF-06.6	Inappropriate or erroneous communication due to less than adequate CHI design results in loss of situational awareness and increased Near Midair Collision (NMAC) risk between aircraft.	Inappropriate communication or erroneous communication associated with ADS-B due to LTA CHI design. Miss communication occurs. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC) w/ Fatal injury.	2C	6 Design in accordance with FAA CT-96/1 69 Design ADS-B CHI to minimize the potential for human error. 70 Design ADS-B for use in international communication in accordance with acceptable human factors design practices (e.g., IACO standard symbology??) 75 Provide alternate means of communication, i.e., Voice backup. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g.
241	HF.07.6	Inappropriate or erroneous communication due to less than adequate CHI design results in loss of situational awareness and increased Near Midair Collision (NMAC) risk between aircraft and ground vehicle.	Inappropriate communication or erroneous communication associated with ADS-B due to LTA CHI design. Miss communication occurs. Aircraft and vehicle on collision course.	Initial pilot/flight crew/controller/driver loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Airport surface, Emergency.	Near Midair Collision (NMAC), w/Fatal injury.	2C	6 Design in accordance with FAA CT-96/1 69 Design ADS-B CHI to minimize the potential for human error. 70 Design ADS-B for use in international communication in accordance with acceptable human factors design practices (e.g., IACO standard symbology??) 75 Provide alternate means of communication, i.e., Voice backup. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g.

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Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
248	SA-01.6	Inappropriate clearance given as a result of erroneous flight data in Data Block, i.e., ACID, ALTITUDE, POSITION, HEADING, etc caused by loss of data integrity. Scenario results in Near Midair Collision (NMAC).	Loss of data integrity due to system anomaly. Inappropriate clearance given as a result of erroneous flight data. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC),w Fatal Injury.	2C	76 Design ADS-B system to include end-to-end data integrity check functionality and provide proper notification if data corruption is detected 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness.
255	SA-02.6	Loss of separation assurance and Near Midair Collision (NMAC) during terminal approach due to frequency saturation i.e., is their sufficient bandwidth to accommodate all aircraft in a terminal environment?	Loss of ADS-B associated with some aircraft as a result of frequency saturation due to LTA bandwidth. Loss of target identification. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC),w/ Fatal injury.	2C	19 Allocate appropriate bandwidth to accommodate current and projected traffic growth. 20 Select transmission frequencies with enough bandwidth to accommodate the allocation. 21 Alternate means of separation assurance must be provided. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness.
262	SA-03.6	Loss of separation assurance and Near Midair Collision (NMAC) due to insufficient range of ADS-B on approaching aircraft.	Insufficient range of ADS-B on approaching aircraft due to LTA design. Loss of target identification. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Approach, Landing	Near Midair Collision (NMAC), w/ Fatal injury.	2C	74 Ensure that both aircraft are equipped for the application. 9b Provide alternate means of detection and collision avoidance. 16N Define criteria for determining threshold values for ADS-B coverage area to assure controller/pilot adequate situational awareness. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness.

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275	SA-05.6	Common Mode failures in ADS-B that could result in loss of separation assurance and collision.	Common Mode failures due to LTA redundancy within design. Loss of ADS-B associated with some aircraft as a result of Common Mode failures. Loss of target identification. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC), w/fatal injury.	2C	26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 27 Design the system to assure that dual independent component failure, dual human errors, or a combination of a component failure and a human error cannot cause a catastrophic event. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 9c Require alternate means of detecting other aircraft, e.g., TCAS, ATC warning, etc. 2a Require warning lights on other aircraft to enhance “see and avoid” separation.
282	SA-06.6	Loss of separation and Near Midair Collision (NMAC) due to common software anomaly.	Common software anomaly due to: LTA design SW malfunction System malfunction Human error. Anomaly results in “ghosting”, “masking”, inappropriate target identification, or loss of target. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC), w/fatal injury.	2C	26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2) 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 18N Design Software in accordance with Advisory Circular 20-115B. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

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289	SA-07.6	Common cause failure in ADS-B results in loss of transmission and consequent collision.	Common cause failures due to: LTA design SW malfunction System malfunction Human error. Loss of ADS-B associated with some aircraft as a result of Common cause failures. Loss of target identification. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC), w/fatal injury.	2C	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2) 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

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296	SA-08.6	Loss of separation integrity due to delay in transmitting data results in collision.	Delay in transmitting data as a result of: Latency within design SW bandwidth SW malfunction System malfunction LTA design. Loss of ADS-B associated with some aircraft as a result of transmission delay. Loss of target identification. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC), w/fatal injury.	2C	28 Provide for appropriate latency budget for ADS-B system. 29 Design the system to assure that potential for delay is minimized. 30 Design the system to monitor time delays and eliminate bad data. 31 Provide design to identify latency delays and indicate those anomaly. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.
303	SA-09.6	Possible increased Near Midair Collision (NMAC) risk due to ADS-B system calibration error.	ADS-B system calibration error. Deviation results in “ghosting”, “masking”, inappropriate target identification, or loss of target. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC), w/ Fatal injury.	2C	22a Require periodic recalibration of ADS-B inputs, processing system and displays. 23 Consider automated system for recalibration of ADS-B systems. 24 Provide a design requirement for system –wide calibration of ADS-B. 25 Provide built-in test capability in the system to identify and report when the system is out of calibration. 76 Require periodic recalibration of ADS-B inputs, processing system and transmitter.

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310	SA-10.6	ADS-B system malfunction occurs and the ground controller does not detect it. Scenario results in Near Midair Collision (NMAC).	ADS-B system malfunction occurs. Loss of or inappropriate target identification. Maintenance does not detect malfunction, or is unable to communicate malfunction in time to controller. Controller does not detect malfunction. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	2C	72 Design reliable built-in test capability. 73 Design system to determine data validity. 32 Provide alternate means of providing functionality. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.
317	SA-11.6	ADS-B system malfunction occurs and the pilot does not detect it. Scenario results in Near Midair Collision (NMAC).	ADS-B system malfunction occurs. Loss of or inappropriate target identification. Maintenance does not detect malfunction, or is unable to communicate malfunction in time to controller. Pilot/flight crew/ Controller does not detect malfunction. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	2C	72 Design reliable built-in test capability. 73 Design system to determine data validity. 32 Provide alternate means of providing functionality. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

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324	SA-12.6	Erroneous malfunction indication to pilot. Scenario results in Near Midair Collision (NMAC).	ADS-B is functional. Erroneous malfunction indication occurs due to: SW error Human error System error Design error. Aircraft not on collision course. Pilot/flight crew takes inappropriate action as a result of indication. Aircraft now on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC), w/ Fatal injury.	2C	33a Design the system to minimize false alarms. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.
331	SA-13.6	Erroneous malfunction indication to controller. Scenario results in Near Midair Collision (NMAC).	ADS-B is functional. Erroneous malfunction indication occurs due to: SW error Human error System error Design error. Aircraft not on collision course. Controller takes inappropriate action as a result of indication. Pilot/flight crew takes inappropriate action. Aircraft now on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	2C	33a Design the system to minimize false alarms. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.

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344	SA-15.6	Erroneous turn indication due to ADS-B system forecast error. Scenario results in Near Midair Collision (NMAC). Aircraft initially on collision course.	Erroneous turn indication due to ADS-B system forecast error. Forecasting error occurs due to: SW malfunction HW malfunction System malfunction LTA design Design error. Aircraft on collision course. Pilot/flight crew/controller takes inappropriate action as a result of turn indication. Aircraft remains on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC), w/ Fatal injury.	2C	34 Design forecasting algorithms with sufficient margins of safety. 33b Design the system to minimize the potential for false alarms. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
351	SA-16.6	Erroneous turn indication due to ADS-B system malfunction. Scenario results in Near Midair Collision (NMAC). Aircraft initially not on collision course.	Erroneous turn indication due to ADS-B system malfunction. Forecasting error occurs due to: SW malfunction HW malfunction System malfunction LTA design Design error. Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result of turn indication. Aircraft now on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC), w/ Fatal injury.	2C	34 Design forecasting algorithms with sufficient margins of safety. 33b Design the system to minimize the potential for false alarms. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
364	SA-18.6	Loss of separation assurance results in Near Midair Collision (NMAC) due to erroneous "future intent" messages, due to system malfunction.	Erroneous "future intent" messages, due to system malfunction. Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result of erroneous "future intent" message. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	2C	34 Design forecasting algorithms with sufficient margins of safety. 33b Design the system to minimize the potential for false alarms. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.
371	SA-19.6	Display information conflict between ground displays and airborne displays due to ADS-B system malfunction results in Near Midair Collision (NMAC).	Display information conflict due to ADS-B system malfunction. Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result of information conflict. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	2C	35 Design the system to minimize the potential for conflict between the ground displays and airborne displays. 36 Design the system to detect and report conflicts in information between ground and airborne displays. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.

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Automatic Dependent Surveillance Broadcast (ADS-B)

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378	SA-20.6	Erroneous position data (latitude-longitude) due to system malfunction resulting in loss of separation and Near Midair Collision (NMAC).	Erroneous position data (latitude-longitude) due to system malfunction. Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result erroneous position data. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	2C	37 Require independent method of validating position data. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.
403	SA-24.6	Barometric Altitude Rate error on own aircraft causes false alarm on receiving aircraft. Scenario results in Near Midair Collision (NMAC).	Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result of false alarm. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC), w/ Fatal injury.	2C	33b Design the system to minimize the potential for false alarms. 41 Design system to detect and indicate erroneous barometric altitude rate errors before transmitting through ADS-B. 42 Provide independent means of validating Barometric altitude rate changes. 43 Provide contingency training to assure situational awareness and acclimation of ADS-B during terminal phase descent. 5N Avionics certification, installation, and approval process established for ADS-B. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
410	SA-25.6	Barometric Altitude error on own aircraft causes false alarm on receiving aircraft. Scenario results in Near Midair Collision (NMAC).	Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result of false alarm. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	2C	33b Design the system to minimize the potential for false alarms. 46 Provide alternate means of collision avoidance such as TCAS, or MSAW. 41 Design system to detect and indicate erroneous barometric altitude rate errors before transmitting through ADS-B. 42 Provide independent means of validating Barometric altitude rate changes. 43 Provide contingency training to assure situational awareness and acclimation of ADS-B during terminal phase descent. 5N Avionics certification, installation, and approval process established for ADS-B. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.

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Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
417	SA-26.6	Position error on own aircraft causes false alarm on receiving aircraft. Scenario results in Near Midair Collision (NMAC).	Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result of false alarm. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	2C	4 Design ADS-B airborne system to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 9c Require alternate means of detecting other aircraft, e.g., TCAS, ATC warning, etc. 2a Require warning lights on other aircraft to enhance "see and avoid" separation. 43 Provide contingency training to assure situational awareness and acclimation of ADS-B during terminal phase descent. 5N Avionics certification, installation, and approval process established for ADS-B. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 33b Design the system to minimize the potential for false alarms.
430	SA-28.6	Failure propagation results in loss of ADS-B. Scenario results in Near Midair Collision (NMAC).	Loss of ADS-B associated with some aircraft. Loss of target identification. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	2C	50 Design ADS-B system architecture to ensure failure isolation of hardware. 48b Design ADS-B system architecture to ensure that hardware, firmware and software fails safe. 27 Design the system to assure that dual independent component failure, dual human errors, or a combination of a component failure and a human error cannot cause a catastrophic event. 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

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Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
445	SA-30.6	Possible increased collision risk due to ADS-B system calibration deviation. Miscalibration is on single aircraft. Scenario results in Near Midair Collision (NMAC).	ADS-B system calibration deviation due to LTA design. Deviation results in "ghosting", "masking", inappropriate target identification, or loss of target. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	2C	22b Require periodic recalibration of all airborne ADS-B systems. 25 Provide built-in test capability in the system to identify and report when the system is out of calibration. 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.
452	LTAD-01.6	Loss of data integrity due to delay in transmitting data due to LTA design. Scenario addresses Transmitter Latency. Scenario results in near midair collision (NMAC).	Delay in transmitting data as a result of: Latency within design LTA design. Loss of ADS-B associated with some aircraft as a result of transmission delay. Loss of target identification. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near midair collision (NMAC) with Fatal Injury	2C	54 Design Transmitter/Receiver to meet Latency Requirements of NAS-SR-1000. 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

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Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
459	LTAD-02.6	Loss of data integrity due to communication link latency errors between the airborne and ground receiving/processing systems. Scenario results in near midair collision (NMAC).	Communication link latency errors between the airborne and ground receiving/processing systems due to latency within design: SW bandwidth SW malfunction System malfunction LTA design. Loss of ADS-B associated with some aircraft as a result of transmission delay. Loss of target identification. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near midair collision (NMAC) with fatal injury	2C	55 Design Communication link to meet latency Requirements of NAS-SR-1000. 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.
466	LTAD-03.6	Loss of separation due to time delay in ground processing system. (UPDATE RATE). Scenario results in near midair collision (NMAC).	Time delay in ground processing system, (UPDATE RATE), due to: SW bandwidth SW malfunction System malfunction LTA design. Pilot/flight crew/controller takes inappropriate action as a result of outdated target information, delay in target updating. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near midair collision (NMAC) with fatal injury	2C	56. Design application processing system to meet Latency Requirements of NAS-SR –1000. 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

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473	EE-01.6	Reduced safety margins due to weather effects on ADS-B which cause temporary "blind spots". Scenario results in near midair collision (NMAC).	"Blind spots" contribute to loss of target information. Pilot/flight crew/controller takes inappropriate action as a result of loss of target information. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near midair collision (NMAC) with fatal injury	2C	57 Select frequency spectrum to minimize adverse effects of weather on ADS-B transmissions 58 Consider alternative frequency spectrum as backup. 59 Design ground stations to minimize damage due to lightning or other adverse weather effect. 7 Provide for appropriate ATC/Aircrew contingency procedures. 2b Require all aircraft to be equipped with appropriate lighting to enhance "see and avoid" separation. 11 Aircrew and ground personnel "see and avoid" procedures. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness.
482	LTAD-02.6 NS	Due to less than adequate design, there is conflicting information communicated to the aircrew. This information addresses redundant flight critical information that is associated with an emergency. This can possibly lead to confusion, delayed response to the emergency situation and possible near midair collision (NMAC) risk.	Due to less than adequate design, there is conflicting information communicated to the aircrew. An emergency condition exists. Pilot/flight crew/controller takes inappropriate action as a result of conflicting information. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near midair collision (NMAC) with fatal injury	2C	61b Conduct analysis, studies, simulations and/or flight tests to identify system safety related risks associated with human factors related to possible conflicting communication. 62 Conduct analysis, studies, simulations and/or flight tests to develop engineering requirements to eliminate or control the system risks to an acceptable level. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 16N Define criteria for determining threshold values for ADS-B coverage area to assure controller/pilot adequate situational awareness. 17N Conduct controller/pilot workload assessments to evaluate the potential for excessive workload associated with ADS-B system.

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489	SA-01.6 NS	Due to system anomaly, there is conflicting information communicated to the aircrew. This information addresses redundant flight critical information that is associated with an emergency. This can possibly lead to confusion, delayed response to the emergency situation and possible near midair collision (NMAC) risk.	Due to system anomaly, there is conflicting information communicated to the aircrew. Pilot/flight crew/controller takes inappropriate action as a result of conflicting information. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near midair collision (NMAC) with fatal injury	2C	63 Conduct analysis, studies, simulations and/or flight tests to identify system safety related risks associated with system anomalies that could cause conflicting flight critical information to be communicated. 64 Conduct analysis, studies, simulations and/or flight tests to develop engineering requirements to minimize system anomalies that result from conflicting information. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 16N Define criteria for determining threshold values for ADS-B coverage area to assure controller/pilot adequate situational awareness. 17N Conduct controller/pilot workload assessments to evaluate the potential for excessive workload associated with ADS-B system.
496	SA-02.6 NS	Due to system anomaly, there is conflicting information communicated to the air traffic controller. This information addresses redundant flight critical information that is associated with an emergency. This can possibly lead to confusion, delayed response to the emergency situation and possible near midair collision (NMAC) risk.	Aircraft not on collision course. Due to system anomaly, there is conflicting information communicated to the air traffic controller. Pilot/flight crew/controller takes inappropriate action as a result of conflicting information. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near midair collision (NMAC) with fatal injury	2C	63 Conduct analysis, studies, simulations and/or flight tests to identify system safety related risks associated with system anomalies that could cause conflicting flight critical information to be communicated. 64 Conduct analysis, studies, simulations and/or flight tests to develop engineering requirements to minimize system anomalies that result from conflicting information. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 16N Define criteria for determining threshold values for ADS-B coverage area to assure controller/pilot adequate situational awareness. 17N Conduct controller/pilot workload assessments to evaluate the potential for excessive workload associated with ADS-B system.

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504	CP-01.6	Less than adequate contingency planning results in possible increased collision risk due to confusion over responsibility for separation assurance in a shared responsibility environment.	Less than adequate contingency planning during tests and system development. Responsibility for separation assurance not fully defined between pilot/flight crew/controller for all possible contingencies. Pilot/flight crew/controller takes inappropriate action as result confusion over responsibility. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near midair collision (NMAC) with fatal injury	2C	65 Develop "rules of the road" 66 Develop appropriate aircrew procedures to accommodate any possible contingency situation 67 Develop appropriate controller procedures to accommodate any possible contingency situation 68 Develop appropriate training materials and training programs to ensure that all participants in a shared responsibility environment understand their role and safe operation procedures.

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Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
507	ISA1-01.2	Near Midair Collision (NMAC) of subject aircraft due to ADS-B malfunction and TCAS-I malfunction.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-I malfunction due to: Above malfunctions. Aircraft on collision course. TIS not helpful in situation.	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC), w/ Fatal injury.	2C	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 19N Design TIS to integrate with ADS-B and provide redundant alert against collision risk. 19Na Design TCAS-I to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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510	ISA1-02.2	Near Midair Collision (NMAC) of subject aircraft due to ADS-B malfunction and conflicting information on CDTI, TCAS, or TIS.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Conflicting information on CDTI, TCAS, or TIS, due to LTA design or malfunction. Aircraft on collision course.	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC)	2C	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 5Nc Avionics certification, installation, and approval process established for ADS-B with CDTI. 19N Design TIS to integrate with ADS-B and provide redundant alert against collision risk. 19Na Design TCAS-I to integrate with ADS-B and provide redundant alert against collision risk. 20N Design CDTI, TCAS, and TIS to integrate with ADS-B, provide redundancy, and minimize conflicting information communicated in cockpit. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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513	ISA1-03.2	Near Midair Collision (NMAC) of subject aircraft due to malfunction of Conflict Avoidance.	Malfunction of Conflict Avoidance due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course.	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC), w/ Fatal injury.	2C	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 5Nc Avionics certification, installation, and approval process established for ADS-B with CDTI. 19Na Design TCAS-I to integrate with ADS-B and provide redundant alert against collision risk. 20N Design CDTI, TCAS, and TIS to integrate with ADS-B, provide redundancy, and minimize conflicting information communicated in cockpit. 21N Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failure of Conflict Avoidance function. 22N Design system to minimize the potential for failure of Conflict Avoidance function. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
516	ISA2.01.2	Near Midair Collision (NMAC) of subject aircraft due to ADS-B malfunction and TCAS-I malfunction.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-I malfunction due to: Above malfunctions. Aircraft on collision course.	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Emergency.	Near Midair Collision (NMAC), w/ Fatal injury.	2C	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 19Na Design TCAS-I to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
521	ISA3.01.2	Near Midair Collision (NMAC) of subject aircraft due to ADS-B malfunction and TCAS-II malfunction, causing error in recommended vertical escape maneuver indication.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-II malfunction causing error in recommended vertical escape maneuver indication due to: Above malfunctions. Aircraft on collision course.	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Emergency.	Near Midair Collision (NMAC), W/ Fatal injury.	2C	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 21Na Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failure of, or error in, recommended vertical escape maneuver indication. 22Na Design system to minimize the potential for failure of, or error in, recommended vertical escape maneuver indication. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
524	ISA3.01.5	Near Midair Collision (NMAC) of subject aircraft due to ADS-B malfunction and TCAS-II malfunction.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-II malfunction due to: Above malfunctions. Aircraft on collision course.	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Emergency.	Near Midair Collision (NMAC), w/ Fatal injury.	2C	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
526	ISA3.01.7	Near Midair Collision (NMAC) of subject aircraft due to ADS-B malfunction and conflicting information on CDTI, TCAS, or TIS.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Conflicting information on CDTI, TCAS, or TIS due to: Above malfunctions. Aircraft on collision course	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Emergency.	Near Midair Collision (NMAC), w/ Fatal injury.	2C	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 19N Design TIS to integrate with ADS-B and provide redundant alert against collision risk. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 20N Design CDTI, TCAS, and TIS to integrate with ADS-B, provide redundancy, and minimize conflicting information communicated in cockpit. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
530	ISA4.01.2	Near Midair Collision (NMAC) of subject aircraft due to ADS-B malfunction and TCAS-II malfunction.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-II malfunction due to: Above malfunctions. Aircraft on collision course.	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Emergency.	Near Midair Collision (NMAC), w/ fatal injury.	2C	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
533	ISA4.01.5	Near Midair Collision (NMAC) of subject aircraft due to ADS-B malfunction and conflicting information on CDTI.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Conflicting information on CDTI due to: Above malfunctions. Aircraft on collision course	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Emergency.	Near Midair Collision (NMAC), w/ Fatal injury.	2C	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 20Na Design CDTI to integrate with ADS-B, provide redundancy, and minimize conflicting information communicated in cockpit. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
536	ISB1.01.2	Loss of separation assurance due to ADS-B malfunction results in Near Midair Collision (NMAC). TCAS -I or TIS or CDTI malfunction contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-I or TIS or CDTI malfunction due to similar malfunctions indicated above. Aircraft progress towards Near Midair Collision (NMAC).	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC), w/ Fatal injury.	2C	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 5Nc Avionics certification, installation, and approval process established for ADS-B with CDTI. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
539	ISB1.01.5	Erroneous sequencing as a result of ADS-B malfunction results in Near Midair Collision (NMAC). TCAS -I or TIS or CDTI malfunction contributes to Near Midair Collision (NMAC).	Erroneous sequence indicated as a result of ADS-B malfunction, due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course due to erroneous sequence. TCAS -I or TIS or CDTI malfunction due to the above contributors.	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC), w/ Fatal injury.	2C	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 5Nc Avionics certification, installation, and approval process established for ADS-B with CDTI. 21Nb Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of erroneous sequencing of aircraft. 22Nb Design system to minimize the potential of erroneous sequencing of aircraft. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
542	ISB2.01.2	Loss of separation assurance due to ADS-B malfunction results in Near Midair Collision (NMAC). TCAS -I or CDTI malfunction contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-I or CDTI malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs.	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC) w/ Fatal injury.	2C	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 5Nc Avionics certification, installation, and approval process established for ADS-B with CDTI. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
545	ISB2.01.5	Erroneous sequencing as a result of ADS-B malfunction results in Near Midair Collision (NMAC). TCAS -I or CDTI malfunction contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-I or CDTI malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs.	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC) w/ Fatal injury.	2C	22Nb Design system to minimize the potential of erroneous sequencing of aircraft. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 5Nc Avionics certification, installation, and approval process established for ADS-B with CDTI. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
547	ISB3.01.1	Loss of separation assurance due to ADS-B malfunction results in Near Midair Collision (NMAC). TCAS –II or TIS or CDTI malfunction contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-II or TIS or CDTI malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs.	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC) w/ Fatal injury.	2C	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 5Nc Avionics certification, installation, and approval process established for ADS-B with CDTI. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
551	ISB3.01.5	Erroneous sequencing as a result of ADS-B malfunction results in Near Midair Collision (NMAC). TCAS -II or TIS or CDTI malfunction contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-II or TIS or CDTI malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs.	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC) w/ Fatal injury.	2C	22Nb Design system to minimize the potential of erroneous sequencing of aircraft. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 5Nc Avionics certification, installation, and approval process established for ADS-B with CDTI. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
554	ISB4.01.2	Loss of separation assurance due to ADS-B malfunction results in Near Midair Collision (NMAC). TCAS –II or CDTI malfunction contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-II or CDTI malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs.	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC) w/ Fatal injury.	2C	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 5Nc Avionics certification, installation, and approval process established for ADS-B with CDTI. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
557	ISB4.01.5	Erroneous sequencing as a result of ADS-B malfunction results in collision. TCAS -II or CDTI malfunction contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-II or CDTI malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs.	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC) w/ Fatal injury.	2C	22Nb Design system to minimize the potential of erroneous sequencing of aircraft 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 5Nc Avionics certification, installation, and approval process established for ADS-B with CDTI. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
560	ISC1.01.2	Loss of separation assurance due to ADS-B malfunction results in Near Midair Collision (NMAC). TCAS –I or TIS or CDTI malfunction contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-I or TIS or CDTI malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs.	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC) w/ Fatal injury.	2C	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 5Nc Avionics certification, installation, and approval process established for ADS-B with CDTI. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
563	ISC1.01.5	Erroneous flight path calculation as a result of ADS-B malfunction results in collision. TCAS -I or TIS or CDTI malfunction contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS -I or TIS, or CDTI malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs.	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC) w/ Fatal injury.	2C	22Nc Design system to minimize the potential of erroneous flight path. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 5Nc Avionics certification, installation, and approval process established for ADS-B with CDTI. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
566	ISC2.01.2	Loss of separation assurance due to ADS-B malfunction results in Near Midair Collision (NMAC). TCAS –I or CDTI malfunction contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-I or CDTI malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs.	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC) w/ Fatal injury.	2C	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 5Nc Avionics certification, installation, and approval process established for ADS-B with CDTI. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
569	ISC2.01.5	Erroneous flight path calculation as a result of ADS-B malfunction results in Near Midair Collision (NMAC). TCAS -I or CDTI malfunction contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS -I, or CDTI malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs.	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC) w/ Fatal injury.	2C	22Nc Design system to minimize the potential of erroneous flight path. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 5Nc Avionics certification, installation, and approval process established for ADS-B with CDTI. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
572	ISC3.01.2	Loss of separation assurance due to ADS-B malfunction results in Near Midair Collision (NMAC). TCAS –II or TIS or CDTI malfunction contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-II or TIS or CDTI malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs.	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC) w/ Fatal injury.	2C	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 5Nc Avionics certification, installation, and approval process established for ADS-B with CDTI. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
574	ISC3.01.4	Erroneous flight path calculation as a result of ADS-B malfunction results in collision. TCAS -II or TIS or CDTI malfunction contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS -II or TIS, or CDTI malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs.	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC) w/ Fatal injury.	2C	22Nc Design system to minimize the potential of erroneous flight path. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 5Nc Avionics certification, installation, and approval process established for ADS-B with CDTI. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
577	ISC4.01.1	Loss of separation assurance due to ADS-B malfunction results in Near Midair Collision (NMAC). TCAS –II or CDTI malfunction contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-II or CDTI malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs.	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC), w/ Fatal injury.	2C	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 5Nc Avionics certification, installation, and approval process established for ADS-B with CDTI. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
581	ISC4.01.5	Erroneous flight path calculation as a result of ADS-B malfunction results in collision. TCAS -II or CDTI malfunction contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS -II, or CDTI malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs.	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC) w/ Fatal injury.	2C	22Nc Design system to minimize the potential of erroneous flight path. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 5Nc Avionics certification, installation, and approval process established for ADS-B with CDTI. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
584	ISD1.01.2	Loss of ability of own aircraft to be seen by Class A and Class C users due to ADS-B malfunction on own aircraft. Scenario results in Near Midair Collision (NMAC) with vehicle.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Loss of target on other aircraft display. Loss of target on ground display. Aircraft or vehicle on collision course.	Pilot/flight crew and ground vehicle driver initially loses situational awareness and is not aware of collision potential. Pilot/aircrew unaware of ground vehicle. Ground vehicle identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew does regain situational awareness. See and avoid successful.	Airport surface, Taxi, Takeoff, Landing.	Near Midair Collision (NMAC) of subject aircraft with vehicle and Fatal injury.	2C	50 Design ADS-B system architecture to ensure failure isolation of hardware. 48b Design ADS-B system architecture to ensure that hardware, firmware and software fails safe. 27 Design the system to assure that dual independent component failure, dual human errors, or a combination of a component failure and a human error cannot cause a catastrophic event. 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 23N Design system to minimize the potential of loss of targets. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 10N Require all aircraft that can become hazards to navigation be equipped with ADS-B transmitters, or other appropriate automated means of identification. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
587	ISD1.01.5	Loss of ability of own aircraft to be seen by Class A and Class C users due to ADS-B malfunction on own aircraft. Scenario results in Near Midair Collision (NMAC) with other aircraft.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Loss of target on other aircraft display. Loss of target on ground display. Aircraft on collision course.	Pilot/flight crew initially loses situational awareness and is not aware of collision potential. Pilot/aircrew unaware of other aircraft. Other aircraft identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew does regain situational awareness. See and avoid successful.	Airport surface, Taxi, Takeoff, Landing.	Near Midair Collision (NMAC) of aircraft and Fatal injury.	2C	50 Design ADS-B system architecture to ensure failure isolation of hardware. 48b Design ADS-B system architecture to ensure that hardware, firmware and software fails safe. 27 Design the system to assure that dual independent component failure, dual human errors, or a combination of a component failure and a human error cannot cause a catastrophic event. 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 23N Design system to minimize the potential of loss of targets. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 10N Require all aircraft that can become hazards to navigation be equipped with ADS-B transmitters, or other appropriate automated means of identification. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
589	ISD2.01.1	Loss of ability of own aircraft to be seen by Class A and Class C users due to ADS-B malfunction on own aircraft. Scenario results in Near Midair Collision (NMAC) with vehicle. MFD not helpful	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Loss of target on other aircraft display. Loss of target on ground display. Aircraft or vehicle on collision course.	Pilot/flight crew and ground vehicle driver initially loses situational awareness and is not aware of collision potential. Pilot/aircrew unaware of ground vehicle. Ground vehicle identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew does regain situational awareness. See and avoid successful.	Airport surface, Taxi, Takeoff, Landing.	Near Midair Collision (NMAC) of subject aircraft with vehicle and Fatal injury.	2C	50 Design ADS-B system architecture to ensure failure isolation of hardware. 48b Design ADS-B system architecture to ensure that hardware, firmware and software fails safe. 27 Design the system to assure that dual independent component failure, dual human errors, or a combination of a component failure and a human error cannot cause a catastrophic event. 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 23N Design system to minimize the potential of loss of targets. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 10N Require all aircraft that can become hazards to navigation be equipped with ADS-B transmitters, or other appropriate automated means of identification. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
593	ISD2.01.5	Loss of ability of own aircraft to be seen by Class A and Class C users due to ADS-B malfunction on own aircraft. Scenario results in Near Midair Collision (NMAC) with aircraft. MFD not helpful	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Loss of target on other aircraft display. Loss of target on ground display. Aircraft on collision course.	Pilot/flight crew initially loses situational awareness and is not aware of collision potential. Pilot/aircrew unaware of other aircraft. Other aircraft identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew does regain situational awareness. See and avoid successful.	Airport surface, Taxi, Takeoff, Landing.	Near Midair Collision (NMAC) of aircraft and Fatal injury.	2C	50 Design ADS-B system architecture to ensure failure isolation of hardware. 48b Design ADS-B system architecture to ensure that hardware, firmware and software fails safe. 27 Design the system to assure that dual independent component failure, dual human errors, or a combination of a component failure and a human error cannot cause a catastrophic event. 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 23N Design system to minimize the potential of loss of targets. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 10N Require all aircraft that can become hazards to navigation be equipped with ADS-B transmitters, or other appropriate automated means of identification. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
596	ISD3.01.2	Loss of ability of own aircraft to be seen by Class A and Class C users due to ADS-B malfunction on own aircraft. Scenario results in Near Midair Collision (NMAC) with vehicle if TIS is useful.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Loss of target on other aircraft display. Loss of target on ground display. Aircraft or vehicle on collision course.	Pilot/flight crew and ground vehicle driver initially loses situational awareness and is not aware of collision potential. Pilot/aircrew unaware of ground vehicle. Ground vehicle identified via radar or other sources TIS. ATCT does communicate warning. Pilot/flight crew does regain situational awareness. See and avoid successful.	Airport surface, Taxi, Takeoff, Landing.	Near Midair Collision (NMAC) of subject aircraft with vehicle and Fatal injury.	2C	50 Design ADS-B system architecture to ensure failure isolation of hardware. 48b Design ADS-B system architecture to ensure that hardware, firmware and software fails safe. 27 Design the system to assure that dual independent component failure, dual human errors, or a combination of a component failure and a human error cannot cause a catastrophic event. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 10N Require all aircraft that can become hazards to navigation be equipped with ADS-B transmitters, or other appropriate automated means of identification. 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 23N Design system to minimize the potential of loss of targets. 19N Design TIS to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
599	ISD3.01.5	Loss of ability of own aircraft to be seen by Class A and Class C users due to ADS-B malfunction on own aircraft. Scenario results in Near Midair Collision (NMAC) with aircraft if TIS is useful.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Loss of target on other aircraft display. Loss of target on ground display. Aircraft on collision course.	Pilot/flight crew initially loses situational awareness and is not aware of collision potential. Pilot/aircrew unaware of other aircraft. Other aircraft identified via radar or other sources, TIS. ATCT does communicate warning. Pilot/flight crew does regain situational awareness. See and avoid successful.	Airport surface, Taxi, Takeoff, Landing.	Near Midair Collision (NMAC) of aircraft and Fatal injury.	2C	50 Design ADS-B system architecture to ensure failure isolation of hardware. 48b Design ADS-B system architecture to ensure that hardware, firmware and software fails safe. 27 Design the system to assure that dual independent component failure, dual human errors, or a combination of a component failure and a human error cannot cause a catastrophic event. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 10N Require all aircraft that can become hazards to navigation be equipped with ADS-B transmitters, or other appropriate automated means of identification. 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 23N Design system to minimize the potential of loss of targets. 19N Design TIS to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
602	ISD4.01.2	Loss of ability of own aircraft to be seen by Class A and Class C users due to ADS-B malfunction on own aircraft. Scenario results in Near Midair Collision (NMAC) with vehicle if TIS is useful.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Loss of target on other aircraft display. Loss of target on ground display. Aircraft or vehicle on collision course.	Pilot/flight crew and ground vehicle driver initially loses situational awareness and is not aware of collision potential. Pilot/aircrew unaware of ground vehicle. Ground vehicle identified via radar or other sources TIS. ATCT does communicate warning. Pilot/flight crew does regain situational awareness. See and avoid successful.	Airport surface, Taxi, Takeoff, Landing.	Near Midair Collision (NMAC) of subject aircraft with vehicle and Fatal injury.	2C	50 Design ADS-B system architecture to ensure failure isolation of hardware. 48b Design ADS-B system architecture to ensure that hardware, firmware and software fails safe. 27 Design the system to assure that dual independent component failure, dual human errors, or a combination of a component failure and a human error cannot cause a catastrophic event. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 10N Require all aircraft that can become hazards to navigation be equipped with ADS-B transmitters, or other appropriate automated means of identification. 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 23N Design system to minimize the potential of loss of targets. 19N Design TIS to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
605	ISD4.01.5	Loss of ability of own aircraft to be seen by Class A and Class C users due to ADS-B malfunction on own aircraft. Scenario results in Near Midair Collision (NMAC) with aircraft if TIS is useful.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Loss of target on other aircraft display. Loss of target on ground display. Aircraft on collision course.	Pilot/flight crew initially loses situational awareness and is not aware of collision potential. Pilot/aircrew unaware of other aircraft. Other aircraft identified via radar or other sources, TIS. ATCT does communicate warning. Pilot/flight crew does regain situational awareness. See and avoid successful.	Airport surface, Taxi, Takeoff, Landing.	Near Midair Collision (NMAC) of aircraft and Fatal injury.	2C	50 Design ADS-B system architecture to ensure failure isolation of hardware. 48b Design ADS-B system architecture to ensure that hardware, firmware and software fails safe. 27 Design the system to assure that dual independent component failure, dual human errors, or a combination of a component failure and a human error cannot cause a catastrophic event. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 10N Require all aircraft that can become hazards to navigation be equipped with ADS-B transmitters, or other appropriate automated means of identification. 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 23N Design system to minimize the potential of loss of targets. 19N Design TIS to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
610	ISE1.01.4	Near Midair Collision (NMAC) occurs due to degraded surveillance due to ADS-B malfunction on single aircraft	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Loss of target on ground display. Malfunction within sensor fusion system due to the above contributors. Aircraft on collision course.	Pilot/flight crew initially loses situational awareness and is not aware of collision potential. Pilot/aircrew unaware of other aircraft. Other aircraft identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew does regain situational awareness. See and avoid successful.	En route, Terminal	Near Midair Collision (NMAC) of aircraft w/ Fatal injury.	2C	24N Design system to minimize the potential of malfunction within sensor fusion system or interface. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. . 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
614	ISE1.01.8	Near Midair Collision (NMAC) occurs due to degraded surveillance due to ADS-B malfunction on many aircraft	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Loss of target on ground display. Malfunction within sensor fusion system due to the above contributors. Aircraft on collision course.	Pilot/flight crew initially loses situational awareness and is not aware of collision potential. Pilot/aircrew unaware of other aircraft. Other aircraft identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew does regain situational awareness. See and avoid successful.	En route, Terminal	Near Midair Collision (NMAC) of aircraft w/ Fatal injury.	2C	24N Design system to minimize the potential of malfunction within sensor fusion system or interface. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
619	ISF1.01.4	Near Midair Collision (NMAC) occurs during parallel runway operations due to ADS-B malfunction. TCAS – I or II or TIS, is helpful.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course or close proximity. Malfunction within sensor fusion system due to the above contributors. TCAS – I or II or TIS, not helpful.	Pilot/flight crew initially loses situational awareness and is not aware of collision potential. Pilot/aircrew unaware of other aircraft. ATCT does communicate warning in time. Pilot/flight crew does regain situational awareness in time. See and avoid successful.	Approach	Near Midair Collision (NMAC) w/ Fatal injury.	2C	24N Design system to minimize the potential of malfunction within sensor fusion system or interface. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 19N Design TIS to integrate with ADS-B and provide redundant alert against collision risk. 19Na Design TCAS-I to integrate with ADS-B and provide redundant alert against collision risk. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
624	ISF1.01.9	Near Midair Collision (NMAC) occurs during surface operations due to ADS-B malfunction. TCAS – I or II or TIS, is helpful.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft/vehicle on collision course or close proximity. Malfunction within sensor fusion system due to the above contributors. TCAS – I or II or TIS, not helpful.	Pilot/flight crew initially loses situational awareness and is not aware of collision potential. Pilot/aircrew unaware of other aircraft/vehicle. ATCT does communicate warning in time. Pilot/flight crew does regain situational awareness in time. See and avoid successful.	Surface	Near Midair Collision (NMAC) w/ Fatal injury.	2C	24N Design system to minimize the potential of malfunction within sensor fusion system or interface. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 7N Require all ground vehicles that can become hazards to ground navigation be equipped with ADS-B transmitters, or other appropriate means of identification. 8N Require alternate means of detecting ground vehicles, i.e. ASDE-X. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 19N Design TIS to integrate with ADS-B and provide redundant alert against collision risk. 19Na Design TCAS-I to integrate with ADS-B and provide redundant alert against collision risk. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
627	ISG1.01.2	Loss of private user flight following surveillance due to ADS-B malfunction results in delayed rescue and recovery after accident. ADS-B fails as a result of the accident.	ADS-B fails as a result of the accident due to: LTA design/survivability. Accident occurs in remote area. Loss of communication occurs.	Delay in rescue occurs due to loss of flight following surveillance.	Emergency, Accident	Fatality	2C	25N Design system to minimize the potential of loss of flight following surveillance. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
630	ISH1.01.2	Loss of separation assurance due to ADS-B malfunction results in Near Midair Collision (NMAC). TCAS – I or MFD or TIS malfunction contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-I or TIS or MFD malfunction due to similar malfunctions indicated above. Aircraft progress towards Near Midair Collision (NMAC).	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC) w/ fatal injury.	2C	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 19N Design TIS to integrate with ADS-B and provide redundant alert against collision risk. 19Na Design TCAS-I to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
633	ISH1.01.5	Erroneous sequencing as a result of ADS-B malfunction results in Near Midair Collision (NMAC). TCAS - I or MFD or TIS malfunction contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-I or TIS or MFD malfunction due to similar malfunctions indicated above. Aircraft on collision course. Loss of separation occurs.	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC) w/ Fatal injury.	2C	22Nb Design system to minimize the potential of erroneous sequencing of aircraft. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 19N Design TIS to integrate with ADS-B and provide redundant alert against collision risk. 19Na Design TCAS-I to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
636	ISH1.01.8	Loss of separation assurance due to ADS-B malfunction results in Near Midair Collision (NMAC). TCAS – I or MFD or TIS conflicting information contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-I or TIS or MFD malfunction due to similar malfunctions indicated above. Aircraft on collision course. Loss of separation occurs.	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC) w/ Fatal injury.	2C	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 19N Design TIS to integrate with ADS-B and provide redundant alert against collision risk. 19Na Design TCAS-I to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
639	ISH2.01.2	Loss of separation assurance due to ADS-B malfunction results in Near Midair Collision (NMAC). TCAS – I or MFD malfunction contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-I or MFD malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs. TCAS – I or MFD malfunction contributes to Near Midair Collision (NMAC).	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC) w/ Fatal injury.	2C	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 19Na Design TCAS-I to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
642	ISH2.01.5	Erroneous sequencing as a result of ADS-B malfunction results in Near Midair Collision (NMAC). TCAS - I or MFD malfunction contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-I or MFD malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs. TCAS - I or MFD malfunction contributes to Near Midair Collision (NMAC).	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC) w/ Fatal injury.	2C	shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 19Na Design TCAS-I to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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Automatic Dependent Surveillance Broadcast (ADS-B)

