

Four Newly Submitted Draft Issue Papers

242A-WP-5-02

Gary Livack

May 21, 2001

IP # 1: How will ADS-B determine if a target helicopter is on the ground or in hover. Also, how will other aircraft determine if an airplane has just taken off?

IP # 2: ADS-B enabled "downlink" and "crosslink" of selected airborne and pilot preset parameters