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645	ISH2.01.8	Loss of separation assurance due to ADS-B malfunction results in Near Midair Collision (NMAC). TCAS – I or MFD conflicting information contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-I or MFD malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs. TCAS-I or MFD conflicting information contributes to Near Midair Collision (NMAC).	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC) w/ Fatal injury.	2C	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 20Nb Design MFD to integrate with ADS-B, provides redundancy, and minimizes conflicting information communicated in cockpit. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 9Na Design TCAS-I to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
648	ISH3.01.2	Loss of separation assurance due to ADS-B malfunction results in Near Midair Collision (NMAC). TCAS – II or MFD or TIS malfunction contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-II or MFD malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs. TCAS –II or MFD malfunction contributes to Near Midair Collision (NMAC).	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC) w/ Fatal injury.	2C	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 21Na Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failure of, or error in, recommended vertical escape maneuver indication. 22Na Design system to minimize the potential for failure of, or error in, recommended vertical escape maneuver indication. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
651	ISH3.01.5	Erroneous sequencing as a result of ADS-B malfunction results in Near Midair Collision (NMAC). TCAS - II or MFD or TIS malfunction contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-II or MFD malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs. TCAS - II or MFD malfunction contributes to Near Midair Collision (NMAC).	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC) w/ Fatal injury.	2C	22Nb Design system to minimize the potential of erroneous sequencing of aircraft. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 21Na Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failure of, or error in, recommended vertical escape maneuver indication. 22Na Design system to minimize the potential for failure of, or error in, recommended vertical escape maneuver indication. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
654	ISH3.01.8	Loss of separation assurance due to ADS-B malfunction results in Near Midair Collision (NMAC). TCAS – II or MFD or TIS conflicting information contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-II or MFD or TIS malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs. TCAS-II or MFD or TIS conflicting information contributes to Near Midair Collision (NMAC).	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC) w/ Fatal injury.	2C	27N Design MFD, TCAS, and TIS to integrate with ADS-B, provide redundancy, and minimize conflicting information communicated in cockpit. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 21Na Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failure of, or error in, recommended vertical escape maneuver indication. 22Na Design system to minimize the potential for failure of, or error in, recommended vertical escape maneuver indication. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
657	ISH4.01.2	Loss of separation assurance due to ADS-B malfunction results in Near Midair Collision (NMAC). TCAS – II or MFD malfunction contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-II or MFD malfunction due to the above contributors. TCAS-II or MFD malfunction contributes to Near Midair Collision (NMAC). Aircraft on collision course. Loss of separation occurs.	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC) w/ Fatal injury.	2C	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
660	ISH4.01.5	Erroneous sequencing as a result of ADS-B malfunction results in Near Midair Collision (NMAC). TCAS - II or MFD malfunction contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-II or MFD malfunction due to the above contributors. TCAS - II or MFD malfunction contributes to Near Midair Collision (NMAC). Aircraft on collision course. Loss of separation occurs.	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC) w/ Fatal injury.	2C	22Nb Design system to minimize the potential of erroneous sequencing of aircraft. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
663	ISH4.01.8	Loss of separation assurance due to ADS-B malfunction results in Near Midair Collision (NMAC). TCAS – II or MFD conflicting information contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-II or MFD malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs. TCAS-II or MFD conflicting information contributes to Near Midair Collision (NMAC).	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC) w/ Fatal injury.	2C	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
666	ISH5.01.2	Loss of separation assurance due to ADS-B malfunction results in Near Midair Collision (NMAC). TCAS – I or MFD or TIS malfunction contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-I or MFD or TIS malfunction due to the above contributors. TCAS-I or MFD or TIS malfunction contributes to Near Midair Collision (NMAC). Aircraft on collision course. Loss of separation occurs.	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC) w/ Fatal injury.	2C	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 19N Design TIS to integrate with ADS-B and provide redundant alert against collision risk. 19Na Design TCAS-I to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
669	ISH5.01.5	Erroneous sequencing as a result of ADS-B malfunction results in Near Midair Collision (NMAC). TCAS - I or MFD or TIS malfunction contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-I or MFD or TIS malfunction due to the above contributors. TCAS - I or MFD or TIS malfunction contributes to Near Midair Collision (NMAC). Aircraft on collision course. Loss of separation occurs.	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC) w/ Fatal injury.	2C	22Nb Design system to minimize the potential of erroneous sequencing of aircraft. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 19N Design TIS to integrate with ADS-B and provide redundant alert against collision risk. 19Na Design TCAS-I to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
672	ISH5.01.8	Loss of separation assurance due to ADS-B malfunction results in Near Midair Collision (NMAC). TCAS – I or MFD or TIS conflicting information contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-I or MFD or TIS malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs. TCAS-I or MFD or TIS conflicting information contributes to Near Midair Collision (NMAC).	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC) w/ Fatal injury.	2C	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 19N Design TIS to integrate with ADS-B and provide redundant alert against collision risk. 19Na Design TCAS-I to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
676	ISH5.01.12	Excessive display congestion as a result of FIS integration results in loss of critical information and increased Near Midair Collision (NMAC) risk. TCAS – I or MFD or TIS do not contribute to risk minimization.	Excessive display congestion as a result of FIS integration due to: LTA design LTA Human Factors consideration. Loss of critical information occurs due to masking. Aircraft on collision course. Loss of separation occurs. Collision alert does occur in time.	Pilot/flight crew regains situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC) w/ Fatal injury.	2C	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 19N Design TIS to integrate with ADS-B and provide redundant alert against collision risk. 19Na Design TCAS-I to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 26N Design system to minimize the potential of excessive display congestion as a result of FIS integration with ADS-B and cockpit displays.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
678	ISH5.01.14	Excessive display congestion as a result of FIS integration results in loss of situational awareness and increased Near Midair Collision (NMAC) risk. TCAS – I or MFD or TIS do not contribute to risk minimization.	Excessive display congestion as a result of FIS integration due to: LTA design LTA Human Factors consideration. Pilot/flight crew initially loses situational awareness due to masking. Aircraft on collision course. Loss of separation occurs. Collision alert does not occur in time.	Pilot/flight crew does not regain situational awareness in time. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC) w/ Fatal injury.	2C	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 19N Design TIS to integrate with ADS-B and provide redundant alert against collision risk. 19Na Design TCAS-I to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 26N Design system to minimize the potential of excessive display congestion as a result of FIS integration with ADS-B and cockpit displays.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
681	ISH6.01.2	Loss of separation assurance due to ADS-B malfunction results in Near Midair Collision (NMAC). TCAS – I or MFD malfunction contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-I or MFD malfunction due to the above contributors. TCAS-I or MFD malfunction contributes to Near Midair Collision (NMAC). Aircraft on collision course. Loss of separation occurs.	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC) w/ Fatal injury.	2C	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 19Na Design TCAS-I to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
684	ISH6.01.5	Erroneous sequencing as a result of ADS-B malfunction results in Near Midair Collision (NMAC). TCAS - I or MFD malfunction contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-I or MFD malfunction due to the above contributors. TCAS - I or MFD malfunction contributes to Near Midair Collision (NMAC). Aircraft on collision course. Loss of separation occurs.	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC) w/ Fatal injury.	2C	22Nb Design system to minimize the potential of erroneous sequencing of aircraft. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 19Na Design TCAS-I to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
687	ISH6.01.8	Loss of separation assurance due to ADS-B malfunction results in Near Midair Collision (NMAC). TCAS – I or MFD conflicting information contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-I or MFD malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs. TCAS-I or MFD conflicting information contributes to Near Midair Collision (NMAC).	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC) w/ Fatal injury.	2C	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 19Na Design TCAS-I to integrate with ADS-B and provide redundant alert against collision risk. 27N Design MFD, TCAS, and TIS to integrate with ADS-B, provide redundancy, and minimize conflicting information communicated in cockpit. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
691	ISH6.01.12	Excessive display congestion as a result of FIS integration results in loss of critical information and increased Near Midair Collision (NMAC) risk. TCAS – I or MFD do not contribute to risk minimization.	Excessive display congestion as a result of FIS integration due to: LTA design LTA Human Factors consideration. Loss of critical information occurs due to masking. Aircraft on collision course. Loss of separation occurs. Collision alert does occur in time.	Pilot/flight crew regains situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC) w/ Fatal injury.	2C	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 19Na Design TCAS-I to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 26N Design system to minimize the potential of excessive display congestion as a result of FIS integration with ADS-B and cockpit displays.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
693	ISH6.01.14	Excessive display congestion as a result of FIS integration results in loss of situational awareness and increased Near Midair Collision (NMAC) risk. TCAS – I or MFD do not contribute to risk minimization.	Excessive display congestion as a result of FIS integration due to: LTA design LTA Human Factors consideration. Pilot/flight crew initially loses situational awareness due to masking. Aircraft on collision course. Loss of separation occurs. Collision alert does not occur in time.	Pilot/flight crew does not regain situational awareness in time. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC) w/ Fatal injury.	2C	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 19Na Design TCAS-I to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 26N Design system to minimize the potential of excessive display congestion as a result of FIS integration with ADS-B and cockpit displays.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
696	ISH7.01.12	Loss of separation assurance due to ADS-B malfunction results in Near Midair Collision (NMAC). TCAS – II or MFD or TIS malfunction contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-II or MFD or TIS malfunction due to the above contributors. TCAS-II or MFD or TIS malfunction contributes to Near Midair Collision (NMAC). Aircraft on collision course. Loss of separation occurs.	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC) w/ Fatal injury.	2C	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 21Na Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failure of, or error in, recommended vertical escape maneuver indication. 22Na Design system to minimize the potential for failure of, or error in, recommended vertical escape maneuver indication. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
699	ISH7.01.5	Erroneous sequencing as a result of ADS-B malfunction results in collision. TCAS - II or MFD or TIS malfunction contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-II or MFD or TIS malfunction due to the above contributors. TCAS-II or MFD or TIS malfunction contributes to Near Midair Collision (NMAC). Aircraft on collision course. Loss of separation occurs.	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC) w/ Fatal injury.	2C	22Nb Design system to minimize the potential of erroneous sequencing of aircraft. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 21Na Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failure of, or error in, recommended vertical escape maneuver indication. 22Na Design system to minimize the potential for failure of, or error in, recommended vertical escape maneuver indication. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
706	ISH7.01.12	Excessive display congestion as a result of FIS integration results in loss of critical information and increased Near Midair Collision (NMAC) risk. TCAS – II or MFD or TIS do not contribute to risk minimization.	Excessive display congestion as a result of FIS integration due to: LTA design LTA Human Factors consideration. Loss of critical information occurs due to masking. Aircraft on collision course. Loss of separation occurs. Collision alert does occur in time.	Pilot/flight crew regains situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC) w/ Fatal injury.	2C	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 21Na Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failure of, or error in, recommended vertical escape maneuver indication. 22Na Design system to minimize the potential for failure of, or error in, recommended vertical escape maneuver indication. 26N Design system to minimize the potential of excessive display congestion as a result of FIS integration with ADS-B and cockpit displays. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
708	ISH7.01.14	Excessive display congestion as a result of FIS integration results in loss of situational awareness and increased Near Midair Collision (NMAC) risk. TCAS – II or MFD or TIS do not contribute to risk minimization.	Excessive display congestion as a result of FIS integration due to: LTA design LTA Human Factors consideration. Pilot/flight crew initially loses situational awareness due to masking. Aircraft on collision course. Loss of separation occurs. Collision alert does not occur in time.	Pilot/flight crew does not regain situational awareness in time. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC) w/ Fatal injury.	2C	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 21Na Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failure of, or error in, recommended vertical escape maneuver indication. 22Na Design system to minimize the potential for failure of, or error in, recommended vertical escape maneuver indication. 26N Design system to minimize the potential of excessive display congestion as a result of FIS integration with ADS-B and cockpit displays. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
711	ISH8.01.2	Loss of separation assurance due to ADS-B malfunction results in Near Midair Collision (NMAC). TCAS – II or MFD malfunction contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-II or MFD malfunction due to the above contributors. TCAS-II or MFD malfunction contributes to Near Midair Collision (NMAC). Aircraft on collision course. Loss of separation occurs.	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC) w/ Fatal injury.	2C	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
717	ISH8.01.8	Loss of separation assurance due to ADS-B malfunction results in Near Midair Collision (NMAC). TCAS – II or MFD conflicting information contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-II or MFD malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs. TCAS-II or MFD conflicting information contributes to Near Midair Collision (NMAC).	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC).	2C	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
721	ISH8.01.12	Excessive display congestion as a result of FIS integration results in loss of critical information and increased Near Midair Collision (NMAC) risk. TCAS – II or MFD do not contribute to risk minimization.	Excessive display congestion as a result of FIS integration due to: LTA design LTA Human Factors consideration. Loss of critical information occurs due to masking. Aircraft on collision course. Loss of separation occurs. Collision alert does occur in time.	Pilot/flight crew regains situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC) w/ Fatal injury.	2C	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 26N Design system to minimize the potential of excessive display congestion as a result of FIS integration with ADS-B and cockpit displays. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
722	ISH8.01.13	Excessive display congestion as a result of FIS integration results in loss of situational awareness and increased Near Midair Collision (NMAC) risk. TCAS – II or MFD do not contribute to risk minimization.	Excessive display congestion as a result of FIS integration due to: LTA design LTA Human Factors consideration. Pilot/flight crew initially loses situational awareness due to masking. Aircraft on collision course. Loss of separation occurs. Collision alert does not occur in time.	Pilot/flight crew does not regain situational awareness in time. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC) w/ fatal injury w/ fatal injury.	2C	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 26N Design system to minimize the potential of excessive display congestion as a result of FIS integration with ADS-B and cockpit displays. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
726	ISI1.01.2	Loss of separation assurance due to ADS-B malfunction results in Near Midair Collision (NMAC). TCAS –I or TIS or MFD malfunction contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-I or TIS or MFD malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs. TCAS-II or MFD conflicting information contributes to Near Midair Collision (NMAC).	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC) w/ fatal injury.	2C	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 27N Design MFD, TCAS, and TIS to integrate with ADS-B, provide redundancy, and minimize conflicting information communicated in cockpit. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
729	ISI1.01.5	Erroneous flight path calculation as a result of ADS-B malfunction results in Near Midair Collision (NMAC). TCAS -I or TIS or MFD malfunction contributes to Near Midair Collision (NMAC).	Erroneous flight path calculation as a result of ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course. Loss of separation occurs TCAS -I or TIS or MFD malfunction contributes to Near Midair Collision (NMAC).	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC) w/ fatal injury.	2C	22Nc Design system to minimize the potential of erroneous flight path. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
731	ISI1.01.7	Erroneous flight path calculation as a result of ADS-B malfunction results in loss of alert and Near Midair Collision (NMAC). TCAS -I or TIS or MFD malfunction contributes to Near Midair Collision (NMAC).	Erroneous flight path calculation as a result of ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course. Loss of separation occurs. Loss of alert occurs. TCAS -I or TIS or MFD malfunction contributes to Near Midair Collision (NMAC).	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. Pilot/flight crew regain situational awareness in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC) w/ fatal injury.	2C	22Nc Design system to minimize the potential of erroneous flight path. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
735	ISI2.01.2	Loss of separation assurance due to ADS-B malfunction results in Near Midair Collision (NMAC). TCAS –I or MFD malfunction contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-I or MFD malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs. TCAS-I or MFD conflicting information contributes to Near Midair Collision (NMAC).	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC) w/ fatal injury.	2C	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 27N Design MFD, TCAS, and TIS to integrate with ADS-B, provide redundancy, and minimize conflicting information communicated in cockpit. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
737	ISI2.01.4	Erroneous flight path calculation as a result of ADS-B malfunction results in Near Midair Collision (NMAC). TCAS -I or MFD malfunction contributes to Near Midair Collision (NMAC).	Erroneous flight path calculation as a result of ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course. Loss of separation occurs TCAS -I or MFD malfunction contributes to Near Midair Collision (NMAC).	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC) w/ fatal injury.	2C	22Nc Design system to minimize the potential of erroneous flight path. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 27N Design MFD, TCAS, and TIS to integrate with ADS-B, provide redundancy, and minimize conflicting information communicated in cockpit. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
741	ISI3.01.2	Loss of separation assurance due to ADS-B malfunction results in Near Midair Collision (NMAC). TCAS –II or TIS or MFD malfunction contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS -II or TIS or MFD malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs. TCAS -II or TIS or MFD conflicting information contributes to Near Midair Collision (NMAC).	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC) w/ fatal injury.	2C	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 27N Design MFD, TCAS, and TIS to integrate with ADS-B, provide redundancy, and minimize conflicting information communicated in cockpit. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
744	ISI3.01.5	Erroneous flight path calculation as a result of ADS-B malfunction results in Near Midair Collision (NMAC). TCAS -II or TIS or MFD malfunction contributes to Near Midair Collision (NMAC).	Erroneous flight path calculation as a result of ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course. Loss of separation occurs TCAS -II or TIS or MFD malfunction contributes to Near Midair Collision (NMAC).	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC) w/ fatal injury.	2C	22Nc Design system to minimize the potential of erroneous flight path. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 27N Design MFD, TCAS, and TIS to integrate with ADS-B, provide redundancy, and minimize conflicting information communicated in cockpit. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
747	ISI4.01.2	Loss of separation assurance due to ADS-B malfunction results in Near Midair Collision (NMAC). TCAS –II or MFD malfunction contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS -II or MFD malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs. TCAS -II or MFD conflicting information contributes to Near Midair Collision (NMAC).	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC) w/ fatal injury.	2C	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 27N Design MFD, TCAS, and TIS to integrate with ADS-B, provide redundancy, and minimize conflicting information communicated in cockpit. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
750	ISI4.01.5	Erroneous flight path calculation as a result of ADS-B malfunction results in Near Midair Collision (NMAC). TCAS -II or MFD malfunction contributes to Near Midair Collision (NMAC).	Erroneous flight path calculation as a result of ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course. Loss of separation occurs TCAS -II or MFD malfunction contributes to Near Midair Collision (NMAC).	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC) w/ fatal injury.	2C	22Nc Design system to minimize the potential of erroneous flight path. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
752	ISJ1.01.1	Loss of separation assurance due to ADS-B malfunction results in Near Midair Collision (NMAC). TCAS –I or TIS or MFD malfunction contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS -I or TIS or MFD malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs. TCAS -I or TIS or MFD conflicting information contributes to Near Midair Collision (NMAC).	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC) w/ fatal injury.	2C	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 27N Design MFD, TCAS, and TIS to integrate with ADS-B, provide redundancy, and minimize conflicting information communicated in cockpit. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
755	ISJ1.01.4	Erroneous flight path calculation as a result of ADS-B malfunction results in Near Midair Collision (NMAC). TCAS -I or TIS or MFD malfunction contributes to Near Midair Collision (NMAC).	Erroneous flight path calculation as a result of ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course. Loss of separation occurs TCAS -I or TIS or MFD malfunction contributes to Near Midair Collision (NMAC).	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC) w/ fatal injury.	2C	22Nc Design system to minimize the potential of erroneous flight path. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 27N Design MFD, TCAS, and TIS to integrate with ADS-B, provide redundancy, and minimize conflicting information communicated in cockpit. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
765	ISJ2.01.2	Loss of separation assurance due to ADS-B malfunction results in Near Midair Collision (NMAC). TCAS –I or MFD malfunction contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS -I or MFD malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs. TCAS -I or TIS or MFD conflicting information contributes to Near Midair Collision (NMAC).	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC) w/ fatal injury.	2C	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 20Nb Design MFD to integrate with ADS-B, provides redundancy, and minimizes conflictive information communicated in cockpit. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 28Nc Design MFD or CDTI, TAWS, and TCAS to integrate with ADS-B, provide redundancy, and minimize conflictive information communicated in cockpit. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
768	ISJ2.01.5	Erroneous flight path calculation as a result of ADS-B malfunction results in Near Midair Collision (NMAC). TCAS -I or MFD malfunction contributes to Near Midair Collision (NMAC).	Erroneous flight path calculation as a result of ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course. Loss of separation occurs TCAS -I or MFD malfunction contributes to Near Midair Collision (NMAC).	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC) w/ fatal injury.	2C	22Nc Design system to minimize the potential of erroneous flight path. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 20Nb Design MFD to integrate with ADS-B, provides redundancy, and minimizes conflictive information communicated in cockpit. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 28Nc Design MFD or CDTI, TAWS, and TCAS to integrate with ADS-B, provide redundancy, and minimize conflictive information communicated in cockpit. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
777	ISJ3.01.2	Loss of separation assurance due to ADS-B malfunction results in Near Midair Collision (NMAC). TCAS –II or TIS or MFD malfunction contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-II or TIS or MFD malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs. TCAS-II or TIS or MFD conflicting information contributes to Near Midair Collision (NMAC).	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC) w/ fatal injury.	2C	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 27N Design MFD, TCAS, and TIS to integrate with ADS-B, provide redundancy, and minimize conflicting information communicated in cockpit. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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780	ISJ3.01.5	Erroneous flight path calculation as a result of ADS-B malfunction results in Near Midair Collision (NMAC). TCAS -II or TIS or MFD malfunction contributes to Near Midair Collision (NMAC).	Erroneous flight path calculation as a result of ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course. Loss of separation occurs TCAS-II or TIS or MFD malfunction contributes to Near Midair Collision (NMAC).	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC) w/ fatal injury.	2C	22Nc Design system to minimize the potential of erroneous flight path. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 27N Design MFD, TCAS, and TIS to integrate with ADS-B, provide redundancy, and minimize conflicting information communicated in cockpit. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
789	ISJ4.01.2	Loss of separation assurance due to ADS-B malfunction results in Near Midair Collision (NMAC). TCAS –II or MFD malfunction contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-II or MFD malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs. TCAS-II or MFD conflicting information contributes to Near Midair Collision (NMAC).	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC) w/ fatal injury.	2C	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 20Nb Design MFD to integrate with ADS-B, provides redundancy, and minimizes conflictive information communicated in cockpit. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 28Nc Design MFD or CDTI, TAWS, and TCAS to integrate with ADS-B, provide redundancy, and minimize conflictive information communicated in cockpit. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
792	ISJ4.01.5	Erroneous flight path calculation as a result of ADS-B malfunction results in Near Midair Collision (NMAC). TCAS -II or MFD malfunction contributes to Near Midair Collision (NMAC).	Erroneous flight path calculation as a result of ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course. Loss of separation occurs TCAS-II or MFD malfunction contributes to Near Midair Collision (NMAC).	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC) w/ fatal injury.	2C	22Nc Design system to minimize the potential of erroneous flight path. 22Nc Design system to minimize the potential of erroneous flight path. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 20Nb Design MFD to integrate with ADS-B, provides redundancy, and minimizes conflictive information communicated in cockpit. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
800	ILIS.01.1	Unidentified aircraft enters ADS-B airspace and poses Near Midair Collision (NMAC). risk.	Unidentified aircraft enters ADS-B airspace. Aircraft on collision course.	Pilot/flight crew loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC) w/ fatal injury.	2C	7 Provide for appropriate ATC/Aircrew contingency procedures. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 44N Design and integrate ADS-B to enable (TBD) aircraft intruder detection within NAS.
829	ISK.03.1	ADS-B malfunction propagates to FMS. Event occurs during critical time, CAT IIIa, IIIb, or 3C approaches.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Loss of FMS due to propagation effects. Possible loss of WAAS and LAAS.	Pilot/flight crew unable to respond in time.	Approach	Collision	2C	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 50 Design ADS-B system architecture to ensure failure isolation of hardware, firmware, and software. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
849	**ISK.12**	Loss of L1 frequency results in loss of: ADS-B, GPS, LAAS and WAAS. Event occurs during non-critical time.	Loss of L1 frequency due to: Electromagnetic environmental effects Sun spots Solar flares Loss of coverage Jamming.	Loss is detected.	Takeoff, Approach Landing, Surface, Flight, Emergency.	Loss of ADS-B, GPS, LAAS and WAAS within local area.	2C	58 Consider alternative frequency spectrum as backup. 57 Select frequency spectrum to minimize adverse effects of weather on ADS-B transmissions. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 22Nd Design system to minimize the potential for interface malfunction between FMS and ADS-B 22Ne Design system to minimize the potential for degraded FMS input to ADS-B. 31N Design WAAS and LAAS to integrate with ADS-B, provide redundancy, and minimize potential for degraded FMS input to ADS-B. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 50 Design ADS-B system architecture to ensure failure isolation of hardware, firmware, and software. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
850	ISK.12.1	Loss of L1 frequency results in loss of: ADS-B, GPS, LAAS and WAAS. Event occurs during critical time, CAT IIIa, IIIb, or 3C approaches.	Loss of L1 frequency due to: Electromagnetic environmental effects Sun spots Solar flares Loss of coverage Jamming.	Pilot/flight crew unable to respond in time.	Takeoff, Approach Landing, Surface, Flight, Emergency.	Collision	2C	58 Consider alternative frequency spectrum as backup. 57 Select frequency spectrum to minimize adverse effects of weather on ADS-B transmissions. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 22Nd Design system to minimize the potential for interface malfunction between FMS and ADS-B 22Ne Design system to minimize the potential for degraded FMS input to ADS-B. 31N Design WAAS and LAAS to integrate with ADS-B, provide redundancy, and minimize potential for degraded FMS input to ADS-B. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 50 Design ADS-B system architecture to ensure failure isolation of hardware, firmware, and software. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
851	**ISL.01**	Unidentified aircraft intruder enters ADS-B airspace and poses collision risk.	Unidentified aircraft intruder enters ADS-B airspace. Aircraft on collision course.	Pilot/flight crew loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	2C	3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 6N Require all flying objects that can become hazards to navigation be equipped with ADS-B transmitters, or other appropriate means of identification. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 16N Define criteria for determining threshold values for ADS-B coverage area to assure controller/pilot adequate situational awareness. 22N Design system to minimize the potential for failure of Conflict Avoidance function. 23N Design system to minimize the potential of loss of targets.
852	ISL.01.1	Unidentified aircraft enters ADS-B airspace and poses collision risk.	Unidentified aircraft enters ADS-B airspace. Aircraft on collision course.	Pilot/flight crew loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	2C	3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 6N Require all flying objects that can become hazards to navigation be equipped with ADS-B transmitters, or other appropriate means of identification. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 16N Define criteria for determining threshold values for ADS-B coverage area to assure controller/pilot adequate situational awareness. 22N Design system to minimize the potential for failure of Conflict Avoidance function. 23N Design system to minimize the potential of loss of targets.

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Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
854	**ISL.03**	Mixed-equipage airspace presents confusion and loss of situational awareness to controllers.	Mixed-equipage airspace. Aircraft on collision course. Confusion and loss of situational awareness of controller due to mixed-equipage inappropriate use as a result of: LTA design LTA analysis LTA risk assessment LTA risk management Oversight and omissions.	Pilot/flight crew loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	2C	32N Conduct analysis, studies, simulations and/or flight-tests to develop engineering requirements and/or procedures to minimize the risks of inappropriate mixed-equipage use. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 6N Require all flying objects that can become hazards to navigation be equipped with ADS-B transmitters, or other appropriate means of identification. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 16N Define criteria for determining threshold values for ADS-B coverage area to assure controller/pilot adequate situational awareness. 22N Design system to minimize the potential for failure of Conflict Avoidance function. 23N Design system to minimize the potential of loss of targets.

Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
855	ISL.03.1	Mixed-equipage airspace presents confusion and loss of situational awareness to pilots/aircrew.	Mixed-equipage airspace. Aircraft on collision course. Confusion and loss of situational awareness pilot/aircrew due to: LTA design LTA analysis LTA risk assessment LTA risk management Oversight and omissions.	Pilot/flight crew loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	2C	32N Conduct analysis, studies, simulations and/or flight-tests to develop engineering requirements and/or procedures to minimize the risks of inappropriate mixed-equipage use. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 6N Require all flying objects that can become hazards to navigation be equipped with ADS-B transmitters, or other appropriate means of identification. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 16N Define criteria for determining threshold values for ADS-B coverage area to assure controller/pilot adequate situational awareness. 22N Design system to minimize the potential for failure of Conflict Avoidance function. 23N Design system to minimize the potential of loss of targets.

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Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
856	**ISL.04**	LTA cross-checking of barometric altimetry with GPS fails to identify deviation in altitude, which results in increased collision risk.	LTA cross-checking of barometric altimetry due to: LTA design LTA procedure Human error. GPS fails to identify deviation in altitude due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course.	Pilot/flight crew loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	2C	41 Design system to detect and indicate erroneous barometric altitude rate errors before transmitting through ADS-B. 42 Provide independent means of validating Barometric altitude rate changes. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 6N Require all flying objects that can become hazards to navigation be equipped with ADS-B transmitters, or other appropriate means of identification. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 16N Define criteria for determining threshold values for ADS-B coverage area to assure controller/pilot adequate situational awareness. 22N Design system to minimize the potential for failure of Conflict Avoidance function. 23N Design system to minimize the potential of loss of targets.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
857	**ISL.05**	Unsuccessful conflict resolution between controllers and pilots results in increased collision risks.	Unsuccessful conflict resolution between controllers and pilots due to: LTA procedures Human error Miscommunication LTA design Loss of situational awareness. Aircraft on collision course.	Pilot/flight crew loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	2C	32Na Conduct analysis, studies, and simulations and/or flight-tests to develop engineering requirements and/or procedures to minimize the risks of unsuccessful conflict resolution between controllers and pilots. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 6N Require all flying objects that can become hazards to navigation be equipped with ADS-B transmitters, or other appropriate means of identification. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 16N Define criteria for determining threshold values for ADS-B coverage area to assure controller/pilot adequate situational awareness. 22N Design system to minimize the potential for failure of Conflict Avoidance function. 23N Design system to minimize the potential of loss of targets. 68 Develop appropriate training materials and training programs to ensure that all participants in a shared responsibility environment understand their role and safe operation procedures.
864	**ISL.11**	Communication delay as a result of LTA mixed equipage procedural integration results in increased collision risks.	Communication delay as a result of LTA mixed equipage procedural integration due to: LTA procedure LTA training Human error. Subject aircraft follows wrong target or takes wrong clearance. Aircraft on collision course.	Pilot/flight crew loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	2C	32N Conduct analysis, studies, simulations and/or flight-tests to develop engineering requirements and/or procedures to minimize the risks of inappropriate mixed-equipage use. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 68 Develop appropriate training materials and training programs to ensure that all participants in a shared responsibility environment understand their role and safe operation procedures.

Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
865	**ISL.12**	Conflicts between subsystems (ADS-B, TCAS, TAWS, TIS) state data results in inaccurate assumptions associated with separation and increased accident risks.	Conflicts between subsystems (ADS-B, TCAS, TAWS, TIS) state data due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Inaccurate assumptions associated with aircraft separation occur. Subject aircraft follows wrong target or takes wrong clearance. Aircraft on collision course.	Pilot/flight crew loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	2C	35N Design and integrate ADS-B system to eliminate conflicts between subsystems (ADS-B, TCAS, TAWS, TIS) state data. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness.

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Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
866	**ISL.13**	LTA integration of audible alerts issued by ADS-B, TCAS, TAWS, TIS, and results in confusion and increased collision risks.	LTA integration of audible alerts issued by ADS-B, TCAS, TAWS, TIS due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course.	Pilot/flight crew loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	2C	28Ne Design MFD or CDTI, TAWS, and TCAS to integrate with ADS-B, provide redundancy, maximize system alert capability, and integration of audible alerts. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness.
867	**ISL.14**	LTA integration of Airborne Conflict Management (ACM) results in increased collision risks.	LTA integration of Airborne Conflict Management (ACM) due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course.	Pilot/flight crew loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	2C	36N Design MFD or CDTI, TAWS, TCAS, and TIS to integrate with ADS-B airborne and ground systems, provide redundancy, and maximize integration of Airborne Conflict Management (ACM) in order to decrease collision risks. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness.

Automatic Dependent Surveillance Broadcast (ADS-B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
870	**ISL.16**	Time from when a hazardous situation develops to the time the pilot takes corrective action is insufficient	Time to safety alert is insufficient. Controller time from situation recognition to pilot notification is inadequate. Pilot response time is too long to prevent accident. Frequency congestion contributes to delay in communication.	Pilot/flight crew loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	2C	28Ne Design MFD or CDTI, TAWS, and TCAS to integrate with ADS-B, provide redundancy, maximize system alert capability, and integration of audible alerts. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness.
873	**ISL.19**	LTA integration of national and international separation standards increases collision risks associated with ADS-B use.	LTA integration of national and international separation standards due to: Management oversight Inadequate Risk Assessment Inadequate policy Political oversight LTA Standards Development. Aircraft on collision course.	Pilot/flight crew loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	2C	39N Assure appropriate development and integration of national and international separation standards associated with ADS-B and related subsystems. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 5N Avionics certification, installation, and approval process established for ADS-B. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 11N Require certification, installation, and approval process established for ADS-B ground system. 10N Require all aircraft that can become hazards to navigation be equipped with ADS-B transmitters, or other appropriate automated means of identification. 68 Develop appropriate training materials and training programs to ensure that all participants in a shared responsibility environment understand their role and safe operation procedures.

Automatic Dependent Surveillance Broadcast (ADS-B)

II.B.3 Major/Remote (3B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
4	AFXO-01.3	Near Collision of subject aircraft with fixed object due to failure to identify fixed object. Fixed object not equipped with ADS-B.	Fixed object not equipped with ADS-B. Aircraft on collision course.	Pilot/flight crew initially loses of situational awareness. Object not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Collision	3B	1 Develop ADS-B ATC/Aircrew procedures to accommodate transitional risks. 2d Require fixed objects to be equipped with appropriate lighting, i.e., “see and avoid”. 3 Aircrew “see and avoid” procedures. 1N Require all fixed objects that are evaluated as hazardous to be equipped with ADS-B transmitters. 2N Provide updated information on fixed objects in appropriate data sources. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude.
5	AFXO-01.4	Near Collision of subject aircraft with fixed object due to failure to identify fixed object. Fixed object not equipped with ADS-B.	Fixed object not equipped with ADS-B. Aircraft on collision course.	Pilot/flight crew initially loses of situational awareness. Object not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Collision	3B	1 Develop ADS-B ATC/Aircrew procedures to accommodate transitional risks. 2d Require fixed objects to be equipped with appropriate lighting, i.e., “see and avoid”. 3 Aircrew “see and avoid” procedures. 1N Require all fixed objects that are evaluated as hazardous to be equipped with ADS-B transmitters. 2N Provide updated information on fixed objects in appropriate data sources. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude.
6	AFXO-01.5	Near Collision of subject aircraft with fixed object due to failure to identify fixed object. Fixed object not equipped with ADS-B.	Fixed object not equipped with ADS-B. Aircraft on collision course.	Pilot/flight crew initially loses of situational awareness. Object not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Collision	3B	1 Develop ADS-B ATC/Aircrew procedures to accommodate transitional risks. 2d Require fixed objects to be equipped with appropriate lighting, i.e., “see and avoid”. 3 Aircrew “see and avoid” procedures. 1N Require all fixed objects that are evaluated as hazardous to be equipped with ADS-B transmitters. 2N Provide updated information on fixed objects in appropriate data sources. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude.

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Automatic Dependent Surveillance Broadcast (ADS-B)

11	AFXO-02.3	Near Collision of subject aircraft with fixed object due to failure to identify fixed object. Fixed object not equipped with ADS-B.	Failure of ADS-B on fixed object, due to: SW malfunction HW malfunction Inappropriate placement Electromagnetic environmental effects Inadvertent damage Vandalism LTA design. Aircraft on collision course.	Pilot/flight crew initially loses of situational awareness. Object not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Collision	3B	5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1. 7 Provide for appropriate ATC/Aircrew contingency procedures. 8 Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 2N Provide updated information on fixed objects in appropriate data sources. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 26 Design the system such that no single software anomaly, common software malfunctions or design feature shall result in a catastrophic event, (severity 1 or 2). 4N Design ADS-B external equipment for physical protection and security to minimize the potential for damage as a result of vandalism. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

12	AFXO-02.4	Near Collision of subject aircraft with fixed object due to failure to identify fixed object. Fixed object not equipped with ADS-B.	Failure of ADS-B on fixed object, due to: SW malfunction HW malfunction Inappropriate placement Electromagnetic environmental effects Inadvertent damage Vandalism LTA design. Aircraft on collision course.	Pilot/flight crew initially loses of situational awareness. Object identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Collision	3B	5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1. 7 Provide for appropriate ATC/Aircrew contingency procedures. 8 Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 2N Provide updated information on fixed objects in appropriate data sources. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 26 Design the system such that no single software anomaly, common software malfunctions or design feature shall result in a catastrophic event, (severity 1 or 2). 4N Design ADS-B external equipment for physical protection and security to minimize the potential for damage as a result of vandalism. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

13	AFXO-02.5	Near Collision of subject aircraft with fixed object due to failure to identify fixed object. Fixed object not equipped with ADS-B.	Failure of ADS-B on fixed object, due to: SW malfunction HW malfunction Inappropriate placement Electromagnetic environmental effects Inadvertent damage Vandalism LTA design. Aircraft on collision course.	Pilot/flight crew initially loses of situational awareness. Object identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Collision	3B	5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1. 7 Provide for appropriate ATC/Aircrew contingency procedures. 8 Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 2N Provide updated information on fixed objects in appropriate data sources. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 26 Design the system such that no single software anomaly, common software malfunctions or design feature shall result in a catastrophic event, (severity 1 or 2). 4N Design ADS-B external equipment for physical protection and security to minimize the potential for damage as a result of vandalism. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations

Automatic Dependent Surveillance Broadcast (ADS-B)

18	AFXO-03.3	Near Collision of subject aircraft with fixed object due to failure of ADS-B on aircraft.	Failure of ADS-B on aircraft due to: SW malfunction HW malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Failure of ADS-B on aircraft not detected. Aircraft on collision course.	Pilot/flight crew initially loses of situational awareness. Object not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Collision	3B	5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1. 7 Provide for appropriate ATC/Aircrew contingency procedures. 8 Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 2N Provide updated information on fixed objects in appropriate data sources. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 26 Design the system such that no single software anomaly, common software malfunctions or design feature shall result in a catastrophic event, (severity 1 or 2). 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 5N Avionics certification, installation, and approval process established for ADS-B.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

Automatic Dependent Surveillance Broadcast (ADS-B)

19	AFXO-03.4	Near Collision of subject aircraft with fixed object due to failure of ADS-B on aircraft.	Failure of ADS-B on aircraft due to: SW malfunction HW malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Failure of ADS-B on aircraft not detected. Aircraft on collision course.	Near Midair Collision (NMAC) of subject aircraft with fixed object as a result of successful recovery. Pilot/flight crew initially loses of situational awareness. Object not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Collision	3B	5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1. 7 Provide for appropriate ATC/Aircrew contingency procedures. 8 Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 2N Provide updated information on fixed objects in appropriate data sources. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 26 Design the system such that no single software anomaly, common software malfunctions or design feature shall result in a catastrophic event, (severity 1 or 2). 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 5N Avionics certification, installation, and approval process established for ADS-B.

20	AFXO-03.5	Near Collision of subject aircraft with fixed object due to failure of ADS-B on aircraft.	Failure of ADS-B on aircraft due to: SW malfunction HW malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Failure of ADS-B on aircraft not detected. Aircraft on collision course.	Near Midair Collision (NMAC) of subject aircraft with fixed object as a result of successful recovery. Pilot/flight crew initially loses of situational awareness. Object identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Collision	3B	5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1. 7 Provide for appropriate ATC/Aircrew contingency procedures. 8 Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 2N Provide updated information on fixed objects in appropriate data sources. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 26 Design the system such that no single software anomaly, common software malfunctions or design feature shall result in a catastrophic event, (severity 1 or 2). 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 5N Avionics certification, installation, and approval process established for ADS-B.
25	AFLO-01.3	Near Midair Collision (NMAC) of subject aircraft with flying object due to failure to identify flying object. Flying object not equipped with ADS-B.	Flying object in collision path. Flying object not equipped with ADS-B.	Pilot/flight crew loses situational awareness Pilot/aircrew unaware of flying object. Flying object not identified via radar or other sources ATCT does not communicate warning. Pilot/flight crew does not regain situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	7 Provide for appropriate ATC/Aircrew contingency procedures. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 6N Require all flying objects that can become hazards to navigation be equipped with ADS-B transmitters, or other appropriate means of identification. 9A Require alternate means of detecting flying object, e.g., TCAS, ATC warning, etc.

Automatic Dependent Surveillance Broadcast (ADS-B)

26	AFLO-01.4	Near Midair Collision (NMAC) of subject aircraft with flying object due to failure to identify flying object. Flying object not equipped with ADS-B.	Flying object in collision path. Flying object not equipped with ADS-B.	Pilot/flight crew loses situational awareness Pilot/aircrew unaware of flying object. Flying object identified via radar or other sources ATCT does not communicate warning. Pilot/flight crew does not regain situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	7 Provide for appropriate ATC/Aircrew contingency procedures. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 6N Require all flying objects that can become hazards to navigation be equipped with ADS-B transmitters, or other appropriate means of identification. 9A Require alternate means of detecting flying object, e.g., TCAS, ATC warning, etc.
27	AFLO-01.5	Near Midair Collision (NMAC) of subject aircraft with flying object due to failure to identify flying object. Flying object not equipped with ADS-B.	Flying object in collision path. Flying object not equipped with ADS-B.	Pilot/flight crew loses situational awareness Pilot/aircrew unaware of flying object. Flying object identified via radar or other sources ATCT does communicate warning. Pilot/flight crew does not regain situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	7 Provide for appropriate ATC/Aircrew contingency procedures. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 6N Require all flying objects that can become hazards to navigation be equipped with ADS-B transmitters, or other appropriate means of identification. 9A Require alternate means of detecting flying object, e.g., TCAS, ATC warning, etc.

32	AFLO-02.3	Near Midair Collision (NMAC) of subject aircraft with flying object due to failure of ADS-B on flying object.	Aircraft in collision path. Failure of ADS-B on flying object due to: SW malfunction HW malfunction Electromagnetic environmental effects Inadvertent damage LTA design.	Pilot/flight crew loses situational awareness Pilot/aircrew unaware of flying object. Flying object not identified via radar or other sources ATCT does not communicate warning. Pilot/flight crew does not regain situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	7 Provide for appropriate ATC/Aircrew contingency procedures. 9a Require alternate means of detecting flying object, e.g., TCAS, ATC warning, etc. 77 Require warning lights on flying object to enhance "see and avoid" separation. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 8 Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 26 Design the system such that no single software anomaly, common software malfunctions or design feature shall result in a catastrophic event, (severity 1 or 2). 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 5N Avionics certification, installation, and approval process established for ADS-B.

33	AFLO-02.4	Near Midair Collision (NMAC) of subject aircraft with flying object due to failure of ADS-B on flying object.	Aircraft in collision path. Failure of ADS-B on flying object due to: SW malfunction HW malfunction Electromagnetic environmental effects Inadvertent damage LTA design.	Pilot/flight crew loses situational awareness Pilot/aircrew unaware of flying object. Flying object identified via radar or other sources ATCT does not communicate warning. Pilot/flight crew does not regain situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	7 Provide for appropriate ATC/Aircrew contingency procedures. 9a Require alternate means of detecting flying object, e.g., TCAS, ATC warning, etc. 77 Require warning lights on flying object to enhance "see and avoid" separation. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 8 Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 26 Design the system such that no single software anomaly, common software malfunctions or design feature shall result in a catastrophic event, (severity 1 or 2). 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 5N Avionics certification, installation, and approval process established for ADS-B.

34	AFLO-02.5	Near Midair Collision (NMAC) of subject aircraft with flying object due to failure of ADS-B on flying object.	Aircraft in collision path. Failure of ADS-B on flying object due to: SW malfunction HW malfunction Electromagnetic environmental effects Inadvertent damage LTA design.	Pilot/flight crew loses situational awareness Pilot/aircrew unaware of flying object. Flying object identified via radar or other sources ATCT doe communicate warning. Pilot/flight crew does not regain situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	7 Provide for appropriate ATC/Aircrew contingency procedures. 9a Require alternate means of detecting flying object, e.g., TCAS, ATC warning, etc. 77 Require warning lights on flying object to enhance "see and avoid" separation. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 8 Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 26 Design the system such that no single software anomaly, common software malfunctions or design feature shall result in a catastrophic event, (severity 1 or 2). 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 5N Avionics certification, installation, and approval process established for ADS-B.
45	AGV-01.3	Near Midair Collision (NMAC) of subject aircraft with ground vehicle due to failure to identify ground vehicle. Ground vehicle not equipped with ADS-B.	Ground vehicle not equipped with ADS-B	Pilot/flight crew loses situational awareness Pilot/aircrew unaware of ground vehicle. Ground vehicle not identified via radar or other sources ATCT does not communicate warning. Pilot/flight crew does regain situational awareness. See and avoid successful.	Airport surface, Taxi, Takeoff, Landing.	Near Midair Collision (NMAC)	3B	1 Develop ADS-B ATC/Aircrew procedures to accommodate transitional risks. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 7N Require all ground vehicles that can become hazards to ground navigation be equipped with ADS-B transmitters, or other appropriate means of identification. 10 Require ground vehicles to be equipped with appropriate lighting and color indication to enhance "see and avoid" separation. 8N Require alternate means of detecting ground vehicles, i.e. ASDE-X. 11 Aircrew/ground operator "see and avoid" procedures. 12a Require alternate means of detecting aircraft and informing ground vehicle operator of position, e.g., AMASS

46	AGV-01.4	Near Midair Collision (NMAC) of subject aircraft with ground vehicle due to failure to identify ground vehicle. Ground vehicle not equipped with ADS-B.	Ground vehicle not equipped with ADS-B	Pilot/flight crew loses situational awareness Pilot/aircrew unaware of ground vehicle. Ground vehicle identified via radar or other sources ATCT does not communicate warning. Pilot/flight crew does regain situational awareness. See and avoid successful.	Airport surface, Taxi, Takeoff, Landing.	Near Midair Collision (NMAC)	3B	1 Develop ADS-B ATC/Aircrew procedures to accommodate transitional risks. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 7N Require all ground vehicles that can become hazards to ground navigation be equipped with ADS-B transmitters, or other appropriate means of identification. 10 Require ground vehicles to be equipped with appropriate lighting and color indication to enhance "see and avoid" separation. 8N Require alternate means of detecting ground vehicles, i.e. ASDE-X. 11 Aircrew/ground operator "see and avoid" procedures. 12a Require alternate means of detecting aircraft and informing ground vehicle operator of position, e.g., AMASS
47	AGV-01.5	Near Midair Collision (NMAC) of subject aircraft with ground vehicle due to failure to identify ground vehicle. Ground vehicle not equipped with ADS-B.	Ground vehicle not equipped with ADS-B	Pilot/flight crew loses situational awareness Pilot/aircrew unaware of ground vehicle. Ground vehicle identified via radar or other sources ATCT does communicate warning. Pilot/flight crew does regain situational awareness. See and avoid successful.	Airport surface, Taxi, Takeoff, Landing.	Near Midair Collision (NMAC)	3B	1 Develop ADS-B ATC/Aircrew procedures to accommodate transitional risks. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 7N Require all ground vehicles that can become hazards to ground navigation be equipped with ADS-B transmitters, or other appropriate means of identification. 10 Require ground vehicles to be equipped with appropriate lighting and color indication to enhance "see and avoid" separation. 8N Require alternate means of detecting ground vehicles, i.e. ASDE-X. 11 Aircrew/ground operator "see and avoid" procedures. 12a Require alternate means of detecting aircraft and informing ground vehicle operator of position, e.g., AMASS.

Automatic Dependent Surveillance Broadcast (ADS-B)

51	AGV-02.3	Near Midair Collision (NMAC) of subject aircraft with ground vehicles due to failure of ADS-B on ground vehicles.	Ground vehicle equipped with ADS-B Failure of ADS-B due to: SW malfunction HW malfunction Electromagnetic environmental effects Inadvertent damage LTA design.	Pilot/flight crew loses situational awareness Pilot/aircrew unaware of ground vehicle. Ground vehicle not identified via radar or other sources ATCT does not communicate warning. Pilot/flight crew does regain situational awareness. See and avoid successful.	Airport surface, Taxi, Takeoff, Landing.	Near Midair Collision (NMAC)	3B	8 Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 7 Provide for appropriate ATC/Aircrew contingency procedures. 10 Require ground vehicles to be equipped with appropriate lighting and color indication to enhance "see and avoid" separation. 12a Require alternate means of detecting aircraft and informing ground vehicle operator of position, e.g., AMASS. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 26 Design the system such that no single software anomaly, common software malfunctions or design feature shall result in a catastrophic event, (severity 1 or 2). 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

52	AGV-02.4	Near Midair Collision (NMAC) of subject aircraft with ground vehicles due to failure of ADS-B on ground vehicles.	Ground vehicle equipped with ADS-B Failure of ADS-B due to: SW malfunction HW malfunction Electromagnetic environmental effects Inadvertent damage LTA design.	Pilot/flight crew loses situational awareness Pilot/aircrew unaware of ground vehicle. Ground vehicle identified via radar or other sources ATCT does not communicate warning. Pilot/flight crew does regain situational awareness. See and avoid successful.	Airport surface, Taxi, Takeoff, Landing.	Near Midair Collision (NMAC)	3B	8 Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 7 Provide for appropriate ATC/Aircrew contingency procedures. 10 Require ground vehicles to be equipped with appropriate lighting and color indication to enhance “see and avoid” separation. 12a Require alternate means of detecting aircraft and informing ground vehicle operator of position, e.g., AMASS. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 26 Design the system such that no single software anomaly, common software malfunctions or design feature shall result in a catastrophic event, (severity 1 or 2). 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

53	AGV-02.5	Near Midair Collision (NMAC) of subject aircraft with ground vehicles due to failure of ADS-B on ground vehicles.	Ground vehicle equipped with ADS-B. Failure of ADS-B due to: SW malfunction HW malfunction Electromagnetic environmental effects Inadvertent damage LTA design.	Pilot/flight crew loses situational awareness Pilot/aircrew unaware of ground vehicle. Ground vehicle identified via radar or other sources ATCT does communicate warning. Pilot/flight crew does regain situational awareness. See and avoid successful.	Airport surface, Taxi, Takeoff, Landing.	Near Midair Collision (NMAC)	3B	8 Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 7 Provide for appropriate ATC/Aircrew contingency procedures. 10 Require ground vehicles to be equipped with appropriate lighting and color indication to enhance “see and avoid” separation. 12a Require alternate means of detecting aircraft and informing ground vehicle operator of position, e.g., AMASS. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 26 Design the system such that no single software anomaly, common software malfunctions or design feature shall result in a catastrophic event, (severity 1 or 2). 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

58	AGV-03.3	Near Midair Collision (NMAC) of subject aircraft with ground vehicles due to failure of ADS-B on own aircraft.	Aircraft equipped with ADS-B. Failure of ADS-B due to: SW malfunction HW malfunction Electromagnetic environmental effects Inadvertent damage LTA design.	Pilot/flight crew and ground vehicle driver loss of situational awareness and are not aware of collision potential. Pilot/aircrew unaware of ground vehicle. Ground vehicle is not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew does regain situational awareness. See and avoid successful.	Airport surface, Taxi, Takeoff, Landing.	Near Midair Collision (NMAC)	3B	8 Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1. 7 Provide for appropriate ATC/Aircrew contingency procedures. 10 Require ground vehicles to be equipped with appropriate lighting and color indication to enhance “see and avoid” separation. 11 Aircrew and ground personnel “see and avoid” procedures. 12a Require alternate means of detecting aircraft and informing ground vehicle operator of position, e.g., AMASS. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 26 Design the system such that no single software anomaly, common software malfunctions or design feature shall result in a catastrophic event, (severity 1 or 2). 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 5N Avionics certification, installation, and approval process established for ADS-B.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

59	AGV-03.4	Near Midair Collision (NMAC) of subject aircraft with ground vehicles due to failure of ADS-B on own aircraft	Aircraft equipped with ADS-B. Failure of ADS-B due to: SW malfunction HW malfunction Electromagnetic environmental effects Inadvertent damage LTA design.	Pilot/flight crew and ground vehicle driver loss of situational awareness and are not aware of collision potential. Pilot/aircrew unaware of ground vehicle. Ground vehicle is identified via radar or other sources. ATCT does not communicate warning in time. Pilot/flight crew does regain situational awareness. See and avoid successful.	Airport surface, Taxi, Takeoff, Landing.	Near Midair Collision (NMAC)	3B	8 Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1. 7 Provide for appropriate ATC/Aircrew contingency procedures. 10 Require ground vehicles to be equipped with appropriate lighting and color indication to enhance “see and avoid” separation. 11 Aircrew and ground personnel “see and avoid” procedures. 12a Require alternate means of detecting aircraft and informing ground vehicle operator of position, e.g., AMASS. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 26 Design the system such that no single software anomaly, common software malfunctions or design feature shall result in a catastrophic event, (severity 1 or 2). 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 5N Avionics certification, installation, and approval process established for ADS-B.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

60	AGV-03.5	Near Midair Collision (NMAC) of subject aircraft with ground vehicles due to failure of ADS-B on aircraft.	Aircraft equipped with ADS-B. Failure of ADS-B due to: SW malfunction HW malfunction Electromagnetic environmental effects Inadvertent damage LTA design.	Pilot/flight crew and ground vehicle driver loss of situational awareness and are not aware of collision potential. Pilot/aircrew unaware of ground vehicle. Ground vehicle is identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew does regain situational awareness. See and avoid successful.	Airport surface, Taxi, Takeoff, Landing.	Near Midair Collision (NMAC)	3B	8 Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1. 7 Provide for appropriate ATC/Aircrew contingency procedures. 10 Require ground vehicles to be equipped with appropriate lighting and color indication to enhance "see and avoid" separation. 11 Aircrew and ground personnel "see and avoid" procedures. 12a Require alternate means of detecting aircraft and informing ground vehicle operator of position, e.g., AMASS. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 26 Design the system such that no single software anomaly, common software malfunctions or design feature shall result in a catastrophic event, (severity 1 or 2). 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 5N Avionics certification, installation, and approval process established for ADS-B.
65	AOAA-01.3	Near Midair Collision (NMAC) of subject aircraft with other airborne aircraft due to failure to identify other airborne aircraft, via ADS-B Other airborne aircraft not equipped with ADS-B.	Other airborne aircraft not equipped with ADS-B. Either aircraft on collision course.	Pilot/flight crew(s) loss of situational awareness and are not aware of collision potential. Other aircraft is not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew does regain situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	1 Develop ADS-B ATC/Aircrew procedures to accommodate transitional risks. 2b Require all aircraft to be equipped with appropriate lighting, i.e., "see and avoid". 3 Aircrew "see and avoid" procedures. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 10N Require all aircraft that can become hazards to navigation be equipped with ADS-B transmitters, or other appropriate automated means of identification.

66	AOAA-01.4	Near Midair Collision (NMAC) of subject aircraft with other airborne aircraft due to failure to identify other airborne aircraft. Other airborne aircraft not equipped with ADS-B.	Other airborne aircraft not equipped with ADS-B. Either aircraft on collision course.	Pilot/flight crew(s) loss of situational awareness and are not aware of collision potential. Other aircraft is identified via radar or other sources. ATCT does not communicate warning in time. Pilot/flight crew does regain situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC).	3B	1 Develop ADS-B ATC/Aircrew procedures to accommodate transitional risks. 2b Require all aircraft to be equipped with appropriate lighting, i.e., “see and avoid”. 3 Aircrew “see and avoid” procedures. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 10N Require all aircraft that can become hazards to navigation be equipped with ADS-B transmitters, or other appropriate automated means of identification.
67	AOAA-01.5	Near Midair Collision (NMAC) of subject aircraft with other airborne aircraft due to failure to identify other airborne aircraft. Other airborne aircraft not equipped with ADS-B.	Other airborne aircraft not equipped with ADS-B. Either aircraft on collision course.	Pilot/flight crew(s) loss of situational awareness and are not aware of collision potential. Other aircraft is not identified via radar or other sources. ATCT does not communicate warning in time. Pilot/flight crew does regain situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC).	3B	1 Develop ADS-B ATC/Aircrew procedures to accommodate transitional risks. 2b Require all aircraft to be equipped with appropriate lighting, i.e., “see and avoid”. 3 Aircrew “see and avoid” procedures. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 10N Require all aircraft that can become hazards to navigation be equipped with ADS-B transmitters, or other appropriate automated means of identification.

71	AOAA-02.3	Near Midair Collision (NMAC) of subject aircraft with other airborne aircraft due to failure of ADS-B on subject aircraft	Subject aircraft equipped with ADS-B. Failure of ADS-B due to: SW malfunction HW malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Either aircraft on collision course.	Pilot/flight crews initially loss situational awareness. Pilot/flight crew(s) are not aware of collision potential. Other aircraft is not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew does regain situational awareness. See and avoid successful.	Takeoff, Flight, Landing.	Near Midair Collision (NMAC)	3B	8 Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1. 7 Provide for appropriate ATC/Aircrew contingency procedures. 10 Require ground vehicles to be equipped with appropriate lighting and color indication to enhance “see and avoid” separation. 11 Aircrew and ground personnel “see and avoid” procedures. 12a Require alternate means of detecting aircraft and informing ground vehicle operator of position, e.g., AMASS. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 26 Design the system such that no single software anomaly, common software malfunctions or design feature shall result in a catastrophic event, (severity 1 or 2). 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 5N Avionics certification, installation, and approval process established for ADS-B. 9a Require alternate means of detecting flying object, e.g., TCAS, ATC warning, etc. 2b Require all aircraft to be equipped with appropriate lighting, i.e., “see and avoid”.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

72	AOAA-02.4	Near Midair Collision (NMAC) of subject aircraft with other airborne aircraft due to failure of ADS-B on subject aircraft	Subject aircraft equipped with ADS-B. Failure of ADS-B due to: SW malfunction HW malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Either aircraft on collision course.	Pilot/flight crews initially loss situational awareness. Pilot/flight crew(s) are not aware of collision potential. Other aircraft is identified via radar or other sources. ATCT does not communicate warning in time. Pilot/flight crew does regain situational awareness. See and avoid successful.	Takeoff, Flight, Landing.	Near Midair Collision (NMAC)	3B	8 Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1. 7 Provide for appropriate ATC/Aircrew contingency procedures. 10 Require ground vehicles to be equipped with appropriate lighting and color indication to enhance “see and avoid” separation. 11 Aircrew and ground personnel “see and avoid” procedures. 12a Require alternate means of detecting aircraft and informing ground vehicle operator of position, e.g., AMASS. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 26 Design the system such that no single software anomaly, common software malfunctions or design feature shall result in a catastrophic event, (severity 1 or 2). 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 5N Avionics certification, installation, and approval process established for ADS-B. 9a Require alternate means of detecting flying object, e.g., TCAS, ATC warning, etc. 2b Require all aircraft to be equipped with appropriate lighting, i.e., “see and avoid”.

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73	AOAA-02.5	Near Midair Collision (NMAC) of subject aircraft with other airborne aircraft due to failure of ADS-B on subject aircraft	Subject aircraft equipped with ADS-B. Failure of ADS-B due to: SW malfunction HW malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Either aircraft on collision course.	Pilot/flight crews initially loss situational awareness. Pilot/flight crew(s) are not aware of collision potential. Other aircraft is identified via radar or other sources. ATCT does communicate warning in time. Pilot/flight crew does regain situational awareness. See and avoid successful.	Takeoff, Flight, Landing.	Near Midair Collision (NMAC)	3B	8 Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1. 7 Provide for appropriate ATC/Aircrew contingency procedures. 10 Require ground vehicles to be equipped with appropriate lighting and color indication to enhance “see and avoid” separation. 11 Aircrew and ground personnel “see and avoid” procedures. 12a Require alternate means of detecting aircraft and informing ground vehicle operator of position, e.g., AMASS. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 26 Design the system such that no single software anomaly, common software malfunctions or design feature shall result in a catastrophic event, (severity 1 or 2). 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 5N Avionics certification, installation, and approval process established for ADS-B. 9a Require alternate means of detecting flying object, e.g., TCAS, ATC warning, etc. 2b Require all aircraft to be equipped with appropriate lighting, i.e., “see and avoid”.

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77	ANAA-01.3	Near Midair Collision (NMAC) of subject aircraft with non-airborne aircraft due to failure to identify non-airborne aircraft. Other aircraft not equipped with ADS-B.	Failure to identify non-airborne aircraft due to: Radar malfunction Electronic masking of aircraft Visual masking of aircraft Loss of signal Procedural error. Either aircraft on collision course.	Pilot/flight crews initially loss situational awareness. Pilot/flight crew(s) are not aware of collision potential. Other aircraft is not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew does regain situational awareness. See and avoid successful.	Takeoff, Landing, Airport surfaces.	Near Midair Collision (NMAC)	3B	12c Require alternate means of detecting aircraft and informing non-airborne aircraft crew of position, e.g., AMASS, ATC controllers. 2b Require all aircraft to be equipped with appropriate lighting, i.e., “see and avoid”. 11 Aircrew and ground personnel “see and avoid” procedures. 12a Require alternate means of detecting aircraft and informing ground vehicle operator of position, e.g., AMASS. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 26 Design the system such that no single software anomaly, common software malfunctions or design feature shall result in a catastrophic event, (severity 1 or 2). 8 Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1. 7 Provide for appropriate ATC/Aircrew contingency procedures.

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78	ANAA-01.4	Near Midair Collision (NMAC) of subject aircraft with non-airborne aircraft due to failure to identify non-airborne aircraft. Other aircraft not equipped with ADS-B.	Failure to identify non-airborne aircraft due to: Radar malfunction Electronic masking of aircraft Visual masking of aircraft Loss of signal Procedural error. Either aircraft on collision course.	Pilot/flight crews initially loss situational awareness. Pilot/flight crew(s) are not aware of collision potential. Other aircraft is identified via radar or other sources. ATCT does not communicate warning in time. Pilot/flight crew does regain situational awareness. See and avoid successful.	Takeoff, Landing, Airport surfaces.	Near Midair Collision (NMAC)	3B	12c Require alternate means of detecting aircraft and informing non-airborne aircraft crew of position, e.g., AMASS, ATC controllers. 2b Require all aircraft to be equipped with appropriate lighting, i.e., “see and avoid”. 11 Aircrew and ground personnel “see and avoid” procedures. 12a Require alternate means of detecting aircraft and informing ground vehicle operator of position, e.g., AMASS. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 26 Design the system such that no single software anomaly, common software malfunctions or design feature shall result in a catastrophic event, (severity 1 or 2). 8 Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1. 7 Provide for appropriate ATC/Aircrew contingency procedures.

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79	ANAA-01.5	Near Midair Collision (NMAC) of subject aircraft with non-airborne aircraft due to failure to identify non-airborne aircraft. Other aircraft not equipped with ADS-B.	Failure to identify non-airborne aircraft due to: Radar malfunction Electronic masking of aircraft Visual masking of aircraft Loss of signal Procedural error. Either aircraft on collision course.	Pilot/flight crews initially loss situational awareness. Pilot/flight crew(s) are not aware of collision potential. Other aircraft is identified via radar or other sources. ATCT does communicate warning in time. Pilot/flight crew does regain situational awareness. See and avoid successful.	Takeoff, Landing, Airport surfaces.	Near Midair Collision (NMAC)	3B	12c Require alternate means of detecting aircraft and informing non-airborne aircraft crew of position, e.g., AMASS, ATC controllers. 2b Require all aircraft to be equipped with appropriate lighting, i.e., “see and avoid”. 11 Aircrew and ground personnel “see and avoid” procedures. 12a Require alternate means of detecting aircraft and informing ground vehicle operator of position, e.g., AMASS. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 26 Design the system such that no single software anomaly, common software malfunctions or design feature shall result in a catastrophic event, (severity 1 or 2). 8 Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1. 7 Provide for appropriate ATC/Aircrew contingency procedures.

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84	ANAA-01.3	Near Midair Collision (NMAC) of subject aircraft with non-airborne aircraft due to failure of ADS-B on non-airborne aircraft	Failure of ADS-B on non-airborne aircraft due to: SW malfunction HW malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Either aircraft on collision course.	Pilot/flight crews initially loss situational awareness. Pilot/flight crew(s) are not aware of collision potential. Other aircraft is not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew does regain situational awareness. See and avoid successful.	Takeoff, Landing, Airport surfaces.	Near Midair Collision (NMAC)	3B	8 Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 2b Require all aircraft to be equipped with appropriate lighting, i.e., “see and avoid”. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1. 7 Provide for appropriate ATC/Aircrew contingency procedures. 10 Require ground vehicles to be equipped with appropriate lighting and color indication to enhance “see and avoid” separation. 11 Aircrew and ground personnel “see and avoid” procedures. 12b Require alternate means of detecting aircraft and informing air crew of position, e.g., AMASS 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 26 Design the system such that no single software anomaly, common software malfunctions or design feature shall result in a catastrophic event, (severity 1 or 2). 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 5N Avionics certification, installation, and approval process established for ADS-B. 2b Require all aircraft to be equipped with appropriate lighting, i.e., “see and avoid”.

85	ANAA-01.4	Near Midair Collision (NMAC) of subject aircraft with non-airborne aircraft due to failure of ADS-B on non-airborne aircraft	Failure of ADS-B on non-airborne aircraft due to: SW malfunction HW malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Either aircraft on collision course.	Pilot/flight crews initially loss situational awareness. Pilot/flight crew(s) are not aware of collision potential. Other aircraft is identified via radar or other sources. ATCT does communicate warning in time. Pilot/flight crew does regain situational awareness. See and avoid successful.	Takeoff, Landing, Airport surfaces.	Near Midair Collision (NMAC)	3B	8 Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 2b Require all aircraft to be equipped with appropriate lighting, i.e., “see and avoid”. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1. 7 Provide for appropriate ATC/Aircrew contingency procedures. 10 Require ground vehicles to be equipped with appropriate lighting and color indication to enhance “see and avoid” separation. 11 Aircrew and ground personnel “see and avoid” procedures. 12b Require alternate means of detecting aircraft and informing air crew of position, e.g., AMASS 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 26 Design the system such that no single software anomaly, common software malfunctions or design feature shall result in a catastrophic event, (severity 1 or 2). 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 5N Avionics certification, installation, and approval process established for ADS-B. 2b Require all aircraft to be equipped with appropriate lighting, i.e., “see and avoid”.

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86	ANAA-01.5	Near Midair Collision (NMAC) of subject aircraft with non-airborne aircraft due to failure of ADS-B on non-airborne aircraft	Failure of ADS-B on non-airborne aircraft due to: SW malfunction HW malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Either aircraft on collision course.	Pilot/flight crews initially loss situational awareness. Pilot/flight crew(s) are not aware of collision potential. Other aircraft is identified via radar or other sources. ATCT does not communicate warning in time. Pilot/flight crew does regain situational awareness. See and avoid successful.	Takeoff, Landing, Airport surfaces.	Near Midair Collision (NMAC)	3B	8 Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 2b Require all aircraft to be equipped with appropriate lighting, i.e., “see and avoid”. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1. 7 Provide for appropriate ATC/Aircrew contingency procedures. 10 Require ground vehicles to be equipped with appropriate lighting and color indication to enhance “see and avoid” separation. 11 Aircrew and ground personnel “see and avoid” procedures. 12b Require alternate means of detecting aircraft and informing air crew of position, e.g., AMASS 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 26 Design the system such that no single software anomaly, common software malfunctions or design feature shall result in a catastrophic event, (severity 1 or 2). 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 5N Avionics certification, installation, and approval process established for ADS-B. 2b Require all aircraft to be equipped with appropriate lighting, i.e., “see and avoid”.

91	ANAA-03.3	Near Midair Collision (NMAC) of subject aircraft with non-airborne aircraft due to failure of ADS-B on subject aircraft.	Failure of ADS-B on subject aircraft due to: SW malfunction HW malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Either aircraft on collision course.	Pilot/flight crews initially loss situational awareness. Pilot/flight crew(s) are not aware of collision potential. Other aircraft is not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew does regain situational awareness. See and avoid successful.	Takeoff, Landing, Airport surfaces.	Near Midair Collision (NMAC)	3B	8 Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 2b Require all aircraft to be equipped with appropriate lighting, i.e., “see and avoid”. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1. 7 Provide for appropriate ATC/Aircrew contingency procedures. 10 Require ground vehicles to be equipped with appropriate lighting and color indication to enhance “see and avoid” separation. 11 Aircrew and ground personnel “see and avoid” procedures. 12b Require alternate means of detecting aircraft and informing air crew of position, e.g., AMASS 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 26 Design the system such that no single software anomaly, common software malfunctions or design feature shall result in a catastrophic event, (severity 1 or 2). 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 5N Avionics certification, installation, and approval process established for ADS-B. 2b Require all aircraft to be equipped with appropriate lighting, i.e., “see and avoid”.

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92	ANAA-03.4	Near Midair Collision (NMAC) of subject aircraft with non-airborne aircraft due to failure of ADS-B on subject aircraft.	Failure of ADS-B on subject aircraft due to: SW malfunction HW malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Either aircraft on collision course.	Pilot/flight crews initially loss situational awareness. Pilot/flight crew(s) are not aware of collision potential. Other aircraft is identified via radar or other sources. ATCT does not communicate warning in time. Pilot/flight crew does regain situational awareness. See and avoid successful.	Takeoff, Landing, Airport surfaces.	Near Midair Collision (NMAC)	3B	8 Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 2b Require all aircraft to be equipped with appropriate lighting, i.e., “see and avoid”. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1. 7 Provide for appropriate ATC/Aircrew contingency procedures. 10 Require ground vehicles to be equipped with appropriate lighting and color indication to enhance “see and avoid” separation. 11 Aircrew and ground personnel “see and avoid” procedures. 12b Require alternate means of detecting aircraft and informing air crew of position, e.g., AMASS 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 26 Design the system such that no single software anomaly, common software malfunctions or design feature shall result in a catastrophic event, (severity 1 or 2). 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 5N Avionics certification, installation, and approval process established for ADS-B. 2b Require all aircraft to be equipped with appropriate lighting, i.e., “see and avoid”.

93	ANAA-03.5	Near Midair Collision (NMAC) of subject aircraft with non-airborne aircraft due to failure of ADS-B on subject aircraft.	Failure of ADS-B on subject aircraft due to: SW malfunction HW malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Either aircraft on collision course.	Pilot/flight crews initially loss situational awareness. Pilot/flight crew(s) are not aware of collision potential. Other aircraft is identified via radar or other sources. ATCT does communicate warning in time. Pilot/flight crew does regain situational awareness. See and avoid successful.	Takeoff, Landing, Airport surfaces.	Near Midair Collision (NMAC)	3B	8 Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 2b Require all aircraft to be equipped with appropriate lighting, i.e., “see and avoid”. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1. 7 Provide for appropriate ATC/Aircrew contingency procedures. 10 Require ground vehicles to be equipped with appropriate lighting and color indication to enhance “see and avoid” separation. 11 Aircrew and ground personnel “see and avoid” procedures. 12b Require alternate means of detecting aircraft and informing air crew of position, e.g., AMASS 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 26 Design the system such that no single software anomaly, common software malfunctions or design feature shall result in a catastrophic event, (severity 1 or 2). 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 5N Avionics certification, installation, and approval process established for ADS-B. 2b Require all aircraft to be equipped with appropriate lighting, i.e., “see and avoid”.

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97	AADF-01.3	Near Midair Collision (NMAC) of subject aircraft with other aircraft due to erroneous position information on subject aircraft cockpit display. Other aircraft transmits erroneous position information.	Erroneous position information on subject aircraft cockpit display. Other aircraft transmits erroneous position information, due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Either aircraft on collision course.	Pilot/flight crews initially loss situational awareness. Pilot/flight crew(s) are not aware of collision potential. Other aircraft is not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew does regain situational awareness. See and avoid successful.	Takeoff, Landing, Flight, Airport surfaces.	Near Midair Collision (NMAC)	3B	8a Design ADS-B airborne system to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 5N Avionics certification, installation, and approval process established for ADS-B. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 9a Require alternate means of detecting flying object, e.g., TCAS, ATC warning, etc. 22a Require periodic recalibration of ADS-B inputs, processing system and displays. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

98	AADF-01.4	Near Midair Collision (NMAC) of subject aircraft with other aircraft due to erroneous position information on subject aircraft cockpit display. Other aircraft transmits erroneous position information.	Erroneous position information on subject aircraft cockpit display. Other aircraft transmits erroneous position information, due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Either aircraft on collision course.	Pilot/flight crews initially loss situational awareness. Pilot/flight crew(s) are not aware of collision potential. Other aircraft is identified via radar or other sources. ATCT does not communicate warning in time. Pilot/flight crew does regain situational awareness. See and avoid successful.	Takeoff, Landing, Flight, Airport surfaces.	Near Midair Collision (NMAC)	3B	8a Design ADS-B airborne system to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 5N Avionics certification, installation, and approval process established for ADS-B. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 9a Require alternate means of detecting flying object, e.g., TCAS, ATC warning, etc. 22a Require periodic recalibration of ADS-B inputs, processing system and displays. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

99	AADF-01.5	Near Midair Collision (NMAC) of subject aircraft with other aircraft due to erroneous position information on subject aircraft cockpit display. Other aircraft transmits erroneous position information.	Erroneous position information on subject aircraft cockpit display. Other aircraft transmits erroneous position information, due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Either aircraft on collision course.	Pilot/flight crews initially loss situational awareness. Pilot/flight crew(s) are not aware of collision potential. Other aircraft is identified via radar or other sources. ATCT does communicate warning in time. Pilot/flight crew does regain situational awareness. See and avoid successful.	Takeoff, Landing, Flight, Airport surfaces.	Near Midair Collision (NMAC)	3B	8a Design ADS-B airborne system to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 5N Avionics certification, installation, and approval process established for ADS-B. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 9a Require alternate means of detecting flying object, e.g., TCAS, ATC warning, etc. 22a Require periodic recalibration of ADS-B inputs, processing system and displays. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

103	AADF-02.3	Near Midair Collision (NMAC) of subject aircraft with other aircraft due to erroneous position information on subject aircraft cockpit display. Subject aircraft displays erroneous position information. Source of erroneous information on display is due to failure of on-board display.	Erroneous position information on subject aircraft cockpit display. Source of erroneous information on display is due to failure of on-board display due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Either aircraft on collision course.	Pilot/flight crews initially loss situational awareness. Pilot/flight crew(s) are not aware of collision potential. Other aircraft is not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew does regain situational awareness. See and avoid successful.	Takeoff, Landing, Flight, Airport surfaces.	Near Midair Collision (NMAC)	3B	8a Design ADS-B airborne system to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 5N Avionics certification, installation, and approval process established for ADS-B. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 9a Require alternate means of detecting flying object, e.g., TCAS, ATC warning, etc. 22a Require periodic recalibration of ADS-B inputs, processing system and displays. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

104	AADF-02.4	Near Midair Collision (NMAC) of subject aircraft with other aircraft due to erroneous position information on subject aircraft cockpit display. Subject aircraft displays erroneous position information. Source of erroneous information on display is due to failure of on-board display.	Erroneous position information on subject aircraft cockpit display. Source of erroneous information on display is due to failure of on-board display due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Either aircraft on collision course.	Pilot/flight crews initially loss situational awareness. Pilot/flight crew(s) are not aware of collision potential. Other aircraft is identified via radar or other sources. ATCT does not communicate warning in time. Pilot/flight crew does regain situational awareness. See and avoid successful.	Takeoff, Landing, Flight, Airport surfaces.	Near Midair Collision (NMAC)	3B	8a Design ADS-B airborne system to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 5N Avionics certification, installation, and approval process established for ADS-B. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 9a Require alternate means of detecting flying object, e.g., TCAS, ATC warning, etc. 22a Require periodic recalibration of ADS-B inputs, processing system and displays. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

105	AADF-02.5	Near Midair Collision (NMAC) of subject aircraft with other aircraft due to erroneous position information on subject aircraft cockpit display. Subject aircraft displays erroneous position information. Source of erroneous information on display is due to failure of on-board display.	Erroneous position information on subject aircraft cockpit display. Source of erroneous information on display is due to failure of on-board display due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Either aircraft on collision course.	Pilot/flight crews initially loss situational awareness. Pilot/flight crew(s) are not aware of collision potential. Other aircraft is identified via radar or other sources. ATCT does communicate warning in time. Pilot/flight crew does regain situational awareness. See and avoid successful.	Takeoff, Landing, Flight, Airport surfaces.	Near Midair Collision (NMAC)	3B	8a Design ADS-B airborne system to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 5N Avionics certification, installation, and approval process established for ADS-B. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 9a Require alternate means of detecting flying object, e.g., TCAS, ATC warning, etc. 22a Require periodic recalibration of ADS-B inputs, processing system and displays. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

110	AADF-03.3	Near Midair Collision (NMAC) of other aircraft with subject aircraft due to erroneous position information on other aircraft cockpit display. Subject aircraft transmits erroneous position information.	Erroneous position information on other aircraft cockpit display. Subject aircraft transmits erroneous position information due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Either aircraft on collision course.	Pilot/flight crews initially loss situational awareness. Pilot/flight crew(s) are not aware of collision potential. Other aircraft is not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew does regain situational awareness. See and avoid successful.	Takeoff, Landing, Flight, Airport surfaces.	Near Midair Collision (NMAC)	3B	8a Design ADS-B airborne system to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 5N Avionics certification, installation, and approval process established for ADS-B. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 9a Require alternate means of detecting flying object, e.g., TCAS, ATC warning, etc. 22a Require periodic recalibration of ADS-B inputs, processing system and displays. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

111	AADF-03.4	Near Midair Collision (NMAC) of other aircraft with subject aircraft due to erroneous position information on other aircraft cockpit display. Subject aircraft transmits erroneous position information.	Erroneous position information on other aircraft cockpit display. Subject aircraft transmits erroneous position information due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Either aircraft on collision course.	Pilot/flight crews initially loss situational awareness. Pilot/flight crew(s) are not aware of collision potential. Other aircraft is identified via radar or other sources. ATCT does not communicate warning in time. Pilot/flight crew does regain situational awareness. See and avoid successful.	Takeoff, Landing, Flight, Airport surfaces.	Near Midair Collision (NMAC)	3B	8a Design ADS-B airborne system to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 5N Avionics certification, installation, and approval process established for ADS-B. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 9a Require alternate means of detecting flying object, e.g., TCAS, ATC warning, etc. 22a Require periodic recalibration of ADS-B inputs, processing system and displays. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

112	AADF-03.5	Near Midair Collision (NMAC) of other aircraft with subject aircraft due to erroneous position information on other aircraft cockpit display. Subject aircraft transmits erroneous position information.	Erroneous position information on other aircraft cockpit display. Subject aircraft transmits erroneous position information due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Either aircraft on collision course.	Pilot/flight crews initially loss situational awareness. Pilot/flight crew(s) are not aware of collision potential. Other aircraft is identified via radar or other sources. ATCT does communicate warning in time. Pilot/flight crew does regain situational awareness. See and avoid successful.	Takeoff, Landing, Flight, Airport surfaces.	Near Midair Collision (NMAC)	3B	8a Design ADS-B airborne system to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 5N Avionics certification, installation, and approval process established for ADS-B. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 9a Require alternate means of detecting flying object, e.g., TCAS, ATC warning, etc. 22a Require periodic recalibration of ADS-B inputs, processing system and displays. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

117	AADF-04.3	Near Midair Collision (NMAC) of other aircraft with subject aircraft due to erroneous position information on other aircraft cockpit display. Other aircraft displays erroneous position information. Source of erroneous information on display is due to failure of on-board display.	Erroneous position information on other aircraft cockpit display. Other aircraft displays erroneous position information. Source of erroneous information on display is due to failure of on-board display due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Either aircraft on collision course.	Pilot/flight crews initially loss situational awareness. Pilot/flight crew(s) are not aware of collision potential. Other aircraft is not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew does regain situational awareness. See and avoid successful.	Takeoff, Landing, Flight, Airport surfaces.	Near Midair Collision (NMAC)	3B	8a Design ADS-B airborne system to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 5N Avionics certification, installation, and approval process established for ADS-B. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 9a Require alternate means of detecting flying object, e.g., TCAS, ATC warning, etc. 22a Require periodic recalibration of ADS-B inputs, processing system and displays. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

118	AADF-04.4	Near Midair Collision (NMAC) of other aircraft with subject aircraft due to erroneous position information on other aircraft cockpit display. Other aircraft displays erroneous position information. Source of erroneous information on display is due to failure of on-board display.	Erroneous position information on other aircraft cockpit display. Other aircraft displays erroneous position information. Source of erroneous information on display is due to failure of on-board display due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Either aircraft on collision course.	Pilot/flight crews initially loss situational awareness. Pilot/flight crew(s) are not aware of collision potential. Other aircraft is identified via radar or other sources. ATCT does not communicate warning in time. Pilot/flight crew does regain situational awareness. See and avoid successful.	Takeoff, Landing, Flight, Airport surfaces.	Near Midair Collision (NMAC)	3B	8a Design ADS-B airborne system to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 5N Avionics certification, installation, and approval process established for ADS-B. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 9a Require alternate means of detecting flying object, e.g., TCAS, ATC warning, etc. 22a Require periodic recalibration of ADS-B inputs, processing system and displays. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

119	AADF-04.5	Near Midair Collision (NMAC) of other aircraft with subject aircraft due to erroneous position information on other aircraft cockpit display. Other aircraft displays erroneous position information. Source of erroneous information on display is due to failure of on-board display.	Erroneous position information on other aircraft cockpit display. Other aircraft displays erroneous position information. Source of erroneous information on display is due to failure of on-board display due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Either aircraft on collision course.	Pilot/flight crews initially loss situational awareness. Pilot/flight crew(s) are not aware of collision potential. Other aircraft is identified via radar or other sources. ATCT does communicate warning in time. Pilot/flight crew does regain situational awareness. See and avoid successful.	Takeoff, Landing, Flight, Airport surfaces.	Near Midair Collision (NMAC)	3B	8a Design ADS-B airborne system to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 5N Avionics certification, installation, and approval process established for ADS-B. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 9a Require alternate means of detecting flying object, e.g., TCAS, ATC warning, etc. 22a Require periodic recalibration of ADS-B inputs, processing system and displays. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

123	AGDF-01.3	Near Midair Collision (NMAC) of subject aircraft with ground vehicle due to erroneous position information on subject aircraft cockpit display. Ground vehicle transmits erroneous position information.	Erroneous position information on subject aircraft cockpit display. Ground vehicle transmits erroneous position information due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Either aircraft or ground vehicle on collision course.	Pilot/flight crew and ground vehicle driver loss of situational awareness and are not aware of collision potential. Pilot/aircrew unaware of ground vehicle. Ground vehicle is not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew does regain situational awareness. See and avoid successful.	Airport surface, Taxi, Takeoff, Landing.	Near Midair Collision (NMAC)	3B	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 10 Require ground vehicles to be equipped with appropriate lighting and color indication to enhance “see and avoid” separation. 11 Aircrew and ground personnel “see and avoid” procedures. 8N Require alternate means of detecting ground vehicles, i.e. ASDE-X. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 11N Require certification, installation, and approval process established for ADS-B ground system. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

124	AGDF-01.4	Near Midair Collision (NMAC) of subject aircraft with ground vehicle due to erroneous position information on subject aircraft cockpit display. Ground vehicle transmits erroneous position information.	Erroneous position information on subject aircraft cockpit display. Ground vehicle transmits erroneous position information due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Either aircraft or ground vehicle on collision course.	Pilot/flight crew and ground vehicle driver loss of situational awareness and are not aware of collision potential. Pilot/aircrew unaware of ground vehicle. Ground vehicle is identified via radar or other sources. ATCT does not communicate warning in time. Pilot/flight crew does regain situational awareness. See and avoid successful.	Airport surface, Taxi, Takeoff, Landing.	Near Midair Collision (NMAC)	3B	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 10 Require ground vehicles to be equipped with appropriate lighting and color indication to enhance “see and avoid” separation. 11 Aircrew and ground personnel “see and avoid” procedures. 8N Require alternate means of detecting ground vehicles, i.e. ASDE-X. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 11N Require certification, installation, and approval process established for ADS-B ground system. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

125	AGDF-01.5	Near Midair Collision (NMAC) of subject aircraft with ground vehicle due to erroneous position information on subject aircraft cockpit display. Ground vehicle transmits erroneous position information.	Erroneous position information on subject aircraft cockpit display. Ground vehicle transmits erroneous position information due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Either aircraft or ground vehicle on collision course.	Pilot/flight crew and ground vehicle driver loss of situational awareness and are not aware of collision potential. Pilot/aircrew unaware of ground vehicle. Ground vehicle is identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew does regain situational awareness. See and avoid successful.	Airport surface, Taxi, Takeoff, Landing.	Near Midair Collision (NMAC)	3B	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 10 Require ground vehicles to be equipped with appropriate lighting and color indication to enhance “see and avoid” separation. 11 Aircrew and ground personnel “see and avoid” procedures. 8N Require alternate means of detecting ground vehicles, i.e. ASDE-X. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 11N Require certification, installation, and approval process established for ADS-B ground system. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

129	AGDF-02.3	Near Midair Collision (NMAC) of subject aircraft with ground vehicle due to erroneous position information on subject aircraft cockpit display. Subject aircraft displays erroneous position information. Source of erroneous information on display is due to failure of on-board display.	Erroneous position information on subject aircraft cockpit display. Subject aircraft displays erroneous position information. Source of erroneous information on display is due to failure of on-board display due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Either aircraft or ground vehicle on collision course.	Pilot/flight crew and ground vehicle driver loss of situational awareness and are not aware of collision potential. Pilot/aircrew unaware of ground vehicle. Ground vehicle is not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew does regain situational awareness. See and avoid successful.	Airport surface, Taxi, Takeoff, Landing.	Near Midair Collision (NMAC)	3B	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 5N Avionics certification, installation, and approval process established for ADS-B. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 10 Require ground vehicles to be equipped with appropriate lighting and color indication to enhance “see and avoid” separation. 11 Aircrew and ground personnel “see and avoid” procedures. 8N Require alternate means of detecting ground vehicles, i.e. ASDE-X. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 11N Require certification, installation, and approval process established for ADS-B ground system. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

130	AGDF-02.4	Near Midair Collision (NMAC) of subject aircraft with ground vehicle due to erroneous position information on subject aircraft cockpit display. Subject aircraft displays erroneous position information. Source of erroneous information on display is due to failure of on-board display.	Erroneous position information on subject aircraft cockpit display. Subject aircraft displays erroneous position information. Source of erroneous information on display is due to failure of on-board display due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Either aircraft or ground vehicle on collision course.	Pilot/flight crew and ground vehicle driver loss of situational awareness and are not aware of collision potential. Pilot/aircrew unaware of ground vehicle. Ground vehicle is identified via radar or other sources. ATCT does not communicate warning in time. Pilot/flight crew does regain situational awareness. See and avoid successful.	Airport surface, Taxi, Takeoff, Landing.	Near Midair Collision (NMAC)	3B	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 5N Avionics certification, installation, and approval process established for ADS-B. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 10 Require ground vehicles to be equipped with appropriate lighting and color indication to enhance “see and avoid” separation. 11 Aircrew and ground personnel “see and avoid” procedures. 8N Require alternate means of detecting ground vehicles, i.e. ASDE-X. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 11N Require certification, installation, and approval process established for ADS-B ground system. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

131	AGDF-02.5	Near Midair Collision (NMAC) of subject aircraft with ground vehicle due to erroneous position information on subject aircraft cockpit display. Subject aircraft displays erroneous position information. Source of erroneous information on display is due to failure of on-board display.	Erroneous position information on subject aircraft cockpit display. Subject aircraft displays erroneous position information. Source of erroneous information on display is due to failure of on-board display due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Either aircraft or ground vehicle on collision course.	Pilot/flight crew and ground vehicle driver loss of situational awareness and are not aware of collision potential. Pilot/aircrew unaware of ground vehicle. Ground vehicle is identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew does regain situational awareness. See and avoid successful.	Airport surface, Taxi, Takeoff, Landing.	Near Midair Collision (NMAC)	3B	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 5N Avionics certification, installation, and approval process established for ADS-B. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 10 Require ground vehicles to be equipped with appropriate lighting and color indication to enhance “see and avoid” separation. 11 Aircrew and ground personnel “see and avoid” procedures. 8N Require alternate means of detecting ground vehicles, i.e. ASDE-X. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 11N Require certification, installation, and approval process established for ADS-B ground system. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

135	SSDF-01.3	Near Midair Collision (NMAC) of subject surface aircraft with other surface aircraft due to erroneous position information on subject aircraft cockpit display. Other surface aircraft transmits erroneous position information.	Erroneous position information on subject aircraft cockpit display. Other surface aircraft transmits erroneous position information due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Either aircraft on collision course.	Pilot/flight crews initially loss situational awareness. Pilot/flight crew(s) are not aware of collision potential. Other aircraft is not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew does regain situational awareness. See and avoid successful.	Airport surfaces.	Near Midair Collision (NMAC)	3B	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 5N Avionics certification, installation, and approval process established for ADS-B. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 2b Require all aircraft to be equipped with appropriate lighting to enhance "see and avoid" separation. 11 Aircrew and ground personnel "see and avoid" procedures. 12b Require alternate means of detecting aircraft and informing air crew of position, e.g., AMASS. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 11N Require certification, installation, and approval process established for ADS-B ground system. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

136	SSDF-01.4	Near Midair Collision (NMAC) of subject surface aircraft with other surface aircraft due to erroneous position information on subject aircraft cockpit display. Other surface aircraft transmits erroneous position information.	Erroneous position information on subject aircraft cockpit display. Other surface aircraft transmits erroneous position information due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Either aircraft on collision course.	Pilot/flight crews initially loss situational awareness. Pilot/flight crew(s) are not aware of collision potential. Other aircraft is identified via radar or other sources. ATCT does not communicate warning in time. Pilot/flight crew does regain situational awareness. See and avoid successful.	Airport surfaces.	Near Midair Collision (NMAC)	3B	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 5N Avionics certification, installation, and approval process established for ADS-B. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 2b Require all aircraft to be equipped with appropriate lighting to enhance "see and avoid" separation. 11 Aircrew and ground personnel "see and avoid" procedures. 12b Require alternate means of detecting aircraft and informing air crew of position, e.g., AMASS. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 11N Require certification, installation, and approval process established for ADS-B ground system. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

137	SSDF-01.5	Near Midair Collision (NMAC) of subject surface aircraft with other surface aircraft due to erroneous position information on subject aircraft cockpit display. Other surface aircraft transmits erroneous position information.	Erroneous position information on subject aircraft cockpit display. Other surface aircraft transmits erroneous position information due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Either aircraft on collision course.	Pilot/flight crews initially loss situational awareness. Pilot/flight crew(s) are not aware of collision potential. Other aircraft is identified via radar or other sources. ATCT does communicate warning in time. Pilot/flight crew does regain situational awareness. See and avoid successful.	Airport surfaces.	Near Midair Collision (NMAC)	3B	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 5N Avionics certification, installation, and approval process established for ADS-B. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 2b Require all aircraft to be equipped with appropriate lighting to enhance "see and avoid" separation. 11 Aircrew and ground personnel "see and avoid" procedures. 12b Require alternate means of detecting aircraft and informing air crew of position, e.g., AMASS. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 11N Require certification, installation, and approval process established for ADS-B ground system. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

142	SSDF-02.3	Near Midair Collision (NMAC) of subject surface aircraft with other surface aircraft due to erroneous position information on subject aircraft cockpit display. Subject aircraft displays erroneous position information. Source of erroneous information on display is due to failure of on-board display.	Erroneous position information on subject aircraft cockpit display. Subject aircraft displays erroneous position information. Source of erroneous information on display is due to failure of on-board display as a result of: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Either aircraft on collision course.	Pilot/flight crews initially loss situational awareness. Pilot/flight crew(s) are not aware of collision potential. Other aircraft is not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew does regain situational awareness. See and avoid successful.	Airport surfaces.	Near Midair Collision (NMAC)	3B	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 5N Avionics certification, installation, and approval process established for ADS-B. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 2b Require all aircraft to be equipped with appropriate lighting to enhance "see and avoid" separation. 11 Aircrew and ground personnel "see and avoid" procedures. 12b Require alternate means of detecting aircraft and informing air crew of position, e.g., AMASS. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 11N Require certification, installation, and approval process established for ADS-B ground system. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

143	SSDF-02.4	Near Midair Collision (NMAC) of subject surface aircraft with other surface aircraft due to erroneous position information on subject aircraft cockpit display. Subject aircraft displays erroneous position information. Source of erroneous information on display is due to failure of on-board display.	Erroneous position information on subject aircraft cockpit display. Subject aircraft displays erroneous position information. Source of erroneous information on display is due to failure of on-board display as a result of: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Either aircraft on collision course.	Pilot/flight crews initially loss situational awareness. Pilot/flight crew(s) are not aware of collision potential. Other aircraft is identified via radar or other sources. ATCT does not communicate warning in time. Pilot/flight crew does regain situational awareness. See and avoid successful.	Airport surfaces.	Near Midair Collision (NMAC)	3B	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 5N Avionics certification, installation, and approval process established for ADS-B. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 2b Require all aircraft to be equipped with appropriate lighting to enhance "see and avoid" separation. 11 Aircrew and ground personnel "see and avoid" procedures. 12b Require alternate means of detecting aircraft and informing air crew of position, e.g., AMASS. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 11N Require certification, installation, and approval process established for ADS-B ground system. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

144	SSDF-02.5	Near Midair Collision (NMAC) of subject surface aircraft with other surface aircraft due to erroneous position information on subject aircraft cockpit display. Subject aircraft displays erroneous position information. Source of erroneous information on display is due to failure of on-board display.	Erroneous position information on subject aircraft cockpit display. Subject aircraft displays erroneous position information. Source of erroneous information on display is due to failure of on-board display as a result of: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Either aircraft on collision course.	Pilot/flight crews initially loss situational awareness. Pilot/flight crew(s) are not aware of collision potential. Other aircraft is identified via radar or other sources. ATCT does communicate warning in time. Pilot/flight crew does regain situational awareness. See and avoid successful.	Airport surfaces.	Near Midair Collision (NMAC)	3B	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 5N Avionics certification, installation, and approval process established for ADS-B. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 2b Require all aircraft to be equipped with appropriate lighting to enhance "see and avoid" separation. 11 Aircrew and ground personnel "see and avoid" procedures. 12b Require alternate means of detecting aircraft and informing air crew of position, e.g., AMASS. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 11N Require certification, installation, and approval process established for ADS-B ground system. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

149	SSDF-03.3	Near Midair Collision (NMAC) of other surface aircraft with subject surface aircraft due to erroneous position information on other surface aircraft's display due to failure of other surface aircraft's display.	Erroneous position information on other surface aircraft's display. Failure of other surface aircraft's display due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Either aircraft on collision course.	Pilot/flight crews initially loss situational awareness. Pilot/flight crew(s) are not aware of collision potential. Other aircraft is not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew does regain situational awareness. See and avoid successful.	Airport surfaces.	Near Midair Collision (NMAC)	3B	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 5N Avionics certification, installation, and approval process established for ADS-B. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 2b Require all aircraft to be equipped with appropriate lighting to enhance "see and avoid" separation. 11 Aircrew and ground personnel "see and avoid" procedures. 12b Require alternate means of detecting aircraft and informing air crew of position, e.g., AMASS. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 11N Require certification, installation, and approval process established for ADS-B ground system. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

150	SSDF-03.4	Near Midair Collision (NMAC) of other surface aircraft with subject surface aircraft due to erroneous position information on other surface aircraft's display due to failure of other surface aircraft's display.	Erroneous position information on other surface aircraft's display. Failure of other surface aircraft's display due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Either aircraft on collision course.	Pilot/flight crews initially loss situational awareness. Pilot/flight crew(s) are not aware of collision potential. Other aircraft is identified via radar or other sources. ATCT does not communicate warning in time. Pilot/flight crew does regain situational awareness. See and avoid successful.	Airport surfaces.	Near Midair Collision (NMAC)	3B	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 5N Avionics certification, installation, and approval process established for ADS-B. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 2b Require all aircraft to be equipped with appropriate lighting to enhance "see and avoid" separation. 11 Aircrew and ground personnel "see and avoid" procedures. 12b Require alternate means of detecting aircraft and informing air crew of position, e.g., AMASS. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 11N Require certification, installation, and approval process established for ADS-B ground system. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

151	SSDF-03.5	Near Midair Collision (NMAC) of other surface aircraft with subject surface aircraft due to erroneous position information on other surface aircraft's display due to failure of other surface aircraft's display.	Erroneous position information on other surface aircraft's display. Failure of other surface aircraft's display due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Either aircraft on collision course.	Pilot/flight crews initially loss situational awareness. Pilot/flight crew(s) are not aware of collision potential. Other aircraft is identified via radar or other sources. ATCT does communicate warning in time. Pilot/flight crew does regain situational awareness. See and avoid successful.	Airport surfaces.	Near Midair Collision (NMAC)	3B	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 5N Avionics certification, installation, and approval process established for ADS-B. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 2b Require all aircraft to be equipped with appropriate lighting to enhance "see and avoid" separation. 11 Aircrew and ground personnel "see and avoid" procedures. 12b Require alternate means of detecting aircraft and informing air crew of position, e.g., AMASS. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 11N Require certification, installation, and approval process established for ADS-B ground system. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

156	SSDF-04.3	Near Midair Collision (NMAC) of other surface aircraft with subject aircraft due to erroneous position information on other surface aircraft display. Source of erroneous information on other surface aircraft display is due to erroneous position data from subject aircraft.	Erroneous position information on other surface aircraft display. Source of erroneous information on other surface aircraft display is due to erroneous position data from subject aircraft resulting from: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Either aircraft on collision course.	Pilot/flight crews initially loss situational awareness. Pilot/flight crew(s) are not aware of collision potential. Other aircraft is not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew does regain situational awareness. See and avoid successful.	Airport surfaces.	Near Midair Collision (NMAC)	3B	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 5N Avionics certification, installation, and approval process established for ADS-B. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 2b Require all aircraft to be equipped with appropriate lighting to enhance "see and avoid" separation. 11 Aircrew and ground personnel "see and avoid" procedures. 12b Require alternate means of detecting aircraft and informing air crew of position, e.g., AMASS. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 11N Require certification, installation, and approval process established for ADS-B ground system. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

157	SSDF-04.4	Near Midair Collision (NMAC) of other surface aircraft with subject aircraft due to erroneous position information on other surface aircraft display. Source of erroneous information on other surface aircraft display is due to erroneous position data from subject aircraft.	Erroneous position information on other surface aircraft display. Source of erroneous information on other surface aircraft display is due to erroneous position data from subject aircraft resulting from: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Either aircraft on collision course.	Pilot/flight crews initially loss situational awareness. Pilot/flight crew(s) are not aware of collision potential. Other aircraft is identified via radar or other sources. ATCT does not communicate warning in time. Pilot/flight crew does regain situational awareness. See and avoid successful.	Airport surfaces.	Near Midair Collision (NMAC)	3B	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 5N Avionics certification, installation, and approval process established for ADS-B. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 2b Require all aircraft to be equipped with appropriate lighting to enhance "see and avoid" separation. 11 Aircrew and ground personnel "see and avoid" procedures. 12b Require alternate means of detecting aircraft and informing air crew of position, e.g., AMASS. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 11N Require certification, installation, and approval process established for ADS-B ground system. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

158	SSDF-04.5	Near Midair Collision (NMAC) of other surface aircraft with subject aircraft due to erroneous position information on other surface aircraft display. Source of erroneous information on other surface aircraft display is due to erroneous position data from subject aircraft.	Erroneous position information on other surface aircraft display. Source of erroneous information on other surface aircraft display is due to erroneous position data from subject aircraft resulting from: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Either aircraft on collision course.	Pilot/flight crews initially loss situational awareness. Pilot/flight crew(s) are not aware of collision potential. Other aircraft is identified via radar or other sources. ATCT does communicate warning in time. Pilot/flight crew does regain situational awareness. See and avoid successful.	Airport surfaces.	Near Midair Collision (NMAC)	3B	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 5N Avionics certification, installation, and approval process established for ADS-B. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 2b Require all aircraft to be equipped with appropriate lighting to enhance "see and avoid" separation. 11 Aircrew and ground personnel "see and avoid" procedures. 12b Require alternate means of detecting aircraft and informing air crew of position, e.g., AMASS. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 11N Require certification, installation, and approval process established for ADS-B ground system. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

163	AFOD-01.3	Near Collision of subject aircraft with fixed object due to display failure on subject aircraft.	Display failure on subject aircraft due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course with fixed object.	Pilot/flight crew initially loses of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Collision	3B	1N Require all fixed objects that are evaluated as hazardous to be equipped with ADS-B transmitters. 2N Provide updated information on fixed objects in appropriate data sources. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 5N Avionics certification, installation, and approval process established for ADS-B. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 11 Aircrew and ground personnel “see and avoid” procedures. 12b Require alternate means of detecting aircraft and informing aircrew of position, e.g., AMASS. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 11N Require certification, installation, and approval process established for ADS-B ground system. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

164	AFOD-01.4	Near Collision of subject aircraft with fixed object due to display failure on subject aircraft.	Display failure on subject aircraft due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course with fixed object.	Pilot/flight crew initially loses of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Collision	3B	1N Require all fixed objects that are evaluated as hazardous to be equipped with ADS-B transmitters. 2N Provide updated information on fixed objects in appropriate data sources. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 5N Avionics certification, installation, and approval process established for ADS-B. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 11 Aircrew and ground personnel “see and avoid” procedures. 12b Require alternate means of detecting aircraft and informing aircrew of position, e.g., AMASS. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 11N Require certification, installation, and approval process established for ADS-B ground system. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

165	AFOD-01.5	Near Collision of subject aircraft with fixed object due to display failure on subject aircraft.	Display failure on subject aircraft due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course with fixed object.	Pilot/flight crew initially loses of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Collision	3B	1N Require all fixed objects that are evaluated as hazardous to be equipped with ADS-B transmitters. 2N Provide updated information on fixed objects in appropriate data sources. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 5N Avionics certification, installation, and approval process established for ADS-B. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 11 Aircrew and ground personnel “see and avoid” procedures. 12b Require alternate means of detecting aircraft and informing aircrew of position, e.g., AMASS. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 11N Require certification, installation, and approval process established for ADS-B ground system. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

170	AFOD-02.3	Near Collision of subject aircraft with fixed object due to erroneous position information on subject aircraft's display due to fixed object transmitting erroneous position data.	Erroneous position information on subject aircraft's display due to fixed object transmitting erroneous position data as a result of: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course with fixed object.	Pilot/flight crew initially loses of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Collision	3B	1N Require all fixed objects that are evaluated as hazardous to be equipped with ADS-B transmitters. 2N Provide updated information on fixed objects in appropriate data sources. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 5N Avionics certification, installation, and approval process established for ADS-B. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 11 Aircrew and ground personnel "see and avoid" procedures. 12b Require alternate means of detecting aircraft and informing aircrew of position, e.g., AMASS. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 11N Require certification, installation, and approval process established for ADS-B ground system. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

171	AFOD-02.4	Near Collision of subject aircraft with fixed object due to erroneous position information on subject aircraft's display due to fixed object transmitting erroneous position data.	Erroneous position information on subject aircraft's display due to fixed object transmitting erroneous position data as a result of: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course with fixed object.	Pilot/flight crew initially loses of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Collision	3B	1N Require all fixed objects that are evaluated as hazardous to be equipped with ADS-B transmitters. 2N Provide updated information on fixed objects in appropriate data sources. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 5N Avionics certification, installation, and approval process established for ADS-B. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 11 Aircrew and ground personnel "see and avoid" procedures. 12b Require alternate means of detecting aircraft and informing aircrew of position, e.g., AMASS. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 11N Require certification, installation, and approval process established for ADS-B ground system. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

172	AFOD-02.5	Near Collision of subject aircraft with fixed object due to erroneous position information on subject aircraft's display due to fixed object transmitting erroneous position data.	Erroneous position information on subject aircraft's display due to fixed object transmitting erroneous position data as a result of: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course with fixed object.	Pilot/flight crew initially loses of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Collision	3B	1N Require all fixed objects that are evaluated as hazardous to be equipped with ADS-B transmitters. 2N Provide updated information on fixed objects in appropriate data sources. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 5N Avionics certification, installation, and approval process established for ADS-B. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 11 Aircrew and ground personnel "see and avoid" procedures. 12b Require alternate means of detecting aircraft and informing aircrew of position, e.g., AMASS. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 11N Require certification, installation, and approval process established for ADS-B ground system. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

177	AAAL-01.3	Loss of separation assurance and Near Midair Collision (NMAC) during terminal approach due to ADS-B failure. (No other surveillance information available, i.e., no backup)	Failure on ADS-B due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course. No other surveillance information available, i.e., no backup.	Pilot/flight crew initially loses of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Terminal Approach	Near Midair Collision (NMAC)	3B	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 9a Require alternate means of detecting flying object, e.g., TCAS, ATC warning, etc. 2a Require warning lights on other aircraft to enhance “see and avoid” separation 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, malfunctions. 10N Require all aircraft that can become hazards to navigation be equipped with ADS-B transmitters, or other appropriate automated means of identification. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 11N Require certification, installation, and approval process established for ADS-B ground system. 5N Avionics certification, installation, and approval process established for ADS-B.

178	AAAL-01.4	Loss of separation assurance and Near Midair Collision (NMAC) during terminal approach due to ADS-B failure. (No other surveillance information available, i.e., no backup)	Failure on ADS-B due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course. No other surveillance information available, i.e., no backup.	Pilot/flight crew initially loses of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Terminal Approach	Near Midair Collision (NMAC)	3B	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 9a Require alternate means of detecting flying object, e.g., TCAS, ATC warning, etc. 2a Require warning lights on other aircraft to enhance “see and avoid” separation 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, malfunctions. 10N Require all aircraft that can become hazards to navigation be equipped with ADS-B transmitters, or other appropriate automated means of identification. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 11N Require certification, installation, and approval process established for ADS-B ground system. 5N Avionics certification, installation, and approval process established for ADS-B.

Automatic Dependent Surveillance Broadcast (ADS-B)

179	AAAL-01.5	Loss of separation assurance and Near Midair Collision (NMAC) during terminal approach due to ADS-B failure. (No other surveillance information available, i.e., no backup)	Failure on ADS-B due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course. No other surveillance information available, i.e., no backup.	Pilot/flight crew initially loses of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Terminal Approach	Near Midair Collision (NMAC)	3B	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 9a Require alternate means of detecting flying object, e.g., TCAS, ATC warning, etc. 2a Require warning lights on other aircraft to enhance “see and avoid” separation 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, malfunctions. 10N Require all aircraft that can become hazards to navigation be equipped with ADS-B transmitters, or other appropriate automated means of identification. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 11N Require certification, installation, and approval process established for ADS-B ground system. 5N Avionics certification, installation, and approval process established for ADS-B.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

184	SR-01.3	Loss of separation assurance and Near Midair Collision (NMAC) during terminal approach due to intentional security intrusion, i.e., intentional "jamming" of ADS-B signal.	Intentional "jamming" of ADS-B signal. Aircraft on collision course.	Pilot/flight crew initially loses of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Terminal Approach	Near Midair Collision (NMAC)	3B	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 9c Require alternate means of detecting other aircraft, e.g., TCAS, ATC warning, etc. 2a Require warning lights on other aircraft to enhance "see and avoid" separation 16 Design ADS-B system to minimize the risk of security intrusion, including detectability, auditing and software protection. 15 Provide message authority verification in the design.
185	SR-01.4	Loss of separation assurance and Near Midair Collision (NMAC) during terminal approach due to intentional security intrusion, i.e., intentional "jamming" of ADS-B signal.	Intentional "jamming" of ADS-B signal. Aircraft on collision course.	Pilot/flight crew initially loses of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Terminal Approach	Near Midair Collision (NMAC)	3B	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 9c Require alternate means of detecting other aircraft, e.g., TCAS, ATC warning, etc. 2a Require warning lights on other aircraft to enhance "see and avoid" separation 16 Design ADS-B system to minimize the risk of security intrusion, including detectability, auditing and software protection. 15 Provide message authority verification in the design.

186	SR-01.5	Loss of separation assurance and Near Midair Collision (NMAC) during terminal approach due to intentional security intrusion, i.e., intentional "jamming" of ADS-B signal.	Intentional "jamming" of ADS-B signal. Aircraft on collision course.	Pilot/flight crew initially loses of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Terminal Approach	Near Midair Collision (NMAC)	3B	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 9c Require alternate means of detecting other aircraft, e.g., TCAS, ATC warning, etc. 2a Require warning lights on other aircraft to enhance "see and avoid" separation 16 Design ADS-B system to minimize the risk of security intrusion, including detectability, auditing and software protection. 15 Provide message authority verification in the design.
191	SR-02.3	Loss of separation assurance and Near Midair Collision (NMAC) due to "spoofing", i.e., hackers breach system security.	"Spoofing", i.e., hackers breach system security. Aircraft on collision course.	Pilot/flight crew initially loses of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 9c Require alternate means of detecting other aircraft, e.g., TCAS, ATC warning, etc. 2a Require warning lights on other aircraft to enhance "see and avoid" separation 16 Design ADS-B system to minimize the risk of security intrusion, including detectability, auditing and software protection. 15 Provide message authority verification in the design.

192	SR-02.4	Loss of separation assurance and Near Midair Collision (NMAC) due to "spoofing", i.e., hackers breach system security.	"Spoofing", i.e., hackers breach system security. Aircraft on collision course.	Pilot/flight crew initially loses of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 9c Require alternate means of detecting other aircraft, e.g., TCAS, ATC warning, etc. 2a Require warning lights on other aircraft to enhance "see and avoid" separation 16 Design ADS-B system to minimize the risk of security intrusion, including detectability, auditing and software protection. 15 Provide message authority verification in the design.
193	SR-02.5	Loss of separation assurance and Near Midair Collision (NMAC) due to "spoofing", i.e., hackers breach system security.	"Spoofing", i.e., hackers breach system security. Aircraft on collision course.	Pilot/flight crew initially loses of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 9c Require alternate means of detecting other aircraft, e.g., TCAS, ATC warning, etc. 2a Require warning lights on other aircraft to enhance "see and avoid" separation 16 Design ADS-B system to minimize the risk of security intrusion, including detectability, auditing and software protection. 15 Provide message authority verification in the design.

198	HF-01.3	Near Midair Collision (NMAC) due to excessive controller workload, loss of situation awareness associated with excessive display clutter.	Loss of situation awareness associated with excessive display clutter as a result of: LTA design SW malfunction HW malfunction System malfunction. Increased collision risk due to excessive controller workload. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1. 17 Human factors shall evaluate the potential controller loss of situational awareness due to excessive workload. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 16N Define criteria for determining threshold values for ADS-B coverage area to assure controller/pilot adequate situational awareness. 17N Conduct controller/pilot workload assessments to evaluate the potential for excessive workload associated with ADS-B system.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

199	HF-01.4	Near Midair Collision (NMAC) due to excessive controller workload, loss of situation awareness associated with excessive display clutter.	Loss of situation awareness associated with excessive display clutter as a result of: LTA design SW malfunction HW malfunction System malfunction. Increased collision risk due to excessive controller workload. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1. 17 Human factors shall evaluate the potential controller loss of situational awareness due to excessive workload. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 16N Define criteria for determining threshold values for ADS-B coverage area to assure controller/pilot adequate situational awareness. 17N Conduct controller/pilot workload assessments to evaluate the potential for excessive workload associated with ADS-B system.

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200	HF-01.5	Near Midair Collision (NMAC) due to excessive controller workload, loss of situation awareness associated with excessive display clutter.	Loss of situation awareness associated with excessive display clutter as a result of: LTA design SW malfunction HW malfunction System malfunction. Increased collision risk due to excessive controller workload. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1. 17 Human factors shall evaluate the potential controller loss of situational awareness due to excessive workload. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 16N Define criteria for determining threshold values for ADS-B coverage area to assure controller/pilot adequate situational awareness. 17N Conduct controller/pilot workload assessments to evaluate the potential for excessive workload associated with ADS-B system.

205	HF-02.3	Increased Near Midair Collision (NMAC) due to pilot workload, loss of situation awareness associated with excessive display clutter, i.e., and too much information.	Excessive display clutter, i.e., and too much information due to LTA design. Increased collision risk due to excessive pilot workload associated with excessive display clutter. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1. 17 Human factors shall evaluate the potential controller loss of situational awareness due to excessive workload. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 16N Define criteria for determining threshold values for ADS-B coverage area to assure controller/pilot adequate situational awareness. 17N Conduct controller/pilot workload assessments to evaluate the potential for excessive workload associated with ADS-B system.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

206	HF-02.4	Increased Near Midair Collision (NMAC) due to pilot workload, loss of situation awareness associated with excessive display clutter, i.e., and too much information.	Excessive display clutter, i.e., and too much information due to LTA design. Increased collision risk due to excessive pilot workload associated with excessive display clutter. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1. 17 Human factors shall evaluate the potential controller loss of situational awareness due to excessive workload. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 16N Define criteria for determining threshold values for ADS-B coverage area to assure controller/pilot adequate situational awareness. 17N Conduct controller/pilot workload assessments to evaluate the potential for excessive workload associated with ADS-B system.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

207	HF-02.5	Increased Near Midair Collision (NMAC) due to pilot workload, loss of situation awareness associated with excessive display clutter, i.e., and too much information.	Excessive display clutter, i.e., and too much information due to LTA design. Increased collision risk due to excessive pilot workload associated with excessive display clutter. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1. 17 Human factors shall evaluate the potential controller loss of situational awareness due to excessive workload. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 16N Define criteria for determining threshold values for ADS-B coverage area to assure controller/pilot adequate situational awareness. 17N Conduct controller/pilot workload assessments to evaluate the potential for excessive workload associated with ADS-B system.
212	HF-03.3	Loss of separation assurance and Near Midair Collision (NMAC) due to erroneous “future intent” messages, due pilot input error.	Erroneous “future intent” messages, due pilot input error. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	18 Design ADS-B CHI to minimize the potential for human error. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 16N Define criteria for determining threshold values for ADS-B coverage area to assure controller/pilot adequate situational awareness. 17N Conduct controller/pilot workload assessments to evaluate the potential for excessive workload associated with ADS-B system.

213	HF-03.4	Loss of separation assurance and Near Midair Collision (NMAC) due to erroneous "future intent" messages, due pilot input error.	Erroneous "future intent" messages, due pilot input error. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	18 Design ADS-B CHI to minimize the potential for human error. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 16N Define criteria for determining threshold values for ADS-B coverage area to assure controller/pilot adequate situational awareness. 17N Conduct controller/pilot workload assessments to evaluate the potential for excessive workload associated with ADS-B system.
214	HF-03.5	Loss of separation assurance and Near Midair Collision (NMAC) due to erroneous "future intent" messages, due pilot input error.	Erroneous "future intent" messages, due pilot input error. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	18 Design ADS-B CHI to minimize the potential for human error. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 16N Define criteria for determining threshold values for ADS-B coverage area to assure controller/pilot adequate situational awareness. 17N Conduct controller/pilot workload assessments to evaluate the potential for excessive workload associated with ADS-B system.

218	HF-04.3	Inappropriate or erroneous communication due to language barrier results in loss of situational awareness and increased Near Midair Collision (NMAC) risk.	Inappropriate communication or erroneous communication associated with ADS-B due to: LTA design LTA procedure LTA consideration of language use. Miss communication occurs. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	70 Design ADS-B for use in international communication in accordance with acceptable human factors design practices (e.g., IACO standard symbology??) 75 Provide alternate means of communication, i.e., Voice backup. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS.
229	HF-04.4	Inappropriate or erroneous communication due to language barrier results in loss of situational awareness and increased Near Midair Collision (NMAC) risk.	Inappropriate communication or erroneous communication associated with ADS-B due to: LTA design LTA procedure LTA consideration of language use. Miss communication occurs. 1. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	70 Design ADS-B for use in international communication in accordance with acceptable human factors design practices (e.g., IACO standard symbology??) 75 Provide alternate means of communication, i.e., Voice backup. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS.

220	HF-04.5	Inappropriate or erroneous communication due to language barrier results in loss of situational awareness and near increased Near Midair Collision (NMAC) risk.	Inappropriate communication or erroneous communication associated with ADS-B due to: LTA design LTA procedure LTA consideration of language use. Miss communication occurs. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	70 Design ADS-B for use in international communication in accordance with acceptable human factors design practices (e.g., IACO standard symbology??) 75 Provide alternate means of communication, i.e., Voice backup. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS.
225	HF-05.3	Inappropriate or erroneous communication due to language barrier results in loss of situational awareness and increased Near Midair Collision (NMAC) risk between aircraft and ground vehicle.	Inappropriate communication or erroneous communication associated with ADS-B due to: LTA design LTA procedure LTA consideration of language use. Miss communication occurs. Aircraft and ground vehicle on collision course.	Initial pilot/flight crew/controller/driver loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	70 Design ADS-B for use in international communication in accordance with acceptable human factors design practices (e.g., IACO standard symbology??) 75 Provide alternate means of communication, i.e., Voice backup. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 8N Require alternate means of detecting ground vehicles, i.e. ASDE-X. 7N Require all ground vehicles that can become hazards to ground navigation be equipped with ADS-B transmitters, or other appropriate means of identification.

226	HF-05.4	Inappropriate or erroneous communication due to language barrier results in loss of situational awareness and increased collision near risk between aircraft and ground vehicle.	Inappropriate communication or erroneous communication associated with ADS-B due to: LTA design LTA procedure LTA consideration of language use. Miss communication occurs. Aircraft and ground vehicle on collision course.	Initial pilot/flight crew/controller/driver loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	70 Design ADS-B for use in international communication in accordance with acceptable human factors design practices (e.g., IACO standard symbology??) 75 Provide alternate means of communication, i.e., Voice backup. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 8N Require alternate means of detecting ground vehicles, i.e. ASDE-X. 7N Require all ground vehicles that can become hazards to ground navigation be equipped with ADS-B transmitters, or other appropriate means of identification.
227	HF-05.5	Inappropriate or erroneous communication due to language barrier results in loss of situational awareness and increased Near Midair Collision (NMAC) risk between aircraft and ground vehicle.	Inappropriate communication or erroneous communication associated with ADS-B due to: LTA design LTA procedure LTA consideration of language use. Miss communication occurs. Aircraft and ground vehicle on collision course.	Initial pilot/flight crew/controller/driver loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	70 Design ADS-B for use in international communication in accordance with acceptable human factors design practices (e.g., IACO standard symbology??) 75 Provide alternate means of communication, i.e., Voice backup. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 8N Require alternate means of detecting ground vehicles, i.e. ASDE-X. 7N Require all ground vehicles that can become hazards to ground navigation be equipped with ADS-B transmitters, or other appropriate means of identification.

231	HF-06.3	Inappropriate or erroneous communication due to less than adequate CHI design results in loss of situational awareness and increased Near Midair Collision (NMAC) risk between aircraft.	Inappropriate communication or erroneous communication associated with ADS-B due to LTA CHI design. Miss communication occurs. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	6 Design in accordance with FAA CT-96/1 69 Design ADS-B CHI to minimize the potential for human error. 70 Design ADS-B for use in international communication in accordance with acceptable human factors design practices (e.g., IACO standard symbology??) 75 Provide alternate means of communication, i.e., Voice backup. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g.
232	HF-06.4	Inappropriate or erroneous communication due to less than adequate CHI design results in loss of situational awareness and increased Near Midair Collision (NMAC) risk between aircraft.	Inappropriate communication or erroneous communication associated with ADS-B due to LTA CHI design. Miss communication occurs. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	6 Design in accordance with FAA CT-96/1 69 Design ADS-B CHI to minimize the potential for human error. 70 Design ADS-B for use in international communication in accordance with acceptable human factors design practices (e.g., IACO standard symbology??) 75 Provide alternate means of communication, i.e., Voice backup. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g.

233	HF-06.5	Inappropriate or erroneous communication due to less than adequate CHI design results in loss of situational awareness and increased Near Midair Collision (NMAC) risk between aircraft.	Inappropriate communication or erroneous communication associated with ADS-B due to LTA CHI design. Miss communication occurs. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	6 Design in accordance with FAA CT-96/1 69 Design ADS-B CHI to minimize the potential for human error. 70 Design ADS-B for use in international communication in accordance with acceptable human factors design practices (e.g., IACO standard symbology??) 75 Provide alternate means of communication, i.e., Voice backup. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g.
238	HF.07.3	Inappropriate or erroneous communication due to less than adequate CHI design results in loss of situational awareness and increased Near Midair Collision (NMAC) risk between aircraft and ground vehicle.	Inappropriate communication or erroneous communication associated with ADS-B due to LTA CHI design. Miss communication occurs. Aircraft and vehicle on collision course.	Initial pilot/flight crew/controller/driver loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	6 Design in accordance with FAA CT-96/1 69 Design ADS-B CHI to minimize the potential for human error. 70 Design ADS-B for use in international communication in accordance with acceptable human factors design practices (e.g., IACO standard symbology??) 75 Provide alternate means of communication, i.e., Voice backup. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g.

239	HF.07.4	Inappropriate or erroneous communication due to less than adequate CHI design results in loss of situational awareness and increased Near Midair Collision (NMAC) risk between aircraft and ground vehicle.	Inappropriate communication or erroneous communication associated with ADS-B due to LTA CHI design. Miss communication occurs. Aircraft and vehicle on collision course.	Initial pilot/flight crew/controller/driver loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	6 Design in accordance with FAA CT-96/1 69 Design ADS-B CHI to minimize the potential for human error. 70 Design ADS-B for use in international communication in accordance with acceptable human factors design practices (e.g., IACO standard symbology??) 75 Provide alternate means of communication, i.e., Voice backup. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g.
240	HF.07.5	Inappropriate or erroneous communication due to less than adequate CHI design results in loss of situational awareness and increased Near Midair Collision (NMAC) risk between aircraft and ground vehicle.	Inappropriate communication or erroneous communication associated with ADS-B due to LTA CHI design. Miss communication occurs. Aircraft and vehicle on collision course.	Initial pilot/flight crew/controller/driver loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	6 Design in accordance with FAA CT-96/1 69 Design ADS-B CHI to minimize the potential for human error. 70 Design ADS-B for use in international communication in accordance with acceptable human factors design practices (e.g., IACO standard symbology??) 75 Provide alternate means of communication, i.e., Voice backup. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g.

245	SA-01.3	Inappropriate clearance given as a result of erroneous flight data in Data Block, i.e., ACID, ALTITUDE, POSITION, HEADING, etc caused by loss of data integrity. Scenario results in Near Midair Collision (NMAC).	Loss of data integrity due to system anomaly. Inappropriate clearance given as a result of erroneous flight data. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	76 Design ADS-B system to include end-to-end data integrity check functionality and provide proper notification if data corruption is detected 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness.
246	SA-01.4	Inappropriate clearance given as a result of erroneous flight data in Data Block, i.e., ACID, ALTITUDE, POSITION, HEADING, etc caused by loss of data integrity. Scenario results in Near Midair Collision (NMAC).	Loss of data integrity due to system anomaly. Inappropriate clearance given as a result of erroneous flight data. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	76 Design ADS-B system to include end-to-end data integrity check functionality and provide proper notification if data corruption is detected 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness.
247	SA-01.5	Inappropriate clearance given as a result of erroneous flight data in Data Block, i.e., ACID, ALTITUDE, POSITION, HEADING, etc caused by loss of data integrity. Scenario results in Near Midair Collision (NMAC).	Loss of data integrity due to system anomaly. Inappropriate clearance given as a result of erroneous flight data. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	76 Design ADS-B system to include end-to-end data integrity check functionality and provide proper notification if data corruption is detected 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness.

252	SA-02.3	Loss of separation assurance and Near Midair Collision (NMAC) during terminal approach due to frequency saturation i.e., is their sufficient bandwidth to accommodate all aircraft in a terminal environment?	Loss of ADS-B associated with some aircraft as a result of frequency saturation due to LTA bandwidth. Loss of target identification. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	19 Allocate appropriate bandwidth to accommodate current and projected traffic growth. 20 Select transmission frequencies with enough bandwidth to accommodate the allocation. 21 Alternate means of separation assurance must be provided. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness.
253	SA-02.4	Loss of separation assurance and Near Midair Collision (NMAC) during terminal approach due to frequency saturation i.e., is their sufficient bandwidth to accommodate all aircraft in a terminal environment?	Loss of ADS-B associated with some aircraft as a result of frequency saturation due to LTA bandwidth. Loss of target identification. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	19 Allocate appropriate bandwidth to accommodate current and projected traffic growth. 20 Select transmission frequencies with enough bandwidth to accommodate the allocation. 21 Alternate means of separation assurance must be provided. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness.
254	SA-02.5	Loss of separation assurance and Near Midair Collision (NMAC) during terminal approach due to frequency saturation i.e., is their sufficient bandwidth to accommodate all aircraft in a terminal environment?	Loss of ADS-B associated with some aircraft as a result of frequency saturation due to LTA bandwidth. Loss of target identification. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	19 Allocate appropriate bandwidth to accommodate current and projected traffic growth. 20 Select transmission frequencies with enough bandwidth to accommodate the allocation. 21 Alternate means of separation assurance must be provided. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness.
259	SA-03.3	Loss of separation assurance and Near Midair Collision (NMAC) due to insufficient range of ADS-B on approaching aircraft.	Insufficient range of ADS-B on approaching aircraft due to LTA design. Loss of target identification. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Approach, Landing	Near Midair Collision (NMAC)	3B	74 Ensure that both aircraft are equipped for the application. 9b Provide alternate means of detection and collision avoidance. 16N Define criteria for determining threshold values for ADS-B coverage area to assure controller/pilot adequate situational awareness. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness.

260	SA-03.4	Loss of separation assurance and Near Midair Collision (NMAC) due to insufficient range of ADS-B on approaching aircraft.	Insufficient range of ADS-B on approaching aircraft due to LTA design. Loss of target identification. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Approach, Landing	Near Midair Collision (NMAC)	3B	74 Ensure that both aircraft are equipped for the application. 9b Provide alternate means of detection and collision avoidance. 16N Define criteria for determining threshold values for ADS-B coverage area to assure controller/pilot adequate situational awareness. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness.
261	SA-03.5	Loss of separation assurance and Near Midair Collision (NMAC) due to insufficient range of ADS-B on approaching aircraft.	Insufficient range of ADS-B on approaching aircraft due to LTA design. Loss of target identification. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Approach, Landing	Near Midair Collision (NMAC)	3B	74 Ensure that both aircraft are equipped for the application. 9b Provide alternate means of detection and collision avoidance. 16N Define criteria for determining threshold values for ADS-B coverage area to assure controller/pilot adequate situational awareness. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness.
266	SA-04.3	Possible increased Near Midair Collision (NMAC) risk due to ADS-B system calibration deviation. Scenario addresses many aircraft.	ADS-B system calibration deviation due to LTA design. Deviation results in “ghosting”, “masking”, inappropriate target identification, or loss of target. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	22a Require periodic recalibration of ADS-B inputs, processing system and displays. 23 Consider automated system for recalibration of ADS-B systems. 24 Provide a design requirement for system –wide calibration of ADS-B. 25 Provide built-in test capability in the system to identify and report when the system is out of calibration. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness.
267	SA-04.4	Possible increased Near Midair Collision (NMAC) risk due to ADS-B system calibration deviation. Scenario addresses many aircraft.	ADS-B system calibration deviation due to LTA design. Deviation results in “ghosting”, “masking”, inappropriate target identification, or loss of target. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	22a Require periodic recalibration of ADS-B inputs, processing system and displays. 23 Consider automated system for recalibration of ADS-B systems. 24 Provide a design requirement for system –wide calibration of ADS-B. 25 Provide built-in test capability in the system to identify and report when the system is out of calibration. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

268	SA-04.5	Possible increased Near Midair Collision (NMAC) risk due to ADS-B system calibration deviation. Scenario addresses many aircraft.	ADS-B system calibration deviation due to LTA design. Deviation results in "ghosting", "masking", inappropriate target identification, or loss of target. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	22a Require periodic recalibration of ADS-B inputs, processing system and displays. 23 Consider automated system for recalibration of ADS-B systems. 24 Provide a design requirement for system –wide calibration of ADS-B. 25 Provide built-in test capability in the system to identify and report when the system is out of calibration. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness.
272	SA-05.3	Common Mode failures in ADS-B that could result in loss of separation assurance and collision.	Common Mode failures due to LTA redundancy within design. Loss of ADS-B associated with some aircraft as a result of Common Mode failures. Loss of target identification. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 27 Design the system to assure that dual independent component failure, dual human errors, or a combination of a component failure and a human error cannot cause a catastrophic event. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 9c Require alternate means of detecting other aircraft, e.g., TCAS, ATC warning, etc. 2a Require warning lights on other aircraft to enhance "see and avoid" separation.

273	SA-05.4	Common Mode failures in ADS-B that could result in loss of separation assurance and collision.	Common Mode failures due to LTA redundancy within design. Loss of ADS-B associated with some aircraft as a result of Common Mode failures. Loss of target identification. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 27 Design the system to assure that dual independent component failure, dual human errors, or a combination of a component failure and a human error cannot cause a catastrophic event. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 9c Require alternate means of detecting other aircraft, e.g., TCAS, ATC warning, etc. 2a Require warning lights on other aircraft to enhance “see and avoid” separation.

274	SA-05.5	Common Mode failures in ADS-B that could result in loss of separation assurance and collision.	Common Mode failures due to LTA redundancy within design. Loss of ADS-B associated with some aircraft as a result of Common Mode failures. Loss of target identification. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 27 Design the system to assure that dual independent component failure, dual human errors, or a combination of a component failure and a human error cannot cause a catastrophic event. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 9c Require alternate means of detecting other aircraft, e.g., TCAS, ATC warning, etc. 2a Require warning lights on other aircraft to enhance “see and avoid” separation.
279	SA-06.3	Loss of separation and Near Midair Collision (NMAC) due to common software anomaly.	Common software anomaly due to: LTA design SW malfunction System malfunction Human error. Anomaly results in “ghosting”, “masking”, inappropriate target identification, or loss of target. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2) 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 18N Design Software in accordance with Advisory Circular 20-115B. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

280	SA-06.4	Loss of separation and Near Midair Collision (NMAC) due to common software anomaly.	Common software anomaly due to: LTA design SW malfunction System malfunction Human error. Anomaly results in “ghosting”, “masking”, inappropriate target identification, or loss of target. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2) 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 18N Design Software in accordance with Advisory Circular 20-115B. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.
281	SA-06.5	Loss of separation and Near Midair Collision (NMAC) due to common software anomaly.	Common software anomaly due to: LTA design SW malfunction System malfunction Human error. Anomaly results in “ghosting”, “masking”, inappropriate target identification, or loss of target. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2) 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 18N Design Software in accordance with Advisory Circular 20-115B. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

286	SA-07.3	Common cause failure in ADS-B results in loss of transmission and consequent collision.	Common cause failures due to: LTA design SW malfunction System malfunction Human error. Loss of ADS-B associated with some aircraft as a result of Common cause failures. Loss of target identification. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2) 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

287	SA-07.4	Common cause failure in ADS-B results in loss of transmission and consequent collision.	Common cause failures due to: LTA design SW malfunction System malfunction Human error. Loss of ADS-B associated with some aircraft as a result of Common cause failures. Loss of target identification. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2) 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

288	SA-07.5	Common cause failure in ADS-B results in loss of transmission and consequent collision.	Common cause failures due to: LTA design SW malfunction System malfunction Human error. Loss of ADS-B associated with some aircraft as a result of Common cause failures. Loss of target identification. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2) 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.
293	SA-08.3	Loss of separation integrity due to delay in transmitting data results in collision.	Delay in transmitting data as a result of: Latency within design SW bandwidth SW malfunction System malfunction LTA design. Loss of ADS-B associated with some aircraft as a result of transmission delay. Loss of target identification. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	28 Provide for appropriate latency budget for ADS-B system. 29 Design the system to assure that potential for delay is minimized. 30 Design the system to monitor time delays and eliminate bad data. 31 Provide design to identify latency delays and indicate those anomaly. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

294	SA-08.4	Loss of separation integrity due to delay in transmitting data results in collision.	Delay in transmitting data as a result of: Latency within design SW bandwidth SW malfunction System malfunction LTA design. Loss of ADS-B associated with some aircraft as a result of transmission delay. Loss of target identification. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	28 Provide for appropriate latency budget for ADS-B system. 29 Design the system to assure that potential for delay is minimized. 30 Design the system to monitor time delays and eliminate bad data. 31 Provide design to identify latency delays and indicate those anomaly. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.
295	SA-08.5	Loss of separation integrity due to delay in transmitting data results in collision.	Delay in transmitting data as a result of: Latency within design SW bandwidth SW malfunction System malfunction LTA design. Loss of ADS-B associated with some aircraft as a result of transmission delay. Loss of target identification. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	28 Provide for appropriate latency budget for ADS-B system. 29 Design the system to assure that potential for delay is minimized. 30 Design the system to monitor time delays and eliminate bad data. 31 Provide design to identify latency delays and indicate those anomaly. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

300	SA-09.3	Possible increased Near Midair Collision (NMAC) risk due to ADS-B system calibration error.	ADS-B system calibration error. Deviation results in “ghosting”, “masking”, inappropriate target identification, or loss of target. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	22a Require periodic recalibration of ADS-B inputs, processing system and displays. 23 Consider automated system for recalibration of ADS-B systems. 24 Provide a design requirement for system –wide calibration of ADS-B. 25 Provide built-in test capability in the system to identify and report when the system is out of calibration. 76 Require periodic recalibration of ADS-B inputs, processing system and transmitter.
301	SA-09.4	Possible increased Near Midair Collision (NMAC) risk due to ADS-B system calibration error.	ADS-B system calibration error. Deviation results in “ghosting”, “masking”, inappropriate target identification, or loss of target. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	22a Require periodic recalibration of ADS-B inputs, processing system and displays. 23 Consider automated system for recalibration of ADS-B systems. 24 Provide a design requirement for system –wide calibration of ADS-B. 25 Provide built-in test capability in the system to identify and report when the system is out of calibration. 76 Require periodic recalibration of ADS-B inputs, processing system and transmitter.
302	SA-09.5	Possible increased Near Midair Collision (NMAC) risk due to ADS-B system calibration error.	ADS-B system calibration error. Deviation results in “ghosting”, “masking”, inappropriate target identification, or loss of target. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	22a Require periodic recalibration of ADS-B inputs, processing system and displays. 23 Consider automated system for recalibration of ADS-B systems. 24 Provide a design requirement for system –wide calibration of ADS-B. 25 Provide built-in test capability in the system to identify and report when the system is out of calibration. 76 Require periodic recalibration of ADS-B inputs, processing system and transmitter.

307	SA-10.3	ADS-B system malfunction occurs and the ground controller does not detect it. Scenario results in Near Midair Collision (NMAC).	ADS-B system malfunction occurs. Loss of or inappropriate target identification. Maintenance does not detect malfunction, or is unable to communicate malfunction in time to controller. Controller does not detect malfunction. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	72 Design reliable built-in test capability. 73 Design system to determine data validity. 32 Provide alternate means of providing functionality. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.
308	SA-10.4	ADS-B system malfunction occurs and the ground controller does not detect it. Scenario results in Near Midair Collision (NMAC).	ADS-B system malfunction occurs. Loss of or inappropriate target identification. Maintenance does not detect malfunction, or is unable to communicate malfunction in time to controller. Controller does not detect malfunction. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	72 Design reliable built-in test capability. 73 Design system to determine data validity. 32 Provide alternate means of providing functionality. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

309	SA-10.5	ADS-B system malfunction occurs and the ground controller does not detect it. Scenario results in Near Midair Collision (NMAC).	ADS-B system malfunction occurs. Loss of or inappropriate target identification. Maintenance does not detect malfunction, or is unable to communicate malfunction in time to controller. Controller does not detect malfunction. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	72 Design reliable built-in test capability. 73 Design system to determine data validity. 32 Provide alternate means of providing functionality. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.
314	SA-11.3	ADS-B system malfunction occurs and the pilot does not detect it. Scenario results in Near Midair Collision (NMAC).	ADS-B system malfunction occurs. Loss of or inappropriate target identification. Maintenance does not detect malfunction, or is unable to communicate malfunction in time to controller. Pilot/flight crew/ Controller does not detect malfunction. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	72 Design reliable built-in test capability. 73 Design system to determine data validity. 32 Provide alternate means of providing functionality. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

315	SA-11.4	ADS-B system malfunction occurs and the pilot does not detect it. Scenario results in Near Midair Collision (NMAC).	ADS-B system malfunction occurs. Loss of or inappropriate target identification. Maintenance does not detect malfunction, or is unable to communicate malfunction in time to controller. Pilot/flight crew/ Controller does not detect malfunction. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	72 Design reliable built-in test capability. 73 Design system to determine data validity. 32 Provide alternate means of providing functionality. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.
316	SA-11.5	ADS-B system malfunction occurs and the pilot does not detect it. Scenario results in Near Midair Collision (NMAC).	ADS-B system malfunction occurs. Loss of or inappropriate target identification. Maintenance does not detect malfunction, or is unable to communicate malfunction in time to controller. Pilot/flight crew/ Controller does not detect malfunction. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	72 Design reliable built-in test capability. 73 Design system to determine data validity. 32 Provide alternate means of providing functionality. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

321	SA-12.3	Erroneous malfunction indication to pilot. Scenario results in Near Midair Collision (NMAC).	ADS-B is functional. Erroneous malfunction indication occurs due to: SW error Human error System error Design error. Aircraft not on collision course. Pilot/flight crew takes inappropriate action as a result of indication. Aircraft now on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	33a Design the system to minimize false alarms. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.
322	SA-12.4	Erroneous malfunction indication to pilot. Scenario results in Near Midair Collision (NMAC).	ADS-B is functional. Erroneous malfunction indication occurs due to: SW error Human error System error Design error. Aircraft not on collision course. Pilot/flight crew takes inappropriate action as a result of indication. Aircraft now on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	33a Design the system to minimize false alarms. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.

323	SA-12.5	Erroneous malfunction indication to pilot. Scenario results in Near Midair Collision (NMAC).	ADS-B is functional. Erroneous malfunction indication occurs due to: SW error Human error System error Design error. Aircraft not on collision course. Pilot/flight crew takes inappropriate action as a result of indication. Aircraft now on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	33a Design the system to minimize false alarms. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.
328	SA-13.3	Erroneous malfunction indication to controller. Scenario results in Near Midair Collision (NMAC).	ADS-B is functional. Erroneous malfunction indication occurs due to: SW error Human error System error Design error. Aircraft not on collision course. Controller takes inappropriate action as a result of indication. Pilot/flight crew takes inappropriate action. Aircraft now on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	33a Design the system to minimize false alarms. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.

329	SA-13.4	Erroneous malfunction indication to controller. Scenario results in Near Midair Collision (NMAC).	ADS-B is functional. Erroneous malfunction indication occurs due to: SW error Human error System error Design error. Aircraft not on collision course. Controller takes inappropriate action as a result of indication. Pilot/flight crew takes inappropriate action. Aircraft now on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	33a Design the system to minimize false alarms. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.
330	SA-13.5	Erroneous malfunction indication to controller. Scenario results in Near Midair Collision (NMAC).	ADS-B is functional. Erroneous malfunction indication occurs due to: SW error Human error System error Design error. Aircraft not on collision course. Controller takes inappropriate action as a result of indication. Pilot/flight crew takes inappropriate action. Aircraft now on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	33a Design the system to minimize false alarms. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.

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335	SA-14.3	Erroneous turn indication due to ADS-B system forecast error. Scenario results in Near Midair Collision (NMAC). Aircraft initially not on collision course.	Erroneous turn indication due to ADS-B system forecast error. Forecasting error occurs due to: SW malfunction HW malfunction System malfunction LTA design Design error. Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result of turn indication. Aircraft now on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	34 Design forecasting algorithms with sufficient margins of safety. 33b Design the system to minimize the potential for false alarms. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.

336	SA-14.4	Erroneous turn indication due to ADS-B system forecast error. Scenario results in Near Midair Collision (NMAC). Aircraft initially not on collision course.	Erroneous turn indication due to ADS-B system forecast error. Forecasting error occurs due to: SW malfunction HW malfunction System malfunction LTA design Design error. Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result of turn indication. Aircraft now on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	34 Design forecasting algorithms with sufficient margins of safety. 33b Design the system to minimize the potential for false alarms. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.

337	SA-14.5	Erroneous turn indication due to ADS-B system forecast error. Scenario results in Near Midair Collision (NMAC). Aircraft initially not on collision course.	Erroneous turn indication due to ADS-B system forecast error. Forecasting error occurs due to: SW malfunction HW malfunction System malfunction LTA design Design error. Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result of turn indication. Aircraft now on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	34 Design forecasting algorithms with sufficient margins of safety. 33b Design the system to minimize the potential for false alarms. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.

341	SA-15.3	Erroneous turn indication due to ADS-B system forecast error. Scenario results in Near Midair Collision (NMAC). Aircraft initially on collision course.	Erroneous turn indication due to ADS-B system forecast error. Forecasting error occurs due to: SW malfunction HW malfunction System malfunction LTA design Design error. Aircraft on collision course. Pilot/flight crew/controller takes inappropriate action as a result of turn indication. Aircraft remains on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	34 Design forecasting algorithms with sufficient margins of safety. 33b Design the system to minimize the potential for false alarms. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.

342	SA-15.4	Erroneous turn indication due to ADS-B system forecast error. Scenario results in Near Midair Collision (NMAC). Aircraft initially on collision course.	Erroneous turn indication due to ADS-B system forecast error. Forecasting error occurs due to: SW malfunction HW malfunction System malfunction LTA design Design error. Aircraft on collision course. Pilot/flight crew/controller takes inappropriate action as a result of turn indication. Aircraft remains on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	34 Design forecasting algorithms with sufficient margins of safety. 33b Design the system to minimize the potential for false alarms. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.

343	SA-15.5	Erroneous turn indication due to ADS-B system forecast error. Scenario results in Near Midair Collision (NMAC). Aircraft initially on collision course.	Erroneous turn indication due to ADS-B system forecast error. Forecasting error occurs due to: SW malfunction HW malfunction System malfunction LTA design Design error. Aircraft on collision course. Pilot/flight crew/controller takes inappropriate action as a result of turn indication. Aircraft remains on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	34 Design forecasting algorithms with sufficient margins of safety. 33b Design the system to minimize the potential for false alarms. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.

348	SA-16.3	Erroneous turn indication due to ADS-B system malfunction. Scenario results in Near Midair Collision (NMAC). Aircraft initially not on collision course.	Erroneous turn indication due to ADS-B system malfunction. Forecasting error occurs due to: SW malfunction HW malfunction System malfunction LTA design Design error. Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result of turn indication. Aircraft now on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	34 Design forecasting algorithms with sufficient margins of safety. 33b Design the system to minimize the potential for false alarms. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.

349	SA-16.4	Erroneous turn indication due to ADS-B system malfunction. Scenario results in Near Midair Collision (NMAC). Aircraft initially not on collision course.	Erroneous turn indication due to ADS-B system malfunction. Forecasting error occurs due to: SW malfunction HW malfunction System malfunction LTA design Design error. Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result of turn indication. Aircraft now on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	34 Design forecasting algorithms with sufficient margins of safety. 33b Design the system to minimize the potential for false alarms. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.

350	SA-16.5	Erroneous turn indication due to ADS-B system malfunction. Scenario results in Near Midair Collision (NMAC). Aircraft initially not on collision course.	Erroneous turn indication due to ADS-B system malfunction. Forecasting error occurs due to: SW malfunction HW malfunction System malfunction LTA design Design error. Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result of turn indication. Aircraft now on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	34 Design forecasting algorithms with sufficient margins of safety. 33b Design the system to minimize the potential for false alarms. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.

355	SA-17.3	Erroneous turn indication due to ADS-B system malfunction. Scenario results in Near Midair Collision (NMAC). Aircraft initially on collision course.	Erroneous turn indication due to ADS-B system malfunction. Forecasting error occurs due to: SW malfunction HW malfunction System malfunction LTA design Design error. Aircraft on collision course. Pilot/flight crew/controller takes inappropriate action as a result of turn indication. Aircraft remains on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	34 Design forecasting algorithms with sufficient margins of safety. 33b Design the system to minimize the potential for false alarms. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.

356	SA-17.4	Erroneous turn indication due to ADS-B system malfunction. Scenario results in Near Midair Collision (NMAC). Aircraft initially on collision course.	Erroneous turn indication due to ADS-B system malfunction. Forecasting error occurs due to: SW malfunction HW malfunction System malfunction LTA design Design error. Aircraft on collision course. Pilot/flight crew/controller takes inappropriate action as a result of turn indication. Aircraft remains on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	34 Design forecasting algorithms with sufficient margins of safety. 33b Design the system to minimize the potential for false alarms. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.

357	SA-17.5	Erroneous turn indication due to ADS-B system malfunction. Scenario results in Near Midair Collision (NMAC). Aircraft initially on collision course.	Erroneous turn indication due to ADS-B system malfunction. Forecasting error occurs due to: SW malfunction HW malfunction System malfunction LTA design Design error. Aircraft on collision course. Pilot/flight crew/controller takes inappropriate action as a result of turn indication. Aircraft remains on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	34 Design forecasting algorithms with sufficient margins of safety. 33b Design the system to minimize the potential for false alarms. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.
361	SA-18.3	Loss of separation assurance results in Near Midair Collision (NMAC) due to erroneous "future intent" messages, due to system malfunction.	Erroneous "future intent" messages, due to system malfunction. Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result of erroneous "future intent" message. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	34 Design forecasting algorithms with sufficient margins of safety. 33b Design the system to minimize the potential for false alarms. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

362	SA-18.4	Loss of separation assurance results in Near Midair Collision (NMAC) due to erroneous "future intent" messages, due to system malfunction.	Erroneous "future intent" messages, due to system malfunction. Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result of erroneous "future intent" message. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	34 Design forecasting algorithms with sufficient margins of safety. 33b Design the system to minimize the potential for false alarms. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.
363	SA-18.5	Loss of separation assurance results in Near Midair Collision (NMAC) due to erroneous "future intent" messages, due to system malfunction.	Erroneous "future intent" messages, due to system malfunction. Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result of erroneous "future intent" message. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	34 Design forecasting algorithms with sufficient margins of safety. 33b Design the system to minimize the potential for false alarms. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.

368	SA-19.3	Display information conflict between ground displays and airborne displays due to ADS-B system malfunction results in Near Midair Collision (NMAC).	Display information conflict due to ADS-B system malfunction. Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result of information conflict. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	35 Design the system to minimize the potential for conflict between the ground displays and airborne displays. 36 Design the system to detect and report conflicts in information between ground and airborne displays. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.
369	SA-19.4	Display information conflict between ground displays and airborne displays due to ADS-B system malfunction results in Near Midair Collision (NMAC).	Display information conflict due to ADS-B system malfunction. Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result of information conflict. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	35 Design the system to minimize the potential for conflict between the ground displays and airborne displays. 36 Design the system to detect and report conflicts in information between ground and airborne displays. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.

370	SA-19.5	Display information conflict between ground displays and airborne displays due to ADS-B system malfunction results in Near Midair Collision (NMAC).	Display information conflict due to ADS-B system malfunction. Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result of information conflict. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	35 Design the system to minimize the potential for conflict between the ground displays and airborne displays. 36 Design the system to detect and report conflicts in information between ground and airborne displays. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.
375	SA-20.3	Erroneous position data (latitude-longitude) due to system malfunction resulting in loss of separation and Near Midair Collision (NMAC).	Erroneous position data (latitude-longitude) due to system malfunction. Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result erroneous position data. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	37 Require independent method of validating position data. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.

376	SA-20.4	Erroneous position data (latitude-longitude) due to system malfunction resulting in loss of separation and Near Midair Collision (NMAC).	Erroneous position data (latitude-longitude) due to system malfunction. Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result erroneous position data. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	37 Require independent method of validating position data. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.
377	SA-20.5	Erroneous position data (latitude-longitude) due to system malfunction resulting in loss of separation and Near Midair Collision (NMAC).	Erroneous position data (latitude-longitude) due to system malfunction. Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result erroneous position data. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	37 Require independent method of validating position data. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.

382	SA-21.3	Erroneous velocity data (speed and direction) due to system malfunction resulting in loss of separation and Near Midair Collision (NMAC).	Erroneous velocity data (speed and direction) due to system malfunction. Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result erroneous position data. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	38 Require independent method of validating velocity data. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.
383	SA-21.4	Erroneous velocity data (speed and direction) due to system malfunction resulting in loss of separation and Near Midair Collision (NMAC).	Erroneous velocity data (speed and direction) due to system malfunction. Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result erroneous position data. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	38 Require independent method of validating velocity data. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.

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384	SA-21.5	Erroneous velocity data (speed and direction) due to system malfunction resulting in loss of separation and Near Midair Collision (NMAC).	Erroneous velocity data (speed and direction) due to system malfunction. Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result erroneous position data. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	38 Require independent method of validating velocity data. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.
388	SA-22.3	Data conflict between airspeed and velocity data results in erroneous data to be transmitted, (i.e., which one do you believe?), as a result of system malfunction. Scenario results in Near Midair Collision (NMAC).	Data conflict between airspeed and velocity data results in erroneous data to be transmitted as a result of system malfunction. Erroneous data transmitted to controller or pilot. Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result erroneous position data. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	39 Design the system to minimize the potential for conflict between airspeed and velocity data. 40 Design the system to detect and indicate a discrepancy between airspeed and calculated velocity. 38 Require independent method of validating velocity data. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.

389	SA-22.4	Data conflict between airspeed and velocity data results in erroneous data to be transmitted, (i.e., which one do you believe?), as a result of system malfunction. Scenario results in Near Midair Collision (NMAC).	Data conflict between airspeed and velocity data results in erroneous data to be transmitted as a result of system malfunction. Erroneous data transmitted to controller or pilot. Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result erroneous position data. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	39 Design the system to minimize the potential for conflict between airspeed and velocity data. 40 Design the system to detect and indicate a discrepancy between airspeed and calculated velocity. 38 Require independent method of validating velocity data. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.

390	SA-22.5	Data conflict between airspeed and velocity data results in erroneous data to be transmitted, (i.e., which one do you believe?), as a result of system malfunction. Scenario results in Near Midair Collision (NMAC).	Data conflict between airspeed and velocity data results in erroneous data to be transmitted as a result of system malfunction. Erroneous data transmitted to controller or pilot. Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result erroneous position data. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	39 Design the system to minimize the potential for conflict between airspeed and velocity data. 40 Design the system to detect and indicate a discrepancy between airspeed and calculated velocity. 38 Require independent method of validating velocity data. 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.
394	SA-23.3	Barometric Altitude Rate error causes loss of separation in terminal approach sequencing. Scenario results in Near Midair Collision (NMAC).	Barometric Altitude Rate error due to: Instrument malfunction Human error System malfunction. Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result of Barometric Altitude Rate error. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	41 Design system to detect and indicate erroneous barometric altitude rate errors before transmitting through ADS-B. 42 Provide independent means of validating Barometric altitude rate changes. 43 Provide contingency training to assure situational awareness and acclimation of ADS-B during terminal phase descent. 5N Avionics certification, installation, and approval process established for ADS-B. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.

395	SA-23.4	Barometric Altitude Rate error causes loss of separation in terminal approach sequencing. Scenario results in Near Midair Collision (NMAC).	Barometric Altitude Rate error due to: Instrument malfunction Human error System malfunction. Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result of Barometric Altitude Rate error. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	41 Design system to detect and indicate erroneous barometric altitude rate errors before transmitting through ADS-B. 42 Provide independent means of validating Barometric altitude rate changes. 43 Provide contingency training to assure situational awareness and acclimation of ADS-B during terminal phase descent. 5N Avionics certification, installation, and approval process established for ADS-B. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.
396	SA-23.5	Barometric Altitude Rate error causes loss of separation in terminal approach sequencing. Scenario results in Near Midair Collision (NMAC).	Barometric Altitude Rate error due to: Instrument malfunction Human error System malfunction. Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result of Barometric Altitude Rate error. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	41 Design system to detect and indicate erroneous barometric altitude rate errors before transmitting through ADS-B. 42 Provide independent means of validating Barometric altitude rate changes. 43 Provide contingency training to assure situational awareness and acclimation of ADS-B during terminal phase descent. 5N Avionics certification, installation, and approval process established for ADS-B. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.

400	SA-24.3	Barometric Altitude Rate error on own aircraft causes false alarm on receiving aircraft. Scenario results in Near Midair Collision (NMAC).	Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result of false alarm. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	33b Design the system to minimize the potential for false alarms. 41 Design system to detect and indicate erroneous barometric altitude rate errors before transmitting through ADS-B. 42 Provide independent means of validating Barometric altitude rate changes. 43 Provide contingency training to assure situational awareness and acclimation of ADS-B during terminal phase descent. 5N Avionics certification, installation, and approval process established for ADS-B. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.
401	SA-24.4	Barometric Altitude Rate error on own aircraft causes false alarm on receiving aircraft. Scenario results in Near Midair Collision (NMAC).	Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result of false alarm. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	33b Design the system to minimize the potential for false alarms. 41 Design system to detect and indicate erroneous barometric altitude rate errors before transmitting through ADS-B. 42 Provide independent means of validating Barometric altitude rate changes. 43 Provide contingency training to assure situational awareness and acclimation of ADS-B during terminal phase descent. 5N Avionics certification, installation, and approval process established for ADS-B. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.

402	SA-24.5	Barometric Altitude Rate error on own aircraft causes false alarm on receiving aircraft. Scenario results in Near Midair Collision (NMAC).	Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result of false alarm. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	33b Design the system to minimize the potential for false alarms. 41 Design system to detect and indicate erroneous barometric altitude rate errors before transmitting through ADS-B. 42 Provide independent means of validating Barometric altitude rate changes. 43 Provide contingency training to assure situational awareness and acclimation of ADS-B during terminal phase descent. 5N Avionics certification, installation, and approval process established for ADS-B. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.
407	SA-25.3	Barometric Altitude error on own aircraft causes false alarm on receiving aircraft. Scenario results in Near Midair Collision (NMAC).	Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result of false alarm. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	33b Design the system to minimize the potential for false alarms. 46 Provide alternate means of collision avoidance such as TCAS, or MSAW. 41 Design system to detect and indicate erroneous barometric altitude rate errors before transmitting through ADS-B. 42 Provide independent means of validating Barometric altitude rate changes. 43 Provide contingency training to assure situational awareness and acclimation of ADS-B during terminal phase descent. 5N Avionics certification, installation, and approval process established for ADS-B. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

408	SA-25.4	Barometric Altitude error on own aircraft causes false alarm on receiving aircraft. Scenario results in Near Midair Collision (NMAC).	Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result of false alarm. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	33b Design the system to minimize the potential for false alarms. 46 Provide alternate means of collision avoidance such as TCAS, or MSAW. 41 Design system to detect and indicate erroneous barometric altitude rate errors before transmitting through ADS-B. 42 Provide independent means of validating Barometric altitude rate changes. 43 Provide contingency training to assure situational awareness and acclimation of ADS-B during terminal phase descent. 5N Avionics certification, installation, and approval process established for ADS-B. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.

409	SA-25.5	Barometric Altitude error on own aircraft causes false alarm on receiving aircraft. Scenario results in Near Midair Collision (NMAC).	Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result of false alarm. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	33b Design the system to minimize the potential for false alarms. 46 Provide alternate means of collision avoidance such as TCAS, or MSAW. 41 Design system to detect and indicate erroneous barometric altitude rate errors before transmitting through ADS-B. 42 Provide independent means of validating Barometric altitude rate changes. 43 Provide contingency training to assure situational awareness and acclimation of ADS-B during terminal phase descent. 5N Avionics certification, installation, and approval process established for ADS-B. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness.

414	SA-26.3	Position error on own aircraft causes false alarm on receiving aircraft. Scenario results in Near Midair Collision (NMAC).	Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result of false alarm. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	4 Design ADS-B airborne system to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 9c Require alternate means of detecting other aircraft, e.g., TCAS, ATC warning, etc. 2a Require warning lights on other aircraft to enhance “see and avoid” separation. 43 Provide contingency training to assure situational awareness and acclimation of ADS-B during terminal phase descent. 5N Avionics certification, installation, and approval process established for ADS-B. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 33b Design the system to minimize the potential for false alarms.

415	SA-26.4	Position error on own aircraft causes false alarm on receiving aircraft. Scenario results in Near Midair Collision (NMAC).	Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result of false alarm. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	4 Design ADS-B airborne system to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 9c Require alternate means of detecting other aircraft, e.g., TCAS, ATC warning, etc. 2a Require warning lights on other aircraft to enhance “see and avoid” separation. 43 Provide contingency training to assure situational awareness and acclimation of ADS-B during terminal phase descent. 5N Avionics certification, installation, and approval process established for ADS-B. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 33b Design the system to minimize the potential for false alarms.

416	SA-26.5	Position error on own aircraft causes false alarm on receiving aircraft. Scenario results in Near Midair Collision (NMAC).	Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result of false alarm. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	4 Design ADS-B airborne system to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 9c Require alternate means of detecting other aircraft, e.g., TCAS, ATC warning, etc. 2a Require warning lights on other aircraft to enhance “see and avoid” separation. 43 Provide contingency training to assure situational awareness and acclimation of ADS-B during terminal phase descent. 5N Avionics certification, installation, and approval process established for ADS-B. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g. 13N Design display symbology and coding to minimize the potential for confusion, HMI, and to enhance situational awareness. 33b Design the system to minimize the potential for false alarms.

Automatic Dependent Surveillance Broadcast (ADS-B)

421	SA-27.3	ADS-B malfunction caused by COTS or NDI results in system anomaly. Scenario results in Near Midair Collision (NMAC).	ADS-B malfunction occurs due to the integration of COTS or NDI. COTS or NDI introduce anomalies due to: LTA suitability for use LTA reliability LTA availability System malfunction HW malfunction SW malfunction. Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result anomaly. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	47 Design ADS-B system architecture to ensure failure isolation of COTS and NDI hardware, firmware, and software. 48a Design ADS-B system architecture to ensure that COTS and NDI hardware, firmware and software fails safe. 49 Provide COTS and NDI hardware, firmware, and software discriminators TBD. 18N Design Software in accordance with Advisory Circular 20-115B. 5N Avionics certification, installation, and approval process established for ADS-B. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g.

422	SA-27.4	ADS-B malfunction caused by COTS or NDI results in system anomaly. Scenario results in Near Midair Collision (NMAC).	ADS-B malfunction occurs due to the integration of COTS or NDI. COTS or NDI introduce anomalies due to: LTA suitability for use LTA reliability LTA availability System malfunction HW malfunction SW malfunction. Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result anomaly. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	47 Design ADS-B system architecture to ensure failure isolation of COTS and NDI hardware, firmware, and software. 48a Design ADS-B system architecture to ensure that COTS and NDI hardware, firmware and software fails safe. 49 Provide COTS and NDI hardware, firmware, and software discriminators TBD. 18N Design Software in accordance with Advisory Circular 20-115B. 5N Avionics certification, installation, and approval process established for ADS-B. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g.

423	SA-27.5	ADS-B malfunction caused by COTS or NDI results in system anomaly. Scenario results in Near Midair Collision (NMAC).	ADS-B malfunction occurs due to the integration of COTS or NDI. COTS or NDI introduce anomalies due to: LTA suitability for use LTA reliability LTA availability System malfunction HW malfunction SW malfunction. Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result anomaly. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	47 Design ADS-B system architecture to ensure failure isolation of COTS and NDI hardware, firmware, and software. 48a Design ADS-B system architecture to ensure that COTS and NDI hardware, firmware and software fails safe. 49 Provide COTS and NDI hardware, firmware, and software discriminators TBD. 18N Design Software in accordance with Advisory Circular 20-115B. 5N Avionics certification, installation, and approval process established for ADS-B. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 12N System operational modes shall be clearly displayed to the operators in accordance with MIL Handbook - 760 and similar requirement FAA-G-2100g.
427	SA-28.3	Failure propagation results in loss of ADS-B. Scenario results in Near Midair Collision (NMAC).	Loss of ADS-B associated with some aircraft. Loss of target identification. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	50 Design ADS-B system architecture to ensure failure isolation of hardware. 48b Design ADS-B system architecture to ensure that hardware, firmware and software fails safe. 27 Design the system to assure that dual independent component failure, dual human errors, or a combination of a component failure and a human error cannot cause a catastrophic event. 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

428	SA-28.4	Failure propagation results in loss of ADS-B. Scenario results in Near Midair Collision (NMAC).	Loss of ADS-B associated with some aircraft. Loss of target identification. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	50 Design ADS-B system architecture to ensure failure isolation of hardware. 48b Design ADS-B system architecture to ensure that hardware, firmware and software fails safe. 27 Design the system to assure that dual independent component failure, dual human errors, or a combination of a component failure and a human error cannot cause a catastrophic event. 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.
429	SA-28.5	Failure propagation results in loss of ADS-B. Scenario results in Near Midair Collision (NMAC).	Loss of ADS-B associated with some aircraft. Loss of target identification. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	50 Design ADS-B system architecture to ensure failure isolation of hardware. 48b Design ADS-B system architecture to ensure that hardware, firmware and software fails safe. 27 Design the system to assure that dual independent component failure, dual human errors, or a combination of a component failure and a human error cannot cause a catastrophic event. 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.
436	SA-29.3	Failure propagation results in erroneous message indication. Scenario results in Near Midair Collision (NMAC).	Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result of erroneous message indication. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	52 Design ADS-B system architecture to ensure failure isolation of hardware, firmware, and software. 48b Design ADS-B system architecture to ensure that hardware, firmware and software fails safe. 27 Design the system to assure that dual independent component failure, dual human errors, or a combination of a component failure and a human error cannot cause a catastrophic event. 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

437	SA-29.4	Failure propagation results in erroneous message indication. Scenario results in Near Midair Collision (NMAC).	Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result of erroneous message indication. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	52 Design ADS-B system architecture to ensure failure isolation of hardware, firmware, and software. 48b Design ADS-B system architecture to ensure that hardware, firmware and software fails safe. 27 Design the system to assure that dual independent component failure, dual human errors, or a combination of a component failure and a human error cannot cause a catastrophic event. 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.
438	SA-29.5	Failure propagation results in erroneous message indication. Scenario results in Near Midair Collision (NMAC).	Aircraft not on collision course. Pilot/flight crew/controller takes inappropriate action as a result of erroneous message indication. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	52 Design ADS-B system architecture to ensure failure isolation of hardware, firmware, and software. 48b Design ADS-B system architecture to ensure that hardware, firmware and software fails safe. 27 Design the system to assure that dual independent component failure, dual human errors, or a combination of a component failure and a human error cannot cause a catastrophic event. 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.
442	SA-30.3	Possible increased collision risk due to ADS-B system calibration deviation. Miscalibration is on single aircraft. Scenario results in Near Midair Collision (NMAC).	ADS-B system calibration deviation due to LTA design. Deviation results in “ghosting”, “masking”, inappropriate target identification, or loss of target. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	22b Require periodic recalibration of all airborne ADS-B systems. 25 Provide built-in test capability in the system to identify and report when the system is out of calibration. 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

443	SA-30.4	Possible increased collision risk due to ADS-B system calibration deviation. Miscalibration is on single aircraft. Scenario results in Near Midair Collision (NMAC).	ADS-B system calibration deviation due to LTA design. Deviation results in "ghosting", "masking", inappropriate target identification, or loss of target. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	22b Require periodic recalibration of all airborne ADS-B systems. 25 Provide built-in test capability in the system to identify and report when the system is out of calibration. 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.
444	SA-30.5	Possible increased collision risk due to ADS-B system calibration deviation. Miscalibration is on single aircraft. Scenario results in Near Midair Collision (NMAC).	ADS-B system calibration deviation due to LTA design. Deviation results in "ghosting", "masking", inappropriate target identification, or loss of target. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near Midair Collision (NMAC)	3B	22b Require periodic recalibration of all airborne ADS-B systems. 25 Provide built-in test capability in the system to identify and report when the system is out of calibration. 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.
449	LTAD-01.3	Loss of data integrity due to delay in transmitting data due to LTA design. Scenario addresses Transmitter Latency. Scenario results in near midair collision (NMAC).	Delay in transmitting data as a result of: Latency within design LTA design. Loss of ADS-B associated with some aircraft as a result of transmission delay. Loss of target identification. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near midair collision (NMAC)	3B	54 Design Transmitter/Receiver to meet Latency Requirements of NAS-SR-1000. 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

450	LTAD-01.4	Loss of data integrity due to delay in transmitting data due to LTA design. Scenario addresses Transmitter Latency. Scenario results in collision.	Delay in transmitting data as a result of: Latency within design LTA design. Loss of ADS-B associated with some aircraft as a result of transmission delay. Loss of target identification. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near midair collision (NMAC)	3B	54 Design Transmitter/Receiver to meet Latency Requirements of NAS-SR-1000. 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.
451	LTAD-01.5	Loss of data integrity due to delay in transmitting data due to LTA design. Scenario addresses Transmitter Latency. Scenario results in near midair collision (NMAC).	Delay in transmitting data as a result of: Latency within design LTA design. Loss of ADS-B associated with some aircraft as a result of transmission delay. Loss of target identification. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near midair collision (NMAC)	3B	54 Design Transmitter/Receiver to meet Latency Requirements of NAS-SR-1000. 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

456	LTAD-02.3	Loss of data integrity due to communication link latency errors between the airborne and ground receiving/processing systems. Scenario results in near midair collision (NMAC).	Communication link latency errors between the airborne and ground receiving/processing systems due to latency within design: SW bandwidth SW malfunction System malfunction LTA design. Loss of ADS-B associated with some aircraft as a result of transmission delay. Loss of target identification. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near midair collision (NMAC)	3B	55 Design Communication link to meet latency Requirements of NAS-SR-1000. 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.
457	LTAD-02.4	Loss of data integrity due to communication link latency errors between the airborne and ground receiving/processing systems. Scenario results in near midair collision (NMAC).	Communication link latency errors between the airborne and ground receiving/processing systems due to latency within design: SW bandwidth SW malfunction System malfunction LTA design. Loss of ADS-B associated with some aircraft as a result of transmission delay. Loss of target identification. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near midair collision (NMAC)	3B	55 Design Communication link to meet latency Requirements of NAS-SR-1000. 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

458	LTAD-02.5	Loss of data integrity due to communication link latency errors between the airborne and ground receiving/processing systems. Scenario results in near midair collision (NMAC).	Communication link latency errors between the airborne and ground receiving/processing systems due to latency within design: SW bandwidth SW malfunction System malfunction LTA design. Loss of ADS-B associated with some aircraft as a result of transmission delay. Loss of target identification. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near midair collision (NMAC)	3B	55 Design Communication link to meet latency Requirements of NAS-SR-1000. 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.
463	LTAD-03.3	Loss of separation due to time delay in ground processing system. (UPDATE RATE). Scenario results in near midair collision (NMAC).	Time delay in ground processing system, (UPDATE RATE), due to: SW bandwidth SW malfunction System malfunction LTA design. Pilot/flight crew/controller takes inappropriate action as a result of outdated target information, delay in target updating. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near midair collision (NMAC)	3B	56. Design application processing system to meet Latency Requirements of NAS-SR –1000. 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

464	LTAD-03.4	Loss of separation due to time delay in ground processing system. (UPDATE RATE). Scenario results in near midair collision (NMAC).	Time delay in ground processing system, (UPDATE RATE), due to: SW bandwidth SW malfunction System malfunction LTA design. Pilot/flight crew/controller takes inappropriate action as a result of outdated target information, delay in target updating. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near midair collision (NMAC)	3B	56. Design application processing system to meet Latency Requirements of NAS-SR –1000. 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.
465	LTAD-03.5	Loss of separation due to time delay in ground processing system. (UPDATE RATE). Scenario results in near midair collision (NMAC).	Time delay in ground processing system, (UPDATE RATE), due to: SW bandwidth SW malfunction System malfunction LTA design. Pilot/flight crew/controller takes inappropriate action as a result of outdated target information, delay in target updating. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near midair collision (NMAC)	3B	56. Design application processing system to meet Latency Requirements of NAS-SR –1000. 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

470	EE-01.3	Reduced safety margins due to weather effects on ADS-B which cause temporary "blind spots". Scenario results in near midair collision (NMAC).	"Blind spots" contribute to loss of target information. Pilot/flight crew/controller takes inappropriate action as a result of loss of target information. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near midair collision (NMAC)	3B	57 Select frequency spectrum to minimize adverse effects of weather on ADS-B transmissions 58 Consider alternative frequency spectrum as backup. 59 Design ground stations to minimize damage due to lightning or other adverse weather effect. 7 Provide for appropriate ATC/Aircrew contingency procedures. 2b Require all aircraft to be equipped with appropriate lighting to enhance "see and avoid" separation. 11 Aircrew and ground personnel "see and avoid" procedures. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness.
471	EE-01.4	Reduced safety margins due to weather effects on ADS-B which cause temporary "blind spots". Scenario results in near midair collision (NMAC).	"Blind spots" contribute to loss of target information. Pilot/flight crew/controller takes inappropriate action as a result of loss of target information. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near midair collision (NMAC)	3B	57 Select frequency spectrum to minimize adverse effects of weather on ADS-B transmissions 58 Consider alternative frequency spectrum as backup. 59 Design ground stations to minimize damage due to lightning or other adverse weather effect. 7 Provide for appropriate ATC/Aircrew contingency procedures. 2b Require all aircraft to be equipped with appropriate lighting to enhance "see and avoid" separation. 11 Aircrew and ground personnel "see and avoid" procedures. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness.

Automatic Dependent Surveillance Broadcast (ADS-B)

472	EE-015	Reduced safety margins due to weather effects on ADS-B which cause temporary "blind spots". Scenario results in near midair collision (NMAC).	"Blind spots" contribute to loss of target information. Pilot/flight crew/controller takes inappropriate action as a result of loss of target information. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near midair collision (NMAC)	3B	57 Select frequency spectrum to minimize adverse effects of weather on ADS-B transmissions 58 Consider alternative frequency spectrum as backup. 59 Design ground stations to minimize damage due to lightning or other adverse weather effect. 7 Provide for appropriate ATC/Aircrew contingency procedures. 2b Require all aircraft to be equipped with appropriate lighting to enhance "see and avoid" separation. 11 Aircrew and ground personnel "see and avoid" procedures. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness.
474	**EE-02**	Loss of ADS-B Ground Station due to natural environmental effects such as solar flares, Gamma Rays, and/ or other related electromagnetic anomalies, such as EMI/EMC).	Loss of ADS-B Ground Station due to natural environmental effects.	Pilot/flight crew/controller maintain situational awareness. Aircraft identified via radar or other sources. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Loss of ADS-B.	3B	60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

479	LTAD-02.3 NS	Due to less than adequate design, there is conflicting information communicated to the aircrew. This information addresses redundant flight critical information that is associated with an emergency. This can possibly lead to confusion, delayed response to the emergency situation and possible increased collision risk.	Due to less than adequate design, there is conflicting information communicated to the aircrew. An emergency condition exists. Pilot/flight crew/controller takes inappropriate action as a result of conflicting information. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near midair collision (NMAC)	3B	61b Conduct analysis, studies, simulations and/or flight tests to identify system safety related risks associated with human factors related to possible conflicting communication. 62 Conduct analysis, studies, simulations and/or flight tests to develop engineering requirements to eliminate or control the system risks to an acceptable level. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 16N Define criteria for determining threshold values for ADS-B coverage area to assure controller/pilot adequate situational awareness. 17N Conduct controller/pilot workload assessments to evaluate the potential for excessive workload associated with ADS-B system.
480	LTAD-02.4 NS	Due to less than adequate design, there is conflicting information communicated to the aircrew. This information addresses redundant flight critical information that is associated with an emergency. This can possibly lead to confusion, delayed response to the emergency situation and possible near midair collision (NMAC) risk.	Due to less than adequate design, there is conflicting information communicated to the aircrew. An emergency condition exists. Pilot/flight crew/controller takes inappropriate action as a result of conflicting information. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near midair collision (NMAC)	3B	61b Conduct analysis, studies, simulations and/or flight tests to identify system safety related risks associated with human factors related to possible conflicting communication. 62 Conduct analysis, studies, simulations and/or flight tests to develop engineering requirements to eliminate or control the system risks to an acceptable level. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 16N Define criteria for determining threshold values for ADS-B coverage area to assure controller/pilot adequate situational awareness. 17N Conduct controller/pilot workload assessments to evaluate the potential for excessive workload associated with ADS-B system.

481	LTAD-02.5 NS	Due to less than adequate design, there is conflicting information communicated to the aircrew. This information addresses redundant flight critical information that is associated with an emergency. This can possibly lead to confusion, delayed response to the emergency situation and possible near midair collision (NMAC) risk.	Due to less than adequate design, there is conflicting information communicated to the aircrew. An emergency condition exists. Pilot/flight crew/controller takes inappropriate action as a result of conflicting information. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near midair collision (NMAC)	3B	61b Conduct analysis, studies, simulations and/or flight tests to identify system safety related risks associated with human factors related to possible conflicting communication. 62 Conduct analysis, studies, simulations and/or flight tests to develop engineering requirements to eliminate or control the system risks to an acceptable level. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 16N Define criteria for determining threshold values for ADS-B coverage area to assure controller/pilot adequate situational awareness. 17N Conduct controller/pilot workload assessments to evaluate the potential for excessive workload associated with ADS-B system.
486	SA-01.3 NS	Due to system anomaly, there is conflicting information communicated to the aircrew. This information addresses redundant flight critical information that is associated with an emergency. This can possibly lead to confusion, delayed response to the emergency situation and possible near midair collision (NMAC) risk.	Due to system anomaly, there is conflicting information communicated to the aircrew. Pilot/flight crew/controller takes inappropriate action as a result of conflicting information. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near midair collision (NMAC)	3B	63 Conduct analysis, studies, simulations and/or flight tests to identify system safety related risks associated with system anomalies that could cause conflicting flight critical information to be communicated. 64 Conduct analysis, studies, simulations and/or flight tests to develop engineering requirements to minimize system anomalies that result from conflicting information. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 16N Define criteria for determining threshold values for ADS-B coverage area to assure controller/pilot adequate situational awareness. 17N Conduct controller/pilot workload assessments to evaluate the potential for excessive workload associated with ADS-B system.

487	SA-01.4 NS	Due to system anomaly, there is conflicting information communicated to the aircrew. This information addresses redundant flight critical information that is associated with an emergency. This can possibly lead to confusion, delayed response to the emergency situation and possible near midair collision (NMAC) risk.	Due to system anomaly, there is conflicting information communicated to the aircrew. Pilot/flight crew/controller takes inappropriate action as a result of conflicting information. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near midair collision (NMAC)	3B	63 Conduct analysis, studies, simulations and/or flight tests to identify system safety related risks associated with system anomalies that could cause conflicting flight critical information to be communicated. 64 Conduct analysis, studies, simulations and/or flight tests to develop engineering requirements to minimize system anomalies that result from conflicting information. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 16N Define criteria for determining threshold values for ADS-B coverage area to assure controller/pilot adequate situational awareness. 17N Conduct controller/pilot workload assessments to evaluate the potential for excessive workload associated with ADS-B system.
488	SA-01.5 NS	Due to system anomaly, there is conflicting information communicated to the aircrew. This information addresses redundant flight critical information that is associated with an emergency. This can possibly lead to confusion, delayed response to the emergency situation and possible near midair collision (NMAC) risk.	Due to system anomaly, there is conflicting information communicated to the aircrew. Pilot/flight crew/controller takes inappropriate action as a result of conflicting information. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near midair collision (NMAC)	3B	63 Conduct analysis, studies, simulations and/or flight tests to identify system safety related risks associated with system anomalies that could cause conflicting flight critical information to be communicated. 64 Conduct analysis, studies, simulations and/or flight tests to develop engineering requirements to minimize system anomalies that result from conflicting information. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 16N Define criteria for determining threshold values for ADS-B coverage area to assure controller/pilot adequate situational awareness. 17N Conduct controller/pilot workload assessments to evaluate the potential for excessive workload associated with ADS-B system.

493	SA-02.3 NS	Due to system anomaly, there is conflicting information communicated to the air traffic controller. This information addresses redundant flight critical information that is associated with an emergency. This can possibly lead to confusion, delayed response to the emergency situation and possible near midair collision (NMAC) risk.	Aircraft not on collision course. Due to system anomaly, there is conflicting information communicated to the air traffic controller. Pilot/flight crew/controller takes inappropriate action as a result of conflicting information. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near midair collision (NMAC)	3B	63 Conduct analysis, studies, simulations and/or flight tests to identify system safety related risks associated with system anomalies that could cause conflicting flight critical information to be communicated. 64 Conduct analysis, studies, simulations and/or flight tests to develop engineering requirements to minimize system anomalies that result from conflicting information. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 16N Define criteria for determining threshold values for ADS-B coverage area to assure controller/pilot adequate situational awareness. 17N Conduct controller/pilot workload assessments to evaluate the potential for excessive workload associated with ADS-B system.
494	SA-02.4 NS	Due to system anomaly, there is conflicting information communicated to the air traffic controller. This information addresses redundant flight critical information that is associated with an emergency. This can possibly lead to confusion, delayed response to the emergency situation and possible near midair collision (NMAC) risk.	Aircraft not on collision course. Due to system anomaly, there is conflicting information communicated to the air traffic controller. Pilot/flight crew/controller takes inappropriate action as a result of conflicting information. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near midair collision (NMAC)	3B	63 Conduct analysis, studies, simulations and/or flight tests to identify system safety related risks associated with system anomalies that could cause conflicting flight critical information to be communicated. 64 Conduct analysis, studies, simulations and/or flight tests to develop engineering requirements to minimize system anomalies that result from conflicting information. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 16N Define criteria for determining threshold values for ADS-B coverage area to assure controller/pilot adequate situational awareness. 17N Conduct controller/pilot workload assessments to evaluate the potential for excessive workload associated with ADS-B system.

495	SA-02.5 NS	Due to system anomaly, there is conflicting information communicated to the air traffic controller. This information addresses redundant flight critical information that is associated with an emergency. This can possibly lead to confusion, delayed response to the emergency situation and possible near midair collision (NMAC) risk.	Aircraft not on collision course. Due to system anomaly, there is conflicting information communicated to the air traffic controller. Pilot/flight crew/controller takes inappropriate action as a result of conflicting information. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near midair collision (NMAC)	3B	63 Conduct analysis, studies, simulations and/or flight tests to identify system safety related risks associated with system anomalies that could cause conflicting flight critical information to be communicated. 64 Conduct analysis, studies, simulations and/or flight tests to develop engineering requirements to minimize system anomalies that result from conflicting information. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 16N Define criteria for determining threshold values for ADS-B coverage area to assure controller/pilot adequate situational awareness. 17N Conduct controller/pilot workload assessments to evaluate the potential for excessive workload associated with ADS-B system.
501	CP-01.3	Less than adequate contingency planning results in possible increased collision risk due to confusion over responsibility for separation assurance in a shared responsibility environment.	Less than adequate contingency planning during tests and system development. Responsibility for separation assurance not fully defined between pilot/flight crew/controller for all possible contingencies. Pilot/flight crew/controller takes inappropriate action as result confusion over responsibility. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near midair collision (NMAC)	3B	65 Develop “rules of the road” 66 Develop appropriate aircrew procedures to accommodate any possible contingency situation 67 Develop appropriate controller procedures to accommodate any possible contingency situation 68 Develop appropriate training materials and training programs to ensure that all participants in a shared responsibility environment understand their role and safe operation procedures.

502	CP-01.4	Less than adequate contingency planning results in possible increased collision risk due to confusion over responsibility for separation assurance in a shared responsibility environment.	Less than adequate contingency planning during tests and system development. Responsibility for separation assurance not fully defined between pilot/flight crew/controller for all possible contingencies. Pilot/flight crew/controller takes inappropriate action as result confusion over responsibility. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near midair collision (NMAC)	3B	65 Develop "rules of the road" 66 Develop appropriate aircrew procedures to accommodate any possible contingency situation 67 Develop appropriate controller procedures to accommodate any possible contingency situation 68 Develop appropriate training materials and training programs to ensure that all participants in a shared responsibility environment understand their role and safe operation procedures.
503	CP-01.5	Less than adequate contingency planning results in possible increased collision risk due to confusion over responsibility for separation assurance in a shared responsibility environment.	Less than adequate contingency planning during tests and system development. Responsibility for separation assurance not fully defined between pilot/flight crew/controller for all possible contingencies. Pilot/flight crew/controller takes inappropriate action as result confusion over responsibility. Aircraft on collision course.	Initial pilot/flight crew/controller loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew regains situational awareness. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Near midair collision (NMAC)	3B	65 Develop "rules of the road" 66 Develop appropriate aircrew procedures to accommodate any possible contingency situation 67 Develop appropriate controller procedures to accommodate any possible contingency situation 68 Develop appropriate training materials and training programs to ensure that all participants in a shared responsibility environment understand their role and safe operation procedures.

Automatic Dependent Surveillance Broadcast (ADS-B)

506	ISA1-01.1	Near Midair Collision (NMAC) of subject aircraft due to ADS-B malfunction and TCAS-I malfunction.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-I malfunction due to: Above malfunctions. Aircraft on collision course. TIS not helpful in situation.	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC)	3B	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 19N Design TIS to integrate with ADS-B and provide redundant alert against collision risk. 19Na Design TCAS-I to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

509	ISA1-02.1	Near Midair Collision (NMAC) of subject aircraft due to ADS-B malfunction and conflicting information on CDTI, TCAS, or TIS.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Conflicting information on CDTI, TCAS, or TIS, due to LTA design or malfunction. Aircraft on collision course.	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC)	3B	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 5Nc Avionics certification, installation, and approval process established for ADS-B with CDTI. 19N Design TIS to integrate with ADS-B and provide redundant alert against collision risk. 19Na Design TCAS-I to integrate with ADS-B and provide redundant alert against collision risk. 20N Design CDTI, TCAS, and TIS to integrate with ADS-B, provide redundancy, and minimize conflicting information communicated in cockpit. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

512	ISA1-03.1	Near Midair Collision (NMAC) of subject aircraft due to malfunction of Conflict Avoidance.	Malfunction of Conflict Avoidance due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course.	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC)	3B	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 5Nc Avionics certification, installation, and approval process established for ADS-B with CDTI. 19Na Design TCAS-I to integrate with ADS-B and provide redundant alert against collision risk. 20N Design CDTI, TCAS, and TIS to integrate with ADS-B, provide redundancy, and minimize conflicting information communicated in cockpit. 21N Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failure of Conflict Avoidance function. 22N Design system to minimize the potential for failure of Conflict Avoidance function. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

Automatic Dependent Surveillance Broadcast (ADS-B)

515	ISA2.01.1	Near Midair Collision (NMAC) of subject aircraft due to ADS-B malfunction and TCAS-I malfunction.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-I malfunction due to: Above malfunctions. Aircraft on collision course.	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Emergency.	Near Midair Collision (NMAC)	3B	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 19Na Design TCAS-I to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

Automatic Dependent Surveillance Broadcast (ADS-B)

520	ISA3.01.1	Near Midair Collision (NMAC) of subject aircraft due to ADS-B malfunction and TCAS-II malfunction, causing error in recommended vertical escape maneuver indication.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-II malfunction causing error in recommended vertical escape maneuver indication due to: Above malfunctions. Aircraft on collision course.	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Emergency.	Near Midair Collision (NMAC)	3B	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 21Na Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failure of, or error in, recommended vertical escape maneuver indication. 22Na Design system to minimize the potential for failure of, or error in, recommended vertical escape maneuver indication. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

Automatic Dependent Surveillance Broadcast (ADS-B)

523	ISA3.01.4	Near Midair Collision (NMAC) of subject aircraft due to ADS-B malfunction and TCAS-II malfunction.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-II malfunction due to: Above malfunctions. Aircraft on collision course.	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Emergency.	Near Midair Collision (NMAC)	3B	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

Automatic Dependent Surveillance Broadcast (ADS-B)

527	ISA3.01.8	Near Midair Collision (NMAC) of subject aircraft due to ADS-B malfunction and conflicting information on CDTI, TCAS, or TIS.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Conflicting information on CDTI, TCAS, or TIS due to: Above malfunctions. Aircraft on collision course	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Emergency.	Near Midair Collision (NMAC)	3B	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 19N Design TIS to integrate with ADS-B and provide redundant alert against collision risk. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 20N Design CDTI, TCAS, and TIS to integrate with ADS-B, provide redundancy, and minimize conflicting information communicated in cockpit. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

529	ISA4.01.1	Near Midair Collision (NMAC) of subject aircraft due to ADS-B malfunction and TCAS-II malfunction.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-II malfunction due to: Above malfunctions. Aircraft on collision course.	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Emergency.	Near Midair Collision (NMAC)	3B	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

Automatic Dependent Surveillance Broadcast (ADS-B)

532	ISA4.01.4	Near Midair Collision (NMAC) of subject aircraft due to ADS-B malfunction and conflicting information on CDTI.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Conflicting information on CDTI due to: Above malfunctions. Aircraft on collision course	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Emergency.	Near Midair Collision (NMAC)	3B	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 20Na Design CDTI to integrate with ADS-B, provide redundancy, and minimize conflicting information communicated in cockpit. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

Automatic Dependent Surveillance Broadcast (ADS-B)

534	**ISB1.01**	Loss of separation assurance due to ADS-B malfunction results in collision. TCAS-I or TIS or CDTI malfunction contributes to loss of separation.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-I or TIS or CDTI malfunction due to similar malfunctions indicated above. Aircraft progress towards loss of separation.	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Loss of separation.	3B	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 5Nc Avionics certification, installation, and approval process established for ADS-B with CDTI. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

Automatic Dependent Surveillance Broadcast (ADS-B)

535	ISB1.01.1	Loss of separation assurance due to ADS-B malfunction results in Near Midair Collision (NMAC). TCAS -I or TIS or CDTI malfunction contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-I or TIS or CDTI malfunction due to similar malfunctions indicated above. Aircraft progress towards Near Midair Collision (NMAC).	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC).	3B	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 5Nc Avionics certification, installation, and approval process established for ADS-B with CDTI. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

538	ISB1.01.4	Erroneous sequencing as a result of ADS-B malfunction results in Near Midair Collision (NMAC). TCAS -I or TIS or CDTI malfunction contributes to Near Midair Collision (NMAC).	Erroneous sequence indicated as a result of ADS-B malfunction, due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course due to erroneous sequence. TCAS -I or TIS or CDTI malfunction due to the above contributors.	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC).	3B	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 5Nc Avionics certification, installation, and approval process established for ADS-B with CDTI. 21Nb Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of erroneous sequencing of aircraft. 22Nb Design system to minimize the potential of erroneous sequencing of aircraft. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

Automatic Dependent Surveillance Broadcast (ADS-B)

541	ISB2.01.1	Loss of separation assurance due to ADS-B malfunction results in Near Midair Collision (NMAC). TCAS -I or CDTI malfunction contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-I or CDTI malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs.	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC).	3B	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 5Nc Avionics certification, installation, and approval process established for ADS-B with CDTI. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

544	ISB2.01.4	Erroneous sequencing as a result of ADS-B malfunction results in Near Midair Collision (NMAC). TCAS -I or CDTI malfunction contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-I or CDTI malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs.	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC).	3B	22Nb Design system to minimize the potential of erroneous sequencing of aircraft. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 5Nc Avionics certification, installation, and approval process established for ADS-B with CDTI. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

548	ISB3.01.2	Loss of separation assurance due to ADS-B malfunction results in Near Midair Collision (NMAC). TCAS –II or TIS or CDTI malfunction contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-II or TIS or CDTI malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs.	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC).	3B	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 5Nc Avionics certification, installation, and approval process established for ADS-B with CDTI. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

550	ISB3.01.4	Erroneous sequencing as a result of ADS-B malfunction results in Near Midair Collision (NMAC). TCAS -II or TIS or CDTI malfunction contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-II or TIS or CDTI malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs.	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC).	3B	22Nb Design system to minimize the potential of erroneous sequencing of aircraft. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 5Nc Avionics certification, installation, and approval process established for ADS-B with CDTI. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

Automatic Dependent Surveillance Broadcast (ADS-B)

553	ISB4.01.1	Loss of separation assurance due to ADS-B malfunction results in Near Midair Collision (NMAC). TCAS –II or CDTI malfunction contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-II or CDTI malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs.	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC).	3B	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 5Nc Avionics certification, installation, and approval process established for ADS-B with CDTI. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

Automatic Dependent Surveillance Broadcast (ADS-B)

556	ISB4.01.4	Erroneous sequencing as a result of ADS-B malfunction results in collision. TCAS -II or CDTI malfunction contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-II or CDTI malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs.	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC).	3B	22Nb Design system to minimize the potential of erroneous sequencing of aircraft 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 5Nc Avionics certification, installation, and approval process established for ADS-B with CDTI. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

Automatic Dependent Surveillance Broadcast (ADS-B)

559	ISC1.01.1	Loss of separation assurance due to ADS-B malfunction results in Near Midair Collision (NMAC). TCAS –I or TIS or CDTI malfunction contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-I or TIS or CDTI malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs.	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC).	3B	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 5Nc Avionics certification, installation, and approval process established for ADS-B with CDTI. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

Automatic Dependent Surveillance Broadcast (ADS-B)

562	ISC1.01.4	Erroneous flight path calculation as a result of ADS-B malfunction results in collision. TCAS -I or TIS or CDTI malfunction contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS -I or TIS, or CDTI malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs.	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC).	3B	22Nc Design system to minimize the potential of erroneous flight path. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 5Nc Avionics certification, installation, and approval process established for ADS-B with CDTI. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

Automatic Dependent Surveillance Broadcast (ADS-B)

565	ISC2.01.1	Loss of separation assurance due to ADS-B malfunction results in Near Midair Collision (NMAC). TCAS –I or CDTI malfunction contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-I or CDTI malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs.	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC).	3B	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 5Nc Avionics certification, installation, and approval process established for ADS-B with CDTI. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

Automatic Dependent Surveillance Broadcast (ADS-B)

568	ISC2.01.4	Erroneous flight path calculation as a result of ADS-B malfunction results in Near Midair Collision (NMAC). TCAS -I or CDTI malfunction contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS -I, or CDTI malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs.	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC).	3B	22Nc Design system to minimize the potential of erroneous flight path. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 5Nc Avionics certification, installation, and approval process established for ADS-B with CDTI. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

Automatic Dependent Surveillance Broadcast (ADS-B)

571	ISC3.01.1	Loss of separation assurance due to ADS-B malfunction results in Near Midair Collision (NMAC). TCAS –II or TIS or CDTI malfunction contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-II or TIS or CDTI malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs.	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC).	3B	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 5Nc Avionics certification, installation, and approval process established for ADS-B with CDTI. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

Automatic Dependent Surveillance Broadcast (ADS-B)

575	ISC3.01.5	Erroneous flight path calculation as a result of ADS-B malfunction results in collision. TCAS -II or TIS or CDTI malfunction contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS -II or TIS, or CDTI malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs.	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC).	3B	22Nc Design system to minimize the potential of erroneous flight path. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 5Nc Avionics certification, installation, and approval process established for ADS-B with CDTI. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

578	ISC4.01.2	Loss of separation assurance due to ADS-B malfunction results in Near Midair Collision (NMAC). TCAS –II or CDTI malfunction contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-II or CDTI malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs.	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC).	3B	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 5Nc Avionics certification, installation, and approval process established for ADS-B with CDTI. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

Automatic Dependent Surveillance Broadcast (ADS-B)

580	ISC4.01.4	Erroneous flight path calculation as a result of ADS-B malfunction results in collision. TCAS -II or CDTI malfunction contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS -II, or CDTI malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs.	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC).	3B	22Nc Design system to minimize the potential of erroneous flight path. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 5Nc Avionics certification, installation, and approval process established for ADS-B with CDTI. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

Automatic Dependent Surveillance Broadcast (ADS-B)

583	ISD1.01.1	Loss of ability of own aircraft to be seen by Class A and Class C users due to ADS-B malfunction on own aircraft. Scenario results in Near Midair Collision (NMAC) with vehicle.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Loss of target on other aircraft display. Loss of target on ground display. Aircraft or vehicle on collision course.	Pilot/flight crew and ground vehicle driver initially loses situational awareness and is not aware of collision potential. Pilot/aircrew unaware of ground vehicle. Ground vehicle identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew does regain situational awareness. See and avoid successful.	Airport surface, Taxi, Takeoff, Landing.	Near Midair Collision (NMAC) of subject aircraft with vehicle.	3B	50 Design ADS-B system architecture to ensure failure isolation of hardware. 48b Design ADS-B system architecture to ensure that hardware, firmware and software fails safe. 27 Design the system to assure that dual independent component failure, dual human errors, or a combination of a component failure and a human error cannot cause a catastrophic event. 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 23N Design system to minimize the potential of loss of targets. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 10N Require all aircraft that can become hazards to navigation be equipped with ADS-B transmitters, or other appropriate automated means of identification. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

586	ISD1.01.4	Loss of ability of own aircraft to be seen by Class A and Class C users due to ADS-B malfunction on own aircraft. Scenario results in Near Midair Collision (NMAC) with other aircraft.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Loss of target on other aircraft display. Loss of target on ground display. Aircraft on collision course.	Pilot/flight crew initially loses situational awareness and is not aware of collision potential. Pilot/aircrew unaware of other aircraft. Other aircraft identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew does regain situational awareness. See and avoid successful.	Airport surface, Taxi, Takeoff, Landing.	Near Midair Collision (NMAC) of aircraft.	3B	50 Design ADS-B system architecture to ensure failure isolation of hardware. 48b Design ADS-B system architecture to ensure that hardware, firmware and software fails safe. 27 Design the system to assure that dual independent component failure, dual human errors, or a combination of a component failure and a human error cannot cause a catastrophic event. 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 23N Design system to minimize the potential of loss of targets. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 10N Require all aircraft that can become hazards to navigation be equipped with ADS-B transmitters, or other appropriate automated means of identification. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

590	ISD2.01.2	Loss of ability of own aircraft to be seen by Class A and Class C users due to ADS-B malfunction on own aircraft. Scenario results in Near Midair Collision (NMAC) with vehicle. MFD not helpful	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Loss of target on other aircraft display. Loss of target on ground display. Aircraft or vehicle on collision course.	Pilot/flight crew and ground vehicle driver initially loses situational awareness and is not aware of collision potential. Pilot/aircrew unaware of ground vehicle. Ground vehicle identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew does regain situational awareness. See and avoid successful.	Airport surface, Taxi, Takeoff, Landing.	Near Midair Collision (NMAC) of subject aircraft with vehicle.	3B	50 Design ADS-B system architecture to ensure failure isolation of hardware. 48b Design ADS-B system architecture to ensure that hardware, firmware and software fails safe. 27 Design the system to assure that dual independent component failure, dual human errors, or a combination of a component failure and a human error cannot cause a catastrophic event. 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 23N Design system to minimize the potential of loss of targets. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 10N Require all aircraft that can become hazards to navigation be equipped with ADS-B transmitters, or other appropriate automated means of identification. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

Automatic Dependent Surveillance Broadcast (ADS-B)

592	ISD2.01.4	Loss of ability of own aircraft to be seen by Class A and Class C users due to ADS-B malfunction on own aircraft. Scenario results in Near Midair Collision (NMAC) with aircraft. MFD not helpful	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Loss of target on other aircraft display. Loss of target on ground display. Aircraft on collision course.	Pilot/flight crew initially loses situational awareness and is not aware of collision potential. Pilot/aircrew unaware of other aircraft. Other aircraft identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew does regain situational awareness. See and avoid successful.	Airport surface, Taxi, Takeoff, Landing.	Near Midair Collision (NMAC) of aircraft.	3B	50 Design ADS-B system architecture to ensure failure isolation of hardware. 48b Design ADS-B system architecture to ensure that hardware, firmware and software fails safe. 27 Design the system to assure that dual independent component failure, dual human errors, or a combination of a component failure and a human error cannot cause a catastrophic event. 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 23N Design system to minimize the potential of loss of targets. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 10N Require all aircraft that can become hazards to navigation be equipped with ADS-B transmitters, or other appropriate automated means of identification. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

595	ISD3.01.1	Loss of ability of own aircraft to be seen by Class A and Class C users due to ADS-B malfunction on own aircraft. Scenario results in Near Midair Collision (NMAC) with vehicle if TIS is useful.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Loss of target on other aircraft display. Loss of target on ground display. Aircraft or vehicle on collision course.	Pilot/flight crew and ground vehicle driver initially loses situational awareness and is not aware of collision potential. Pilot/aircrew unaware of ground vehicle. Ground vehicle identified via radar or other sources TIS. ATCT does communicate warning. Pilot/flight crew does regain situational awareness. See and avoid successful.	Airport surface, Taxi, Takeoff, Landing.	Near Midair Collision (NMAC) of subject aircraft with vehicle.	3B	50 Design ADS-B system architecture to ensure failure isolation of hardware. 48b Design ADS-B system architecture to ensure that hardware, firmware and software fails safe. 27 Design the system to assure that dual independent component failure, dual human errors, or a combination of a component failure and a human error cannot cause a catastrophic event. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 10N Require all aircraft that can become hazards to navigation be equipped with ADS-B transmitters, or other appropriate automated means of identification. 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 23N Design system to minimize the potential of loss of targets. 19N Design TIS to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

598	ISD3.01.4	Loss of ability of own aircraft to be seen by Class A and Class C users due to ADS-B malfunction on own aircraft. Scenario results in Near Midair Collision (NMAC) with aircraft if TIS is useful.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Loss of target on other aircraft display. Loss of target on ground display. Aircraft on collision course.	Pilot/flight crew initially loses situational awareness and is not aware of collision potential. Pilot/aircrew unaware of other aircraft. Other aircraft identified via radar or other sources, TIS. ATCT does communicate warning. Pilot/flight crew does regain situational awareness. See and avoid successful.	Airport surface, Taxi, Takeoff, Landing.	Near Midair Collision (NMAC) of aircraft.	3B	50 Design ADS-B system architecture to ensure failure isolation of hardware. 48b Design ADS-B system architecture to ensure that hardware, firmware and software fails safe. 27 Design the system to assure that dual independent component failure, dual human errors, or a combination of a component failure and a human error cannot cause a catastrophic event. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 10N Require all aircraft that can become hazards to navigation be equipped with ADS-B transmitters, or other appropriate automated means of identification. 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 23N Design system to minimize the potential of loss of targets. 19N Design TIS to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

Automatic Dependent Surveillance Broadcast (ADS-B)

601	ISD4.01.1	Loss of ability of own aircraft to be seen by Class A and Class C users due to ADS-B malfunction on own aircraft. Scenario results in Near Midair Collision (NMAC) with vehicle if TIS is useful.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Loss of target on other aircraft display. Loss of target on ground display. Aircraft or vehicle on collision course.	Pilot/flight crew and ground vehicle driver initially loses situational awareness and is not aware of collision potential. Pilot/aircrew unaware of ground vehicle. Ground vehicle identified via radar or other sources TIS. ATCT does communicate warning. Pilot/flight crew does regain situational awareness. See and avoid successful.	Airport surface, Taxi, Takeoff, Landing.	Near Midair Collision (NMAC) of subject aircraft with vehicle.	3B	50 Design ADS-B system architecture to ensure failure isolation of hardware. 48b Design ADS-B system architecture to ensure that hardware, firmware and software fails safe. 27 Design the system to assure that dual independent component failure, dual human errors, or a combination of a component failure and a human error cannot cause a catastrophic event. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 10N Require all aircraft that can become hazards to navigation be equipped with ADS-B transmitters, or other appropriate automated means of identification. 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 23N Design system to minimize the potential of loss of targets. 19N Design TIS to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

Automatic Dependent Surveillance Broadcast (ADS-B)

604	ISD4.01.4	Loss of ability of own aircraft to be seen by Class A and Class C users due to ADS-B malfunction on own aircraft. Scenario results in Near Midair Collision (NMAC) with aircraft if TIS is useful.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Loss of target on other aircraft display. Loss of target on ground display. Aircraft on collision course.	Pilot/flight crew initially loses situational awareness and is not aware of collision potential. Pilot/aircrew unaware of other aircraft. Other aircraft identified via radar or other sources, TIS. ATCT does communicate warning. Pilot/flight crew does regain situational awareness. See and avoid successful.	Airport surface, Taxi, Takeoff, Landing.	Near Midair Collision (NMAC) of aircraft.	3B	50 Design ADS-B system architecture to ensure failure isolation of hardware. 48b Design ADS-B system architecture to ensure that hardware, firmware and software fails safe. 27 Design the system to assure that dual independent component failure, dual human errors, or a combination of a component failure and a human error cannot cause a catastrophic event. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 10N Require all aircraft that can become hazards to navigation be equipped with ADS-B transmitters, or other appropriate automated means of identification. 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 23N Design system to minimize the potential of loss of targets. 19N Design TIS to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

Automatic Dependent Surveillance Broadcast (ADS-B)

607	ISE1.01.1	Degraded surveillance due to ADS-B malfunction on many aircraft.	ADS-B malfunction on single aircraft due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Degraded surveillance occurs. Malfunction within sensor fusion system due to the above contributors.	Degraded surveillance occurs and condition is detected by ATCT.	En route, Terminal	Degraded surveillance occurs associated with many aircraft.	3B	24N Design system to minimize the potential of malfunction within sensor fusion system or interface. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. . 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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Automatic Dependent Surveillance Broadcast (ADS-B)

611	ISE1.01.5	Near Midair Collision (NMAC) occurs due to degraded surveillance due to ADS-B malfunction on single aircraft	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Loss of target on ground display. Malfunction within sensor fusion system due to the above contributors. Aircraft on collision course.	Pilot/flight crew initially loses situational awareness and is not aware of collision potential. Pilot/aircrew unaware of other aircraft. Other aircraft identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew does regain situational awareness. See and avoid successful.	En route, Terminal	Near Midair Collision (NMAC) of aircraft.	3B	24N Design system to minimize the potential of malfunction within sensor fusion system or interface. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. . 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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Automatic Dependent Surveillance Broadcast (ADS-B)

613	ISE1.01.7	Near Midair Collision (NMAC) occurs due to degraded surveillance due to ADS-B malfunction on many aircraft	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Loss of target on ground display. Malfunction within sensor fusion system due to the above contributors. Aircraft on collision course.	Pilot/flight crew initially loses situational awareness and is not aware of collision potential. Pilot/aircrew unaware of other aircraft. Other aircraft identified via radar or other sources. ATCT does communicate warning. Pilot/flight crew does regain situational awareness. See and avoid successful.	En route, Terminal	Near Midair Collision (NMAC) of aircraft.	3B	24N Design system to minimize the potential of malfunction within sensor fusion system or interface. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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Automatic Dependent Surveillance Broadcast (ADS-B)

618	ISF1.01.3	Near Midair Collision (NMAC) occurs during parallel runway operations due to ADS-B malfunction. TCAS – I or II or TIS, is helpful.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course or close proximity. Malfunction within sensor fusion system due to the above contributors. TCAS – I or II or TIS, not helpful.	Pilot/flight crew initially loses situational awareness and is not aware of collision potential. Pilot/aircrew unaware of other aircraft. ATCT does communicate warning in time. Pilot/flight crew does regain situational awareness in time. See and avoid successful.	Approach	Near Midair Collision (NMAC)	3B	24N Design system to minimize the potential of malfunction within sensor fusion system or interface. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 19N Design TIS to integrate with ADS-B and provide redundant alert against collision risk. 19Na Design TCAS-I to integrate with ADS-B and provide redundant alert against collision risk. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

Automatic Dependent Surveillance Broadcast (ADS-B)

623	ISF1.01.8	Near Midair Collision (NMAC) occurs during surface operations due to ADS-B malfunction. TCAS – I or II or TIS, is helpful.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft/vehicle on collision course or close proximity. Malfunction within sensor fusion system due to the above contributors. TCAS – I or II or TIS, not helpful.	Pilot/flight crew initially loses situational awareness and is not aware of collision potential. Pilot/aircrew unaware of other aircraft/vehicle. ATCT does communicate warning in time. Pilot/flight crew does regain situational awareness in time. See and avoid successful.	Surface	Near Midair Collision (NMAC)	3B	24N Design system to minimize the potential of malfunction within sensor fusion system or interface. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 7N Require all ground vehicles that can become hazards to ground navigation be equipped with ADS-B transmitters, or other appropriate means of identification. 8N Require alternate means of detecting ground vehicles, i.e. ASDE-X. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 19N Design TIS to integrate with ADS-B and provide redundant alert against collision risk. 19Na Design TCAS-I to integrate with ADS-B and provide redundant alert against collision risk. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

629	ISH1.01.1	Loss of separation assurance due to ADS-B malfunction results in Near Midair Collision (NMAC). TCAS – I or MFD or TIS malfunction contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-I or TIS or MFD malfunction due to similar malfunctions indicated above. Aircraft progress towards Near Midair Collision (NMAC).	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC).	3B	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 19N Design TIS to integrate with ADS-B and provide redundant alert against collision risk. 19Na Design TCAS-I to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

632	ISH1.01.4	Erroneous sequencing as a result of ADS-B malfunction results in Near Midair Collision (NMAC). TCAS - I or MFD or TIS malfunction contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-I or TIS or MFD malfunction due to similar malfunctions indicated above. Aircraft on collision course. Loss of separation occurs.	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC).	3B	22Nb Design system to minimize the potential of erroneous sequencing of aircraft. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 19N Design TIS to integrate with ADS-B and provide redundant alert against collision risk. 19Na Design TCAS-I to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

635	ISH1.01.7	Loss of separation assurance due to ADS-B malfunction results in Near Midair Collision (NMAC). TCAS – I or MFD or TIS conflicting information contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-I or TIS or MFD malfunction due to similar malfunctions indicated above. Aircraft on collision course. Loss of separation occurs.	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC).	3B	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 19N Design TIS to integrate with ADS-B and provide redundant alert against collision risk. 19Na Design TCAS-I to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

Automatic Dependent Surveillance Broadcast (ADS-B)

638	ISH2.01.1	Loss of separation assurance due to ADS-B malfunction results in Near Midair Collision (NMAC). TCAS – I or MFD malfunction contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-I or MFD malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs. TCAS – I or MFD malfunction contributes to Near Midair Collision (NMAC).	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC).	3B	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 19Na Design TCAS-I to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

Automatic Dependent Surveillance Broadcast (ADS-B)

641	ISH2.01.4	Erroneous sequencing as a result of ADS-B malfunction results in Near Midair Collision (NMAC). TCAS - I or MFD malfunction contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-I or MFD malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs. TCAS - I or MFD malfunction contributes to Near Midair Collision (NMAC).	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC).	3B	22Nb Design system to minimize the potential of erroneous sequencing of aircraft. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 19Na Design TCAS-I to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

644	ISH2.01.7	Loss of separation assurance due to ADS-B malfunction results in Near Midair Collision (NMAC). TCAS – I or MFD conflicting information contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-I or MFD malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs. TCAS-I or MFD conflicting information contributes to Near Midair Collision (NMAC).	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC).	3B	installation, and approval process established for ADS-B with MFD. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 19Na Design TCAS-I to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

Automatic Dependent Surveillance Broadcast (ADS-B)

647	ISH3.01.1	Loss of separation assurance due to ADS-B malfunction results in Near Midair Collision (NMAC). TCAS – II or MFD or TIS malfunction contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-II or MFD malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs. TCAS –II or MFD malfunction contributes to Near Midair Collision (NMAC).	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC).	3B	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 21Na Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failure of, or error in, recommended vertical escape maneuver indication. 22Na Design system to minimize the potential for failure of, or error in, recommended vertical escape maneuver indication. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

650	ISH3.01.4	Erroneous sequencing as a result of ADS-B malfunction results in Near Midair Collision (NMAC). TCAS - II or MFD or TIS malfunction contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-II or MFD malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs. TCAS - II or MFD malfunction contributes to Near Midair Collision (NMAC).	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC).	3B	22Nb Design system to minimize the potential of erroneous sequencing of aircraft. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 21Na Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failure of, or error in, recommended vertical escape maneuver indication. 22Na Design system to minimize the potential for failure of, or error in, recommended vertical escape maneuver indication. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

653	ISH3.01.7	Loss of separation assurance due to ADS-B malfunction results in Near Midair Collision (NMAC). TCAS – II or MFD or TIS conflicting information contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-II or MFD or TIS malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs. TCAS-II or MFD or TIS conflicting information contributes to Near Midair Collision (NMAC).	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC).	3B	27N Design MFD, TCAS, and TIS to integrate with ADS-B, provide redundancy, and minimize conflicting information communicated in cockpit. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 21Na Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failure of, or error in, recommended vertical escape maneuver indication. 22Na Design system to minimize the potential for failure of, or error in, recommended vertical escape maneuver indication. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

Automatic Dependent Surveillance Broadcast (ADS-B)

656	ISH4.01.1	Loss of separation assurance due to ADS-B malfunction results in Near Midair Collision (NMAC). TCAS – II or MFD malfunction contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-II or MFD malfunction due to the above contributors. TCAS-II or MFD malfunction contributes to Near Midair Collision (NMAC). Aircraft on collision course. Loss of separation occurs.	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC).	3B	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

659	ISH4.01.4	Erroneous sequencing as a result of ADS-B malfunction results in Near Midair Collision (NMAC). TCAS - II or MFD malfunction contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-II or MFD malfunction due to the above contributors. TCAS - II or MFD malfunction contributes to Near Midair Collision (NMAC). Aircraft on collision course. Loss of separation occurs.	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC).	3B	22Nb Design system to minimize the potential of erroneous sequencing of aircraft. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

Automatic Dependent Surveillance Broadcast (ADS-B)

662	ISH4.01.7	Loss of separation assurance due to ADS-B malfunction results in Near Midair Collision (NMAC). TCAS – II or MFD conflicting information contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-II or MFD malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs. TCAS-II or MFD conflicting information contributes to Near Midair Collision (NMAC).	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC).	3B	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

665	ISH5.01.1	Loss of separation assurance due to ADS-B malfunction results in Near Midair Collision (NMAC). TCAS – I or MFD or TIS malfunction contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-I or MFD or TIS malfunction due to the above contributors. TCAS-I or MFD or TIS malfunction contributes to Near Midair Collision (NMAC). Aircraft on collision course. Loss of separation occurs.	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC).	3B	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 19N Design TIS to integrate with ADS-B and provide redundant alert against collision risk. 19Na Design TCAS-I to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

668	ISH5.01.4	Erroneous sequencing as a result of ADS-B malfunction results in Near Midair Collision (NMAC). TCAS - I or MFD or TIS malfunction contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-I or MFD or TIS malfunction due to the above contributors. TCAS - I or MFD or TIS malfunction contributes to Near Midair Collision (NMAC). Aircraft on collision course. Loss of separation occurs.	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC).	3B	22Nb Design system to minimize the potential of erroneous sequencing of aircraft. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 19N Design TIS to integrate with ADS-B and provide redundant alert against collision risk. 19Na Design TCAS-I to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

Automatic Dependent Surveillance Broadcast (ADS-B)

671	ISH5.01.7	Loss of separation assurance due to ADS-B malfunction results in Near Midair Collision (NMAC). TCAS – I or MFD or TIS conflicting information contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-I or MFD or TIS malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs. TCAS-I or MFD or TIS conflicting information contributes to Near Midair Collision (NMAC).	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC).	3B	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 19N Design TIS to integrate with ADS-B and provide redundant alert against collision risk. 19Na Design TCAS-I to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

675	ISH5.01.11	Excessive display congestion as a result of FIS integration results in loss of critical information and increased Near Midair Collision (NMAC) risk. TCAS – I or MFD or TIS do not contribute to risk minimization.	Excessive display congestion as a result of FIS integration due to: LTA design LTA Human Factors consideration. Loss of critical information occurs due to masking. Aircraft on collision course. Loss of separation occurs. Collision alert does occur in time.	Pilot/flight crew regains situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC)	3B	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 19N Design TIS to integrate with ADS-B and provide redundant alert against collision risk. 19Na Design TCAS-I to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 26N Design system to minimize the potential of excessive display congestion as a result of FIS integration with ADS-B and cockpit displays.

n State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum
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677	ISH5.01.13	Excessive display congestion as a result of FIS integration results in loss of situational awareness and increased Near Midair Collision (NMAC) risk. TCAS – I or MFD or TIS do not contribute to risk minimization.	Excessive display congestion as a result of FIS integration due to: LTA design LTA Human Factors consideration. Pilot/flight crew initially loses situational awareness due to masking. Aircraft on collision course. Loss of separation occurs. Collision alert does not occur in time.	Pilot/flight crew does not regain situational awareness in time. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC)	3B	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 19N Design TIS to integrate with ADS-B and provide redundant alert against collision risk. 19Na Design TCAS-I to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 20N Design system to minimize the potential of excessive display congestion as a result of FIS integration with ADS-B and cockpit displays.

n State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum
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Automatic Dependent Surveillance Broadcast (ADS-B)

680	ISH6.01.1	Loss of separation assurance due to ADS-B malfunction results in Near Midair Collision (NMAC). TCAS – I or MFD malfunction contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-I or MFD malfunction due to the above contributors. TCAS-I or MFD malfunction contributes to Near Midair Collision (NMAC). Aircraft on collision course. Loss of separation occurs.	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC).	3B	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 19Na Design TCAS-I to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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Automatic Dependent Surveillance Broadcast (ADS-B)

683	ISH6.01.4	Erroneous sequencing as a result of ADS-B malfunction results in Near Midair Collision (NMAC). TCAS - I or MFD malfunction contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-I or MFD malfunction due to the above contributors. TCAS - I or MFD malfunction contributes to Near Midair Collision (NMAC). Aircraft on collision course. Loss of separation occurs.	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC).	3B	22Nb Design system to minimize the potential of erroneous sequencing of aircraft. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 19Na Design TCAS-I to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

686	ISH6.01.7	Loss of separation assurance due to ADS-B malfunction results in Near Midair Collision (NMAC). TCAS – I or MFD conflicting information contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-I or MFD malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs. TCAS-I or MFD conflicting information contributes to Near Midair Collision (NMAC).	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC).	3B	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 19Na Design TCAS-I to integrate with ADS-B and provide redundant alert against collision risk. 27N Design MFD, TCAS, and TIS to integrate with ADS-B, provide redundancy, and minimize conflicting information communicated in cockpit. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

690	ISH6.01.11	Excessive display congestion as a result of FIS integration results in loss of critical information and increased Near Midair Collision (NMAC) risk. TCAS – I or MFD do not contribute to risk minimization.	Excessive display congestion as a result of FIS integration due to: LTA design LTA Human Factors consideration. Loss of critical information occurs due to masking. Aircraft on collision course. Loss of separation occurs. Collision alert does occur in time.	Pilot/flight crew regains situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC)	3B	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 19Na Design TCAS-I to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 26N Design system to minimize the potential of excessive display congestion as a result of FIS integration with ADS-B and cockpit displays.

692	ISH6.01.13	Excessive display congestion as a result of FIS integration results in loss of situational awareness and increased Near Midair Collision (NMAC) risk. TCAS – I or MFD do not contribute to risk minimization.	Excessive display congestion as a result of FIS integration due to: LTA design LTA Human Factors consideration. Pilot/flight crew initially loses situational awareness due to masking. Aircraft on collision course. Loss of separation occurs. Collision alert does not occur in time.	Pilot/flight crew does not regain situational awareness in time. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC)	3B	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 9N Require certification, installation, and approval process established for ADS-B equipped ground vehicles. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 19Na Design TCAS-I to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 26N Design system to minimize the potential of excessive display congestion as a result of FIS integration with ADS-B and cockpit displays.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

Automatic Dependent Surveillance Broadcast (ADS-B)

695	ISH7.01.1	Loss of separation assurance due to ADS-B malfunction results in Near Midair Collision (NMAC). TCAS – II or MFD or TIS malfunction contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-II or MFD or TIS malfunction due to the above contributors. TCAS-II or MFD or TIS malfunction contributes to Near Midair Collision (NMAC). Aircraft on collision course. Loss of separation occurs.	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC).	3B	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 21Na Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failure of, or error in, recommended vertical escape maneuver indication. 22Na Design system to minimize the potential for failure of, or error in, recommended vertical escape maneuver indication. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

698	ISH7.01.4	Erroneous sequencing as a result of ADS-B malfunction results in collision. TCAS - II or MFD or TIS malfunction contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-II or MFD or TIS malfunction due to the above contributors. TCAS-II or MFD or TIS malfunction contributes to Near Midair Collision (NMAC). Aircraft on collision course. Loss of separation occurs.	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC).	3B	22Nb Design system to minimize the potential of erroneous sequencing of aircraft. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 21Na Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failure of, or error in, recommended vertical escape maneuver indication. 22Na Design system to minimize the potential for failure of, or error in, recommended vertical escape maneuver indication. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

701	ISH7.01.7	Loss of separation assurance due to ADS-B malfunction results in Near Midair Collision (NMAC). TCAS – II or MFD or TIS conflicting information contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-II or MFD or TIS malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs. TCAS-II or MFD or TIS conflicting information contributes to Near Midair Collision (NMAC).	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC).	3B	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 21Na Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failure of, or error in, recommended vertical escape maneuver indication. 22Na Design system to minimize the potential for failure of, or error in, recommended vertical escape maneuver indication. 27N Design MFD, TCAS, and TIS to integrate with ADS-B, provide redundancy, and minimize conflicting information communicated in cockpit. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

702	ISH7.01.8	Loss of separation assurance due to ADS-B malfunction results in Near Midair Collision (NMAC). TCAS – II or MFD or TIS conflicting information contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-II or MFD or TIS malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs. TCAS-II or MFD or TIS conflicting information contributes to Near Midair Collision (NMAC).	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC) w/ Fatal injury.	3B	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 21Na Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failure of, or error in, recommended vertical escape maneuver indication. 22Na Design system to minimize the potential for failure of, or error in, recommended vertical escape maneuver indication. 27N Design MFD, TCAS, and TIS to integrate with ADS-B, provide redundancy, and minimize conflicting information communicated in cockpit. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

705	ISH7.01.11	Excessive display congestion as a result of FIS integration results in loss of critical information and increased Near Midair Collision (NMAC) risk. TCAS – II or MFD or TIS do not contribute to risk minimization.	Excessive display congestion as a result of FIS integration due to: LTA design LTA Human Factors consideration. Loss of critical information occurs due to masking. Aircraft on collision course. Loss of separation occurs. Collision alert does occur in time.	Pilot/flight crew regains situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC)	3B	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 21Na Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failure of, or error in, recommended vertical escape maneuver indication. 22Na Design system to minimize the potential for failure of, or error in, recommended vertical escape maneuver indication. 26N Design system to minimize the potential of excessive display congestion as a result of FIS integration with ADS-B and cockpit displays. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

707	ISH7.01.13	Excessive display congestion as a result of FIS integration results in loss of situational awareness and increased Near Midair Collision (NMAC) risk. TCAS – II or MFD or TIS do not contribute to risk minimization.	Excessive display congestion as a result of FIS integration due to: LTA design LTA Human Factors consideration. Pilot/flight crew initially loses situational awareness due to masking. Aircraft on collision course. Loss of separation occurs. Collision alert does not occur in time.	Pilot/flight crew does not regain situational awareness in time. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC)	3B	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 21Na Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failure of, or error in, recommended vertical escape maneuver indication. 22Na Design system to minimize the potential for failure of, or error in, recommended vertical escape maneuver indication. 26N Design system to minimize the potential of excessive display congestion as a result of FIS integration with ADS-B and cockpit displays. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

Automatic Dependent Surveillance Broadcast (ADS-B)

710	ISH8.01.1	Loss of separation assurance due to ADS-B malfunction results in Near Midair Collision (NMAC). TCAS – II or MFD malfunction contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-II or MFD malfunction due to the above contributors. TCAS-II or MFD malfunction contributes to Near Midair Collision (NMAC). Aircraft on collision course. Loss of separation occurs.	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC).	3B	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

713	ISH8.01.4	Erroneous sequencing as a result of ADS-B malfunction results in collision. TCAS - II or MFD malfunction contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-II or MFD malfunction due to the above contributors. TCAS-II or MFD malfunction contributes to Near Midair Collision (NMAC). Aircraft on collision course. Loss of separation occurs.	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC).	3B	22Nb Design system to minimize the potential of erroneous sequencing of aircraft. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

Automatic Dependent Surveillance Broadcast (ADS-B)

716	ISH8.01.7	Loss of separation assurance due to ADS-B malfunction results in Near Midair Collision (NMAC). TCAS – II or MFD conflicting information contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-II or MFD malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs. TCAS-II or MFD conflicting information contributes to Near Midair Collision (NMAC).	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC).	3B	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

720	ISH8.01.11	Excessive display congestion as a result of FIS integration results in loss of critical information and increased Near Midair Collision (NMAC) risk. TCAS – II or MFD do not contribute to risk minimization.	Excessive display congestion as a result of FIS integration due to: LTA design LTA Human Factors consideration. Loss of critical information occurs due to masking. Aircraft on collision course. Loss of separation occurs. Collision alert does occur in time.	Pilot/flight crew regains situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC)	3B	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 26N Design system to minimize the potential of excessive display congestion as a result of FIS integration with ADS-B and cockpit displays. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

723	ISH8.01.14	Excessive display congestion as a result of FIS integration results in loss of situational awareness and increased Near Midair Collision (NMAC) risk. TCAS – II or MFD do not contribute to risk minimization.	Excessive display congestion as a result of FIS integration due to: LTA design LTA Human Factors consideration. Pilot/flight crew initially loses situational awareness due to masking. Aircraft on collision course. Loss of separation occurs. Collision alert does not occur in time.	Pilot/flight crew does not regain situational awareness in time. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC)	3B	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 26N Design system to minimize the potential of excessive display congestion as a result of FIS integration with ADS-B and cockpit displays. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

Automatic Dependent Surveillance Broadcast (ADS-B)

725	ISI1.01.1	Loss of separation assurance due to ADS-B malfunction results in Near Midair Collision (NMAC). TCAS –I or TIS or MFD malfunction contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-I or TIS or MFD malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs. TCAS-II or MFD conflicting information contributes to Near Midair Collision (NMAC).	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC).	3B	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 27N Design MFD, TCAS, and TIS to integrate with ADS-B, provide redundancy, and minimize conflicting information communicated in cockpit. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

Automatic Dependent Surveillance Broadcast (ADS-B)

728	ISI1.01.4	Erroneous flight path calculation as a result of ADS-B malfunction results in Near Midair Collision (NMAC). TCAS -I or TIS or MFD malfunction contributes to Near Midair Collision (NMAC).	Erroneous flight path calculation as a result of ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course. Loss of separation occurs TCAS -I or TIS or MFD malfunction contributes to Near Midair Collision (NMAC).	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC).	3B	22Nc Design system to minimize the potential of erroneous flight path. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

Automatic Dependent Surveillance Broadcast (ADS-B)

732	ISI1.01.8	Erroneous flight path calculation as a result of ADS-B malfunction results in loss of alert and Near Midair Collision (NMAC). TCAS -I or TIS or MFD malfunction contributes to Near Midair Collision (NMAC).	Erroneous flight path calculation as a result of ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course. Loss of separation occurs. Loss of alert occurs. TCAS -I or TIS or MFD malfunction contributes to Near Midair Collision (NMAC).	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. Pilot/flight crew regain situational awareness in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC).	3B	22Nc Design system to minimize the potential of erroneous flight path. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

Automatic Dependent Surveillance Broadcast (ADS-B)

734	ISI2.01.1	Loss of separation assurance due to ADS-B malfunction results in Near Midair Collision (NMAC). TCAS –I or MFD malfunction contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-I or MFD malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs. TCAS-I or MFD conflicting information contributes to Near Midair Collision (NMAC).	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC).	3B	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 27N Design MFD, TCAS, and TIS to integrate with ADS-B, provide redundancy, and minimize conflicting information communicated in cockpit. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

738	ISI2.01.5	Erroneous flight path calculation as a result of ADS-B malfunction results in Near Midair Collision (NMAC). TCAS -I or MFD malfunction contributes to Near Midair Collision (NMAC).	Erroneous flight path calculation as a result of ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course. Loss of separation occurs TCAS -I or MFD malfunction contributes to Near Midair Collision (NMAC).	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC).	3B	22Nc Design system to minimize the potential of erroneous flight path. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 27N Design MFD, TCAS, and TIS to integrate with ADS-B, provide redundancy, and minimize conflicting information communicated in cockpit. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

Automatic Dependent Surveillance Broadcast (ADS-B)

740	ISI3.01.1	Loss of separation assurance due to ADS-B malfunction results in Near Midair Collision (NMAC). TCAS –II or TIS or MFD malfunction contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS -II or TIS or MFD malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs. TCAS -II or TIS or MFD conflicting information contributes to Near Midair Collision (NMAC).	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC).	3B	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 27N Design MFD, TCAS, and TIS to integrate with ADS-B, provide redundancy, and minimize conflicting information communicated in cockpit. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

743	ISI3.01.4	Erroneous flight path calculation as a result of ADS-B malfunction results in Near Midair Collision (NMAC). TCAS -II or TIS or MFD malfunction contributes to Near Midair Collision (NMAC).	Erroneous flight path calculation as a result of ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course. Loss of separation occurs TCAS -II or TIS or MFD malfunction contributes to Near Midair Collision (NMAC).	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC).	3B	22Nc Design system to minimize the potential of erroneous flight path. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 27N Design MFD, TCAS, and TIS to integrate with ADS-B, provide redundancy, and minimize conflicting information communicated in cockpit. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

Automatic Dependent Surveillance Broadcast (ADS-B)

746	ISI4.01.1	Loss of separation assurance due to ADS-B malfunction results in Near Midair Collision (NMAC). TCAS –II or MFD malfunction contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS -II or MFD malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs. TCAS -II or MFD conflicting information contributes to Near Midair Collision (NMAC).	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC).	3B	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 27N Design MFD, TCAS, and TIS to integrate with ADS-B, provide redundancy, and minimize conflicting information communicated in cockpit. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

Automatic Dependent Surveillance Broadcast (ADS-B)

749	ISI4.01.4	Erroneous flight path calculation as a result of ADS-B malfunction results in Near Midair Collision (NMAC). TCAS -II or MFD malfunction contributes to Near Midair Collision (NMAC).	Erroneous flight path calculation as a result of ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course. Loss of separation occurs TCAS -II or MFD malfunction contributes to Near Midair Collision (NMAC).	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC).	3B	22Ne Design system to minimize the potential of erroneous flight path. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 19Nb Design TCAS-II to integrate with ADS-B and provide redundant alert against collision risk. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

753	ISJ1.01.2	Loss of separation assurance due to ADS-B malfunction results in Near Midair Collision (NMAC). TCAS –I or TIS or MFD malfunction contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS -I or TIS or MFD malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs. TCAS -I or TIS or MFD conflicting information contributes to Near Midair Collision (NMAC).	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC).	3B	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 27N Design MFD, TCAS, and TIS to integrate with ADS-B, provide redundancy, and minimize conflicting information communicated in cockpit. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

756	ISJ1.01.5	Erroneous flight path calculation as a result of ADS-B malfunction results in Near Midair Collision (NMAC). TCAS -I or TIS or MFD malfunction contributes to Near Midair Collision (NMAC).	Erroneous flight path calculation as a result of ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course. Loss of separation occurs TCAS -I or TIS or MFD malfunction contributes to Near Midair Collision (NMAC).	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC).	3B	22Nc Design system to minimize the potential of erroneous flight path. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 27N Design MFD, TCAS, and TIS to integrate with ADS-B, provide redundancy, and minimize conflicting information communicated in cockpit. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

Automatic Dependent Surveillance Broadcast (ADS-B)

764	ISJ2.01.1	Loss of separation assurance due to ADS-B malfunction results in Near Midair Collision (NMAC). TCAS –I or MFD malfunction contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS -I or MFD malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs. TCAS -I or TIS or MFD conflicting information contributes to Near Midair Collision (NMAC).	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC).	3B	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 20Nb Design MFD to integrate with ADS-B, provides redundancy, and minimizes conflictive information communicated in cockpit. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 28Nc Design MFD or CDTI, TAWS, and TCAS to integrate with ADS-B, provide redundancy, and minimize conflictive information communicated in cockpit. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

Automatic Dependent Surveillance Broadcast (ADS-B)

767	ISJ2.01.4	Erroneous flight path calculation as a result of ADS-B malfunction results in Near Midair Collision (NMAC). TCAS -I or MFD malfunction contributes to Near Midair Collision (NMAC).	Erroneous flight path calculation as a result of ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course. Loss of separation occurs TCAS -I or MFD malfunction contributes to Near Midair Collision (NMAC).	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC).	3B	22Nc Design system to minimize the potential of erroneous flight path. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 20Nb Design MFD to integrate with ADS-B, provides redundancy, and minimizes conflictive information communicated in cockpit. 5Nb Avionics certification, installation, and approval process established for ADS-B with TCAS-I. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 28Nc Design MFD or CDTI, TAWS, and TCAS to integrate with ADS-B, provide redundancy, and minimize conflictive information communicated in cockpit. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

776	ISJ3.01.1	Loss of separation assurance due to ADS-B malfunction results in Near Midair Collision (NMAC). TCAS –II or TIS or MFD malfunction contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-II or TIS or MFD malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs. TCAS-II or TIS or MFD conflicting information contributes to Near Midair Collision (NMAC).	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC).	3B	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 27N Design MFD, TCAS, and TIS to integrate with ADS-B, provide redundancy, and minimize conflicting information communicated in cockpit. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

779	ISJ3.01.4	Erroneous flight path calculation as a result of ADS-B malfunction results in Near Midair Collision (NMAC). TCAS -II or TIS or MFD malfunction contributes to Near Midair Collision (NMAC).	Erroneous flight path calculation as a result of ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course. Loss of separation occurs TCAS-II or TIS or MFD malfunction contributes to Near Midair Collision (NMAC).	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC).	3B	22Nc Design system to minimize the potential of erroneous flight path. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 5Na Avionics certification, installation, and approval process established for ADS-B with TIS. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 27N Design MFD, TCAS, and TIS to integrate with ADS-B, provide redundancy, and minimize conflicting information communicated in cockpit. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

Automatic Dependent Surveillance Broadcast (ADS-B)

788	ISJ4.01.1	Loss of separation assurance due to ADS-B malfunction results in Near Midair Collision (NMAC). TCAS –II or MFD malfunction contributes to Near Midair Collision (NMAC).	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. TCAS-II or MFD malfunction due to the above contributors. Aircraft on collision course. Loss of separation occurs. TCAS-II or MFD conflicting information contributes to Near Midair Collision (NMAC).	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC).	3B	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 20Nb Design MFD to integrate with ADS-B, provides redundancy, and minimizes conflictive information communicated in cockpit. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 28Nc Design MFD or CDTI, TAWS, and TCAS to integrate with ADS-B, provide redundancy, and minimize conflictive information communicated in cockpit. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

791	ISJ4.01.4	Erroneous flight path calculation as a result of ADS-B malfunction results in Near Midair Collision (NMAC). TCAS -II or MFD malfunction contributes to Near Midair Collision (NMAC).	Erroneous flight path calculation as a result of ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course. Loss of separation occurs TCAS-II or MFD malfunction contributes to Near Midair Collision (NMAC).	Pilot/flight crew initially loses situational awareness. ATCT does communicate warning in time. See and avoid successful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Near Midair Collision (NMAC).	3B	22Nc Design system to minimize the potential of erroneous flight path. 22Nc Design system to minimize the potential of erroneous flight path. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 20Nb Design MFD to integrate with ADS-B, provides redundancy, and minimizes conflictive information communicated in cockpit. 5Ne Avionics certification, installation, and approval process established for ADS-B with TCAS-II. 5Nd Avionics certification, installation, and approval process established for ADS-B with MFD. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

816	**ILIS.13**	Pilot/flight crew enhanced traffic awareness results in increased go-around or rejected takeoffs.	Increased pilot/flight crew traffic awareness. Increased go-around or rejected takeoffs.	Possible increase in pilot/flight crew workload. Possible increase in controller workload.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Increased go-around or rejected takeoffs.	3B	3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 48N Design and update pilot and controllers procedures to accommodate ADS-B / NAS integration and decrease associated risks. 17N Conduct controller/pilot workload assessments to evaluate the potential for excessive workload associated with ADS-B system.

II.C Low Risk Hazard Scenarios

II.C.1 Hazardous/Extremely Improbable (2D)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
827	ISK.02.1	Degraded FMS input to ADS-B results in decreased accuracy. Scenario results in collision.	Degraded FMS input due to: Degraded WAAS Degraded LAAS Degraded GPS FMS internal malfunction. Degraded accuracy ADS-B due to FMS input. Pilot/flight crew loses situational awareness. Aircraft on collision course.	Pilot/flight crew does not regain situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Surface, Flight, Emergency.	Collision	2D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 28Nd Design MFD or CDTI, TAWS, and TCAS to integrate with ADS-B, provide redundancy, maximize system alert capability, and minimize alert delay or masking of alert. 22Nd Design system to minimize the potential for interface malfunction between FMS and ADS-B. 22Ne Design system to minimize the potential for degraded FMS input to ADS-B. 31N Design WAAS and LAAS to integrate with ADS-B, provide redundancy, and minimize potential for degraded FMS input to ADS-B.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

Automatic Dependent Surveillance Broadcast (ADS-B)

832	ISK.05.1	ADS-B malfunction propagates to other aircraft systems, effecting LAAS. Event occurs during non-critical time.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Loss of LAAS. No existing collision potentials.	Pilot/flight crew detects malfunction. GPS provides backup functions.	Takeoff, Approach Landing, Surface, Flight.	Loss of ADS-B and LAAS on single aircraft.	2D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 22Nd Design system to minimize the potential for interface malfunction between FMS and ADS-B 22Ne Design system to minimize the potential for degraded FMS input to ADS-B. 31N Design WAAS and LAAS to integrate with ADS-B, provide redundancy, and minimize potential for degraded FMS input to ADS-B. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 50 Design ADS-B system architecture to ensure failure isolation of hardware, firmware, and software. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 50 Design ADS-B system architecture to ensure failure isolation of hardware, firmware, and software.

Automatic Dependent Surveillance Broadcast (ADS-B)

833	ISK.05.2	ADS-B malfunction propagates to other aircraft systems, effecting LAAS. Event occurs during critical time, CAT IIIa, IIIb, or 3C approaches.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Loss of LAAS.	Pilot/flight crew unable to respond in time.	Approach	Collision	2D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 22Nd Design system to minimize the potential for interface malfunction between FMS and ADS-B 22Ne Design system to minimize the potential for degraded FMS input to ADS-B. 31N Design WAAS and LAAS to integrate with ADS-B, provide redundancy, and minimize potential for degraded FMS input to ADS-B. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 50 Design ADS-B system architecture to ensure failure isolation of hardware, firmware, and software. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 50 Design ADS-B system architecture to ensure failure isolation of hardware, firmware, and software.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

Automatic Dependent Surveillance Broadcast (ADS-B)

835	**ISK.06**	Loss of L1 frequency results in loss of: ADS-B, GPS, LAAS and WAAS. Event occurs during non-critical time.	Loss of L1 frequency due to: Electromagnetic environmental effects Sun spots Solar flares Loss of coverage Jamming.	Loss is detected.	Takeoff, Approach Landing, Surface, Flight, Emergency.	Loss of ADS-B, GPS, LAAS and WAAS within local area.	2D	58 Consider alternative frequency spectrum as backup. 57 Select frequency spectrum to minimize adverse effects of weather on ADS-B transmissions. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 22Nd Design system to minimize the potential for interface malfunction between FMS and ADS-B 22Ne Design system to minimize the potential for degraded FMS input to ADS-B. 31N Design WAAS and LAAS to integrate with ADS-B, provide redundancy, and minimize potential for degraded FMS input to ADS-B. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 50 Design ADS-B system architecture to ensure failure isolation of hardware, firmware, and software. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

868	**ISL.15**	Pilot/flight crew increase in traffic awareness results in increased go-around or rejected takeoffs.	Increased pilot/flight crew traffic awareness. Increased go-around or rejected takeoffs.	Possible increase in pilot/flight crew workload. Possible increase in controller workload.	Takeoff, Approach Landing, Emergency.	Increased go-around or rejected takeoffs.	2D	14Na Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS, and the potential for Pilot/flight crew increase in traffic awareness results in increased go-around or rejected takeoffs. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness.
869	ISL.15.1	Pilot/flight crew increase in traffic awareness results in increased go-around or rejected takeoffs and possible increase in collision risks.	Increased pilot/flight crew traffic awareness. Increased go-around or rejected takeoffs. Inaccurate assumptions associated with aircraft separation occur. Subject aircraft follows wrong target or takes wrong clearance. Aircraft on collision course.	Pilot/flight crew loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Emergency.	Collision	2D	14Na Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS, and the potential for Pilot/flight crew increase in traffic awareness results in increased go-around or rejected takeoffs. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 7 Provide for appropriate ATC/Aircrew contingency procedures.

Automatic Dependent Surveillance Broadcast (ADS-B)

877	**ISL.23**	Corruption of ADS-B message formats data results in increased collision risks.	Corruption occurs due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Corruption occurs to: Trajectory Change Point Navigation Uncertainty (NUC) Call Sign Aircraft Addresses Emergency/Priority Status. Aircraft on collision course.	Pilot/flight crew loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	2D	76 Design ADS-B system to include end-to-end data integrity check functionality and provide proper notification if data corruption is detected. 42N Design ADS-B system to minimize the potential for corruption of ADS-B message formats data Trajectory Change Point, Navigation Uncertainty (NUC), Call Sign, Aircraft Addresses, and Emergency/Priority Status. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 5N Avionics certification, installation, and approval process established for ADS-B. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 11N Require certification, installation, and approval process established for ADS-B ground system. 10N Require all aircraft that can become hazards to navigation be equipped with ADS-B transmitters, or other appropriate automated means of identification. 68 Develop appropriate training materials and training programs to ensure that all participants in a shared responsibility environment understand their role and safe operation procedures. 50 Design ADS-B system architecture to ensure failure isolation of hardware. 48b Design ADS-B system architecture to ensure that hardware, firmware and software fails safe. 27 Design the system to assure that dual independent component failure, dual human errors, or a combination of a component failure and a human error cannot cause a catastrophic event. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

II.C. Low Risk Hazard Scenarios

II.C.1 Hazardous/Extremely Improbable (2D)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
827	ISK.02.1	Degraded FMS input to ADS-B results in decreased accuracy. Scenario results in collision.	Degraded FMS input due to: Degraded WAAS Degraded LAAS Degraded GPS FMS internal malfunction. Degraded accuracy ADS-B due to FMS input. Pilot/flight crew loses situational awareness. Aircraft on collision course.	Pilot/flight crew does not regain situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Surface, Flight, Emergency.	Collision	2D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 28Nd Design MFD or CDTI, TAWS, and TCAS to integrate with ADS-B, provide redundancy, maximize system alert capability, and minimize alert delay or masking of alert. 22Nd Design system to minimize the potential for interface malfunction between FMS and ADS-B. 22Ne Design system to minimize the potential for degraded FMS input to ADS-B. 31N Design WAAS and LAAS to integrate with ADS-B, provide redundancy, and minimize potential for degraded FMS input to ADS-B.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

Automatic Dependent Surveillance Broadcast (ADS-B)

832	ISK.05.1	ADS-B malfunction propagates to other aircraft systems, effecting LAAS. Event occurs during non-critical time.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Loss of LAAS. No existing collision potentials.	Pilot/flight crew detects malfunction. GPS provides backup functions.	Takeoff, Approach Landing, Surface, Flight.	Loss of ADS-B and LAAS on single aircraft.	2D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 22Nd Design system to minimize the potential for interface malfunction between FMS and ADS-B 22Ne Design system to minimize the potential for degraded FMS input to ADS-B. 31N Design WAAS and LAAS to integrate with ADS-B, provide redundancy, and minimize potential for degraded FMS input to ADS-B. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 50 Design ADS-B system architecture to ensure failure isolation of hardware, firmware, and software. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 50 Design ADS-B system architecture to ensure failure isolation of hardware, firmware, and software.

Automatic Dependent Surveillance Broadcast (ADS-B)

833	ISK.05.2	ADS-B malfunction propagates to other aircraft systems, effecting LAAS. Event occurs during critical time, CAT IIIa, IIIb, or 3C approaches.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Loss of LAAS.	Pilot/flight crew unable to respond in time.	Approach	Collision	2D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 22Nd Design system to minimize the potential for interface malfunction between FMS and ADS-B 22Ne Design system to minimize the potential for degraded FMS input to ADS-B. 31N Design WAAS and LAAS to integrate with ADS-B, provide redundancy, and minimize potential for degraded FMS input to ADS-B. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 50 Design ADS-B system architecture to ensure failure isolation of hardware, firmware, and software. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 50 Design ADS-B system architecture to ensure failure isolation of hardware, firmware, and software.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

Automatic Dependent Surveillance Broadcast (ADS-B)

835	**ISK.06**	Loss of L1 frequency results in loss of: ADS-B, GPS, LAAS and WAAS. Event occurs during non-critical time.	Loss of L1 frequency due to: Electromagnetic environmental effects Sun spots Solar flares Loss of coverage Jamming.	Loss is detected.	Takeoff, Approach Landing, Surface, Flight, Emergency.	Loss of ADS-B, GPS, LAAS and WAAS within local area.	2D	58 Consider alternative frequency spectrum as backup. 57 Select frequency spectrum to minimize adverse effects of weather on ADS-B transmissions. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 22Nd Design system to minimize the potential for interface malfunction between FMS and ADS-B 22Ne Design system to minimize the potential for degraded FMS input to ADS-B. 31N Design WAAS and LAAS to integrate with ADS-B, provide redundancy, and minimize potential for degraded FMS input to ADS-B. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 50 Design ADS-B system architecture to ensure failure isolation of hardware, firmware, and software. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

868	**ISL.15**	Pilot/flight crew increase in traffic awareness results in increased go-around or rejected takeoffs.	Increased pilot/flight crew traffic awareness. Increased go-around or rejected takeoffs.	Possible increase in pilot/flight crew workload. Possible increase in controller workload.	Takeoff, Approach Landing, Emergency.	Increased go-around or rejected takeoffs.	2D	14Na Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS, and the potential for Pilot/flight crew increase in traffic awareness results in increased go-around or rejected takeoffs. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness.
869	ISL.15.1	Pilot/flight crew increase in traffic awareness results in increased go-around or rejected takeoffs and possible increase in collision risks.	Increased pilot/flight crew traffic awareness. Increased go-around or rejected takeoffs. Inaccurate assumptions associated with aircraft separation occur. Subject aircraft follows wrong target or takes wrong clearance. Aircraft on collision course.	Pilot/flight crew loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Emergency.	Collision	2D	14Na Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS, and the potential for Pilot/flight crew increase in traffic awareness results in increased go-around or rejected takeoffs. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 7 Provide for appropriate ATC/Aircrew contingency procedures.

Automatic Dependent Surveillance Broadcast (ADS-B)

877	**ISL.23**	Corruption of ADS-B message formats data results in increased collision risks.	Corruption occurs due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Corruption occurs to: Trajectory Change Point Navigation Uncertainty (NUC) Call Sign Aircraft Addresses Emergency/Priority Status. Aircraft on collision course.	Pilot/flight crew loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	2D	76 Design ADS-B system to include end-to-end data integrity check functionality and provide proper notification if data corruption is detected. 42N Design ADS-B system to minimize the potential for corruption of ADS-B message formats data Trajectory Change Point, Navigation Uncertainty (NUC), Call Sign, Aircraft Addresses, and Emergency/Priority Status. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 5N Avionics certification, installation, and approval process established for ADS-B. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 11N Require certification, installation, and approval process established for ADS-B ground system. 10N Require all aircraft that can become hazards to navigation be equipped with ADS-B transmitters, or other appropriate automated means of identification. 68 Develop appropriate training materials and training programs to ensure that all participants in a shared responsibility environment understand their role and safe operation procedures. 50 Design ADS-B system architecture to ensure failure isolation of hardware. 48b Design ADS-B system architecture to ensure that hardware, firmware and software fails safe. 27 Design the system to assure that dual independent component failure, dual human errors, or a combination of a component failure and a human error cannot cause a catastrophic event. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

Automatic Dependent Surveillance Broadcast (ADS-B)

II.C.2 Major/Extremely Remote (3C)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
432	SA-28.8	Failure propagation results in loss of ADS-B. Scenario addresses loss of ADS-B in specific coverage area.	Loss of ADS-B in specific coverage area due to: SW malfunction HW malfunction Inappropriate placement Electromagnetic environmental effects Inadvertent damage Vandalism LTA design.	Pilot/flight crew/controller maintain situational awareness. Aircraft identified via radar or other sources. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Loss of ADS-B.	3C	50 Design ADS-B system architecture to ensure failure isolation of hardware. 48b Design ADS-B system architecture to ensure that hardware, firmware and software fails safe. 27 Design the system to assure that dual independent component failure, dual human errors, or a combination of a component failure and a human error cannot cause a catastrophic event. 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

Automatic Dependent Surveillance Broadcast (ADS-B)

823	**ISK.01**	Interface malfunction between FMS and ADS-B results in loss of ADS-B. Event occurs during non-critical time.	Interface malfunction due to: Cable chafing Connector short Open conductors Electromagnetic LTA interface design. Loss of ADS-B due to interface malfunction. No existing collision potentials.	Pilot/flight crew detects malfunction. FMS provides backup functions.	Takeoff, Approach Landing, Surface, Flight.	Loss of ADS-B on single aircraft.	3C	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 28Nd Design MFD or CDTI, TAWS, and TCAS to integrate with ADS-B, provide redundancy, maximize system alert capability, and minimize alert delay or masking of alert. 22Nd Design system to minimize the potential for interface malfunction between FMS and ADS-B

Automatic Dependent Surveillance Broadcast (ADS-B)

824	ISK.01.1	Interface malfunction between FMS and ADS-B results in degraded accuracy of ADS-B. Event occurs during non-critical time.	Interface malfunction due to: Cable chafing Connector short Open conductors Electromagnetic LTA interface design. Degraded accuracy ADS-B due to interface malfunction. No existing collision potentials.	Pilot/flight crew detects malfunction/degradation. FMS provides backup functions.	Takeoff, Approach Landing, Surface, Flight.	Degraded accuracy of ADS-B on single aircraft.	3C	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 28Nd Design MFD or CDTI, TAWS, and TCAS to integrate with ADS-B, provide redundancy, maximize system alert capability, and minimize alert delay or masking of alert. 22Nd Design system to minimize the potential for interface malfunction between FMS and ADS-B

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

Automatic Dependent Surveillance Broadcast (ADS-B)

826	**ISK.02**	Degraded FMS input to ADS-B results in decreased accuracy. Event occurs during non-critical time.	Degraded FMS input due to: Degraded WAAS Degraded LAAS Degraded GPS FMS internal malfunction. Degraded accuracy ADS-B due to FMS input. No existing collision potentials.	Pilot/flight crew detects malfunction/degradation. GPS provides backup functions.	Takeoff, Approach Landing, Surface, Flight.	Degraded accuracy of ADS-B on single aircraft.	3C	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 28Nd Design MFD or CDTI, TAWS, and TCAS to integrate with ADS-B, provide redundancy, maximize system alert capability, and minimize alert delay or masking of alert. 22Nd Design system to minimize the potential for interface malfunction between FMS and ADS-B. 22Ne Design system to minimize the potential for degraded FMS input to ADS-B. 31N Design WAAS and LAAS to integrate with ADS-B, provide redundancy, and minimize potential for degraded FMS input to ADS-B.

Automatic Dependent Surveillance Broadcast (ADS-B)

828	**ISK.03**	ADS-B malfunction propagates to FMS. Event occurs during non-critical time.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Loss of FMS due to propagation effects.	Pilot/flight crew detects malfunction/degradation. GPS provides backup functions.	Takeoff, Approach Landing, Surface, Flight.	Loss of FMS on single aircraft.	3C	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 50 Design ADS-B system architecture to ensure failure isolation of hardware, firmware, and software. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

Automatic Dependent Surveillance Broadcast (ADS-B)

830	**ISK.04**	Failure of FMS results in loss of ADS-B. Event occurs during non-critical time.	Failure of FMS due to: Loss of WAAS Loss of LAAS Loss of GPS FMS internal malfunction. Loss of ADS-B. No existing collision potentials.	Pilot/flight crew detects malfunction. GPS provides backup functions.	Takeoff, Approach Landing, Surface, Flight.	Loss of ADS-B on single aircraft.	3C	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 22Nd Design system to minimize the potential for interface malfunction between FMS and ADS-B 22Ne Design system to minimize the potential for degraded FMS input to ADS-B. 31N Design WAAS and LAAS to integrate with ADS-B, provide redundancy, and minimize potential for degraded FMS input to ADS-B. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 50 Design ADS-B system architecture to ensure failure isolation of hardware, firmware, and software. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

Automatic Dependent Surveillance Broadcast (ADS-B)

834	ISK.05.3 May be covered.	ADS-B malfunction propagates to other ground systems.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. ADS-B malfunction propagates to ATCT display, or other associated systems.	Malfunction is detected.	Takeoff, Approach Landing, Surface, Flight emergency.	Loss of local area ADS-B.	3C	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 22Nd Design system to minimize the potential for interface malfunction between FMS and ADS-B 22Ne Design system to minimize the potential for degraded FMS input to ADS-B. 31N Design WAAS and LAAS to integrate with ADS-B, provide redundancy, and minimize potential for degraded FMS input to ADS-B. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 50 Design ADS-B system architecture to ensure failure isolation of hardware, firmware, and software. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations. 50 Design ADS-B system architecture to ensure failure isolation of hardware, firmware, and software.

Automatic Dependent Surveillance Broadcast (ADS-B)

836	ISK.06.1	Loss of L1 frequency results in loss of: ADS-B, GPS, LAAS and WAAS. Event occurs during critical time, CAT IIIa, 3B, or 3C approaches.	Loss of L1 frequency due to: Electromagnetic environmental effects Sun spots Solar flares Loss of coverage Jamming.	Pilot/flight crew unable to respond in time.	Takeoff, Approach Landing, Surface, Flight, Emergency.	Collision	3C	58 Consider alternative frequency spectrum as backup. 57 Select frequency spectrum to minimize adverse effects of weather on ADS-B transmissions. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 22Nd Design system to minimize the potential for interface malfunction between FMS and ADS-B 22Ne Design system to minimize the potential for degraded FMS input to ADS-B. 31N Design WAAS and LAAS to integrate with ADS-B, provide redundancy, and minimize potential for degraded FMS input to ADS-B. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 50 Design ADS-B system architecture to ensure failure isolation of hardware, firmware, and software. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

Automatic Dependent Surveillance Broadcast (ADS-B)

837	**ISK.07**	Interface malfunction between FMS and ADS-B results in loss of ADS-B. Event occurs during non-critical time.	Interface malfunction due to: Cable chafing Connector short Open conductors Electromagnetic LTA interface design. Loss of ADS-B due to interface malfunction. No existing collision potentials.	Pilot/flight crew detects malfunction. FMS provides backup functions.	Takeoff, Approach Landing, Surface, Flight.	Loss of ADS-B on single aircraft.	3C	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 28Nd Design MFD or CDTI, TAWS, and TCAS to integrate with ADS-B, provide redundancy, maximize system alert capability, and minimize alert delay or masking of alert. 22Nd Design system to minimize the potential for interface malfunction between FMS and ADS-B

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Automatic Dependent Surveillance Broadcast (ADS-B)

853	**ISL.02**	Incremental risks not adequately addressed presents increased risk of accident.	Incremental risks not adequately addressed: LTA design LTA analysis LTA risk assessment LTA risk management Oversight and omissions. Aircraft on collision course.	Pilot/flight crew loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	3C	61a Conduct analysis, studies, simulations and/or flight tests to identify system safety related risks associated with human factors in the integration of NAS Modernization systems, i.e., ADS-B, CPDLC, FIS, etc. 61b Conduct analysis, studies, simulations and/or flight tests to identify system safety related risks associated with human factors related to possible conflicting communication. 62 Conduct analysis, studies simulations and/or flight-tests to develop engineering requirements to eliminate or control the system risks to an acceptable level. 63 Conduct analysis, studies, simulations and/or flight tests to identify system safety related risks associated with system anomalies that could cause conflicting flight critical information to be communicated. 64 Conduct analysis, studies, simulations and/or flight-tests to develop engineering requirements and/or procedures to minimize system anomalies that result from conflicting information.

Automatic Dependent Surveillance Broadcast (ADS-B)

858	**ISL.06**	LTA visual identification of other aircraft by subject aircraft pilots/aircrew results in inappropriate communication with ATCT and increased collision risks.	LTA visual identification of other aircraft by subject aircraft pilots/aircrew due to: LTA procedure LTA design Human error Poor visibility. Inappropriate communication occurs between pilot/aircrew and controller. Aircraft on collision course.	Pilot/flight crew loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	3C	32Na Conduct analysis, studies, and simulations and/or flight-tests to develop engineering requirements and/or procedures to minimize the risks of unsuccessful conflict resolution between controllers and pilots. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 6N Require all flying objects that can become hazards to navigation be equipped with ADS-B transmitters, or other appropriate means of identification. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 16N Define criteria for determining threshold values for ADS-B coverage area to assure controller/pilot adequate situational awareness. 22N Design system to minimize the potential for failure of Conflict Avoidance function. 23N Design system to minimize the potential of loss of targets. 28Nb Design MFD or CDTI, TAWS, TCAS, and TIS to integrate with ADS-B, provide redundancy, maximize system alert capability, and minimize alert delay or masking of alert. 28N Design MFD or CDTI, TAWS, TCAS, and TIS to integrate with ADS-B, provide redundancy, and minimize conflictive information communicated in cockpit.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

859	ISL.06.1	LTA visual identification of other aircraft by subject aircraft pilots/aircrew results in subject aircraft following wrong target.	LTA visual identification of other aircraft by subject aircraft pilots/aircrew due to: LTA procedure LTA design Human error Poor visibility. Subject aircraft follows wrong target. Aircraft on collision course.	Pilot/flight crew loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	3C	32Na Conduct analysis, studies, and simulations and/or flight-tests to develop engineering requirements and/or procedures to minimize the risks of unsuccessful conflict resolution between controllers and pilots. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 6N Require all flying objects that can become hazards to navigation be equipped with ADS-B transmitters, or other appropriate means of identification. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 16N Define criteria for determining threshold values for ADS-B coverage area to assure controller/pilot adequate situational awareness. 22N Design system to minimize the potential for failure of Conflict Avoidance function. 23N Design system to minimize the potential of loss of targets. 28Nb Design MFD or CDTI, TAWS, TCAS, and TIS to integrate with ADS-B, provide redundancy, maximize system alert capability, and minimize alert delay or masking of alert. 28N Design MFD or CDTI, TAWS, TCAS, and TIS to integrate with ADS-B, provide redundancy, and minimize conflictive information communicated in cockpit. 22Nf Design system to minimize the potential for visual identification of wrong aircraft by pilot/aircrew.

Automatic Dependent Surveillance Broadcast (ADS-B)

860	**ISL.07**	Accuracy delta between ADS-B and TIS-B presents difficulty in target identification and increased accident risk.	Accuracy delta between ADS-B and TIS-B presents difficulty in target identification due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Subject aircraft follows wrong target. Aircraft on collision course.	Pilot/flight crew loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	3C	19N Design TIS to integrate with ADS-B and provide redundant alert against collision risk. 33N Design system to minimize the potential of accuracy delta between ADS-B and TIS-B which presents difficulty in target identification. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 6N Require all flying objects that can become hazards to navigation be equipped with ADS-B transmitters, or other appropriate means of identification. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 16N Define criteria for determining threshold values for ADS-B coverage area to assure controller/pilot adequate situational awareness. 22N Design system to minimize the potential for failure of Conflict Avoidance function. 23N Design system to minimize the potential of loss of targets. 28N Design MFD or CDTI, TAWS, TCAS, and TIS to integrate with ADS-B, provide redundancy, and minimize conflictive information communicated in cockpit. 22Nf Design system to minimize the potential for visual identification of wrong aircraft by pilot/aircrew.

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Automatic Dependent Surveillance Broadcast (ADS-B)

871	**ISL.17**	System (Integrated ADS-B System) time source is unsynchronized resulting in inaccurate position, velocity and time.	System time source is unsynchronized due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Inaccurate position or velocity or time indication. Aircraft on collision course.	Pilot/flight crew loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	3C	37N Design MFD or CDTI, TAWS, TCAS, and TIS to integrate with ADS-B airborne and ground systems, and assure that time source is synchronized resulting in accurate position, velocity and time. 50 Design ADS-B system architecture to ensure failure isolation of hardware. 48b Design ADS-B system architecture to ensure that hardware, firmware and software fails safe. 27 Design the system to assure that dual independent component failure, dual human errors, or a combination of a component failure and a human error cannot cause a catastrophic event. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 23N Design system to minimize the potential of loss of targets. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

Automatic Dependent Surveillance Broadcast (ADS-B)

872	**ISL.18**	Malfunction within Data Fusion processing results in undetected corruption of safety-critical information and increased collision risks.	Corruption occurs due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Corruption occurs to: ADS-B reports Or TIS Or TCAS Targets Or Terrain data Or Weather data. Inaccurate position or velocity or time indication. Aircraft on collision course.	Pilot/flight crew loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	3C	38N Design MFD or CDTI, TAWS, TCAS, and TIS to integrate with ADS-B airborne and ground systems, and assure accurate Data Fusion Processing. 50 Design ADS-B system architecture to ensure failure isolation of hardware. 48b Design ADS-B system architecture to ensure that hardware, firmware and software fails safe. 27 Design the system to assure that dual independent component failure, dual human errors, or a combination of a component failure and a human error cannot cause a catastrophic event. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

Automatic Dependent Surveillance Broadcast (ADS-B)

874	**ISL.20**	LTA airspace transition integration results in increased collision risks.	LTA airspace transition integration due to: Management oversight Inadequate Risk Assessment Inadequate policy Political oversight LTA Standards Development. Aircraft on collision course.	Pilot/flight crew loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	3C	39Na Assure appropriate development and integration of national and international separation standards associated with ADS-B and assure airspace transition integration. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 5N Avionics certification, installation, and approval process established for ADS-B. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 11N Require certification, installation, and approval process established for ADS-B ground system. 10N Require all aircraft that can become hazards to navigation be equipped with ADS-B transmitters, or other appropriate automated means of identification. 68 Develop appropriate training materials and training programs to ensure that all participants in a shared responsibility environment understand their role and safe operation procedures.
875	**ISL.21**	LTA ADS-B equipage or site coverage results in inadequate coverage and increased collision risks.	LTA ADS-B equipage or site coverage due to: LTA design Management oversight LTA resources Inadequate Risk Assessment Inadequate policy Political oversight. Aircraft on collision course.	Pilot/flight crew loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	3C	40N Apply risk-based approach in the determination of resources associated with ADS-B implementation throughout the NAS, in order to assure ADS-B coverage priority in higher risk airspace. 39Na Assure appropriate development and integration of national and international separation standards associated with ADS-B and assure airspace transition integration. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 5N Avionics certification, installation, and approval process established for ADS-B. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 11N Require certification, installation, and approval process established for ADS-B ground system. 10N Require all aircraft that can become hazards to navigation be equipped with ADS-B transmitters, or other appropriate automated means of identification. 68 Develop appropriate training materials and training programs to ensure that all participants in a shared responsibility environment understand their role and safe operation procedures.

Automatic Dependent Surveillance Broadcast (ADS-B)

876	**ISL.22**	LTA integration of ADS-B coverage areas results in "blind spots" and increased collision risks.	LTA integration of ADS-B coverage areas due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Aircraft on collision course.	Pilot/flight crew loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	3C	41N Design ADS-B system considering site-unique configuration to minimize the potential for blind spots. 40N Apply risk-based approach in the determination of resources associated with ADS-B implementation throughout the NAS, in order to assure ADS-B coverage priority in higher risk airspace. 39Na Assure appropriate development and integration of national and international separation standards associated with ADS-B and assure airspace transition integration. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 5N Avionics certification, installation, and approval process established for ADS-B. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 11N Require certification, installation, and approval process established for ADS-B ground system. 10N Require all aircraft that can become hazards to navigation be equipped with ADS-B transmitters, or other appropriate automated means of identification. 68 Develop appropriate training materials and training programs to ensure that all participants in a shared responsibility environment understand their role and safe operation procedures. 50 Design ADS-B system architecture to ensure failure isolation of hardware. 48b Design ADS-B system architecture to ensure that hardware, firmware and software fails safe. 27 Design the system to assure that dual independent component failure, dual human errors, or a combination of a component failure and a human error cannot cause a catastrophic event. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

Automatic Dependent Surveillance Broadcast (ADS-B)

878	**ISL.24**	Loss of safety-critical information/communication to pilot/aircrew as a result of ADS-B malfunction increases accident risk associated with SUA or weather.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. As a result of ADS-B malfunction LTA information/communication occurs associated with: Special Use Airspace information Or Critical weather information. Aircraft is inadvertently exposed to additional risks: Possible collision Or Loss of aircraft control.	Pilot/flight crew/controller are unaware of additional risks. Pilot/flight crew loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	3C	34Na Design MFD or CDTI, TAWS, TCAS, and TIS to integrate with ADS-B, provide redundancy, and minimize the potential for LTA communication. 32Na Conduct analysis, studies, and simulations and/or flight-tests to develop engineering requirements and/or procedures to minimize the risks of unsuccessful conflict resolution between controllers and pilots. 28Ne Design MFD or CDTI, TAWS, and TCAS to integrate with ADS-B, provide redundancy, maximize system alert capability, and integration of audible alerts. 28N Design MFD or CDTI, TAWS, TCAS, and TIS to integrate with ADS-B, provide redundancy, and minimize conflictive information communicated in cockpit. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 5N Avionics certification, installation, and approval process established for ADS-B. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 11N Require certification, installation, and approval process established for ADS-B ground system. 10N Require all aircraft that can become hazards to navigation be equipped with ADS-B transmitters, or other appropriate automated means of identification. 68 Develop appropriate training materials and training programs to ensure that all participants in a shared responsibility environment understand their role and safe operation procedures. 50 Design ADS-B system architecture to ensure failure isolation of hardware. 48b Design ADS-B system architecture to ensure that hardware, firmware and software fails safe. 27 Design the system to assure that dual independent component failure, dual human errors, or a combination of a component failure and a human error cannot cause a catastrophic event. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

n State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum
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Automatic Dependent Surveillance Broadcast (ADS-B)

II.C.3 Minor/Remote (4B)

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
431	SA-28.7	Failure propagation results in loss of ADS-B. Scenario addresses partial loss of ADS-B in specific coverage area.	Partial loss of ADS-B in specific coverage area due to: SW malfunction HW malfunction Inappropriate placement Electromagnetic environmental effects Inadvertent damage Vandalism LTA design.	Pilot/flight crew/controller maintain situational awareness. Aircraft identified via radar or other sources. See and avoid successful.	Takeoff, Approach Landing, Flight, Airport surface, Emergency.	Partial loss of ADS-B.	4B	50 Design ADS-B system architecture to ensure failure isolation of hardware. 48b Design ADS-B system architecture to ensure that hardware, firmware and software fails safe. 27 Design the system to assure that dual independent component failure, dual human errors, or a combination of a component failure and a human error cannot cause a catastrophic event. 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions.

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Automatic Dependent Surveillance Broadcast (ADS-B)

606	**ISE1.01**	Degraded surveillance due to ADS-B malfunction on single aircraft.	ADS-B malfunction on single aircraft due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Degraded surveillance occurs. Malfunction within sensor fusion system due to the above contributors.	Degraded surveillance occurs and condition is detected by ATCT.	En route, Terminal	Degraded surveillance occurs associated with single aircraft.	4B	24N Design system to minimize the potential of malfunction within sensor fusion system or interface. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. . 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

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Automatic Dependent Surveillance Broadcast (ADS-B)

625	**ISG1.01**	Loss of private user flight following surveillance due to ADS-B malfunction.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Loss of flight following surveillance.	Loss of flight following surveillance is detected. Pilot/flight crew does maintain situational awareness.	Flight	Loss of flight following surveillance.	4B	25N Design system to minimize the potential of loss of flight following surveillance. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

Automatic Dependent Surveillance Broadcast (ADS-B)

II.C.4 Major/Extremely Remote

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
838	ISK.07.1	Interface malfunction between FMS and ADS-B results in degraded accuracy of ADS-B. Event occurs during non-critical time.	Interface malfunction due to: Cable chafing Connector short Open conductors Electromagnetic LTA interface design. Degraded accuracy ADS-B due to interface malfunction. No existing collision potentials.	Pilot/flight crew detects malfunction/degradation. FMS provides backup functions.	Takeoff, Approach Landing, Surface, Flight.	Degraded accuracy of ADS-B on single aircraft.	3D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 28Nd Design MFD or CDTI, TAWS, and TCAS to integrate with ADS-B, provide redundancy, maximize system alert capability, and minimize alert delay or masking of alert. 22Nd Design system to minimize the potential for interface malfunction between FMS and ADS-B

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.

Automatic Dependent Surveillance Broadcast (ADS-B)

839	ISK.07.2	Interface malfunction between FMS and ADS-B results in degraded accuracy of ADS-B. Scenario results in collision.	Interface malfunction due to: Cable chafing Connector short Open conductors Electromagnetic LTA interface design. Degraded accuracy ADS-B due to interface malfunction. Pilot/flight crew loses situational awareness. Aircraft on collision course.	Pilot/flight crew does not regain situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Surface, Flight, Emergency.	Collision	3D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 28Nd Design MFD or CDTI, TAWS, and TCAS to integrate with ADS-B, provide redundancy, maximize system alert capability, and minimize alert delay or masking of alert. 22Nd Design system to minimize the potential for interface malfunction between FMS and ADS-B.

Automatic Dependent Surveillance Broadcast (ADS-B)

840	**ISK.08**	Degraded FMS input to ADS-B results in decreased accuracy. Event occurs during non-critical time.	Degraded FMS input due to: Degraded WAAS Degraded LAAS Degraded GPS FMS internal malfunction. Degraded accuracy ADS-B due to FMS input. No existing collision potentials.	Pilot/flight crew detects malfunction/degradation. GPS provides backup functions.	Takeoff, Approach Landing, Surface, Flight.	Degraded accuracy of ADS-B on single aircraft.	3D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 28Nd Design MFD or CDTI, TAWS, and TCAS to integrate with ADS-B, provide redundancy, maximize system alert capability, and minimize alert delay or masking of alert. 22Nd Design system to minimize the potential for interface malfunction between FMS and ADS-B. 22Ne Design system to minimize the potential for degraded FMS input to ADS-B. 31N Design WAAS and LAAS to integrate with ADS-B, provide redundancy, and minimize potential for degraded FMS input to ADS-B.

Automatic Dependent Surveillance Broadcast (ADS-B)

841	ISK.08.1	Degraded FMS input to ADS-B results in decreased accuracy. Scenario results in collision.	Degraded FMS input due to: Degraded WAAS Degraded LAAS Degraded GPS FMS internal malfunction. Degraded accuracy ADS-B due to FMS input. Pilot/flight crew loses situational awareness. Aircraft on collision course.	Pilot/flight crew does not regain situational awareness. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Surface, Flight, Emergency.	Collision	3D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 28Nd Design MFD or CDTI, TAWS, and TCAS to integrate with ADS-B, provide redundancy, maximize system alert capability, and minimize alert delay or masking of alert. 22Nd Design system to minimize the potential for interface malfunction between FMS and ADS-B. 22Ne Design system to minimize the potential for degraded FMS input to ADS-B. 31N Design WAAS and LAAS to integrate with ADS-B, provide redundancy, and minimize potential for degraded FMS input to ADS-B.

Automatic Dependent Surveillance Broadcast (ADS-B)

842	**ISK.09**	ADS-B malfunction propagates to FMS. Event occurs during non-critical time.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Loss of FMS due to propagation effects.	Pilot/flight crew detects malfunction/degradation. GPS provides backup functions.	Takeoff, Approach Landing, Surface, Flight.	Loss of FMS on single aircraft.	3D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 50 Design ADS-B system architecture to ensure failure isolation of hardware, firmware, and software. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

Automatic Dependent Surveillance Broadcast (ADS-B)

843	ISK.09.1	ADS-B malfunction propagates to FMS. Event occurs during critical time, CAT IIIa, 3B, or 3C approaches.	ADS-B malfunction due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Loss of FMS due to propagation effects. Possible loss of WAAS and LAAS.	Pilot/flight crew unable to respond in time.	Approach	Collision	3D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 50 Design ADS-B system architecture to ensure failure isolation of hardware, firmware, and software. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

Automatic Dependent Surveillance Broadcast (ADS-B)

844	**ISK.10**	Failure of FMS results in loss of ADS-B. Event occurs during non-critical time.	Failure of FMS due to: Loss of WAAS Loss of LAAS Loss of GPS FMS internal malfunction. Loss of ADS-B. No existing collision potentials.	Pilot/flight crew detects malfunction. GPS provides backup functions.	Takeoff, Approach Landing, Surface, Flight.	Loss of ADS-B on single aircraft.	3D	8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 22Nd Design system to minimize the potential for interface malfunction between FMS and ADS-B 22Ne Design system to minimize the potential for degraded FMS input to ADS-B. 31N Design WAAS and LAAS to integrate with ADS-B, provide redundancy, and minimize potential for degraded FMS input to ADS-B. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. 50 Design ADS-B system architecture to ensure failure isolation of hardware, firmware, and software. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

861	**ISL.08**	Inappropriate use of call sign or other language results in mis-communication and increased collision risks.	Inappropriate use of call sign or other language results in mis-communication due to: LTA training LTA design LTA procedure Human error. Subject aircraft follows wrong target or takes wrong clearance. Aircraft on collision course.	Pilot/flight crew loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	3D	34N Design MFD or CDTI, TAWS, TCAS, and TIS to integrate with ADS-B, provide redundancy, and minimize the potential for miscommunication. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude.
862	**ISL.09**	Inappropriate use of new terminology or phraseology results in mis-communication and increased collision risk.	Inappropriate use of new terminology or phraseology results in mis-communication due to: LTA training LTA design LTA procedure Human error. Subject aircraft follows wrong target or takes wrong clearance. Aircraft on collision course.	Pilot/flight crew loss of situational awareness. Aircraft not identified via radar or other sources. ATCT does not communicate warning in time. See and avoid unsuccessful.	Takeoff, Approach Landing, Flight, Surface, Emergency.	Collision	3D	34N Design MFD or CDTI, TAWS, TCAS, and TIS to integrate with ADS-B, provide redundancy, and minimize the potential for miscommunication. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness. 15Na Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and inappropriate use of new terminology or phraseology. 14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude.
863	**ISL.10**	System inaccuracies between ADS-B and other subsystem results in inadvertent contact with wake vortex and increased accident risks.	System inaccuracies between ADS-B and other subsystem result in inadvertent contact with wake vortex. Loss of aircraft control occurs.	Pilot/flight crew unable to regain aircraft control in time.	Takeoff, Approach Landing, Flight, Emergency.	Collision with terrain.	3D	14N Conduct human factor analyses, evaluations, and/or simulations to identify safety-related risks associated with the integration of ADS-B system into the NAS. 3N ATCT use of 7110.65 procedures for validating aircraft ID, position, and altitude. 15N Assure that controller/pilot training and procedures are in place for ADS-B, to minimize human error and increase situational awareness.

Automatic Dependent Surveillance Broadcast (ADS-B)

II.C.5 Minor/Extremely Remote

Seq.	Scenario #	Scenario Description	Contributors	Subsequent Contributors	Phase	Possible Effect	Risk	Recommendations for Precautions, Controls & Mitigations
608	ISE1.01.2	Loss of surveillance due to ADS-B malfunction on single aircraft.	ADS-B malfunction on single aircraft due to: SW malfunction HW malfunction System malfunction Electromagnetic environmental effects Inadvertent damage LTA design. Loss of surveillance on single aircraft. Malfunction within sensor fusion system due to the above contributors.	Loss of surveillance on single aircraft, loss of target, and condition is detected by ATCT.	En route, Terminal	Loss of surveillance on single aircraft.	4C	24N Design system to minimize the potential of malfunction within sensor fusion system or interface. 8b Design ADS-B to assure that system failures/malfunctions are detected and reported automatically. 5 Design ADS-B System to automatically report system failure/ malfunction to ATC and affected aircrews. 6 Failure/malfunction indication shall be designed to conform to FAA CT-96/1 7 Provide for appropriate ATC/Aircrew contingency procedures. 12d Provide alternate means of identifying other aircraft/vehicle/fixed object. 26 Design the system such that no single failure, common mode failure, human error or design feature shall result in a catastrophic event, (severity 1 or 2). 5N Avionics certification, installation, and approval process established for ADS-B. 11N Require certification, installation, and approval process established for ADS-B ground system. 14 Apply appropriate system reliability and availability requirements (TBD) to minimize the risk of failures, system anomalies, and malfunctions. . 60 Design ADS-B to be hardened against electromagnetic interference to the standards in FAA G 2100-F, MIL-STD-461D, MIL-STD-436D AND FCC Regulations.

System State considers worst case environmental and traffic conditions, poor weather, night, minimal visibility, maximum Traffic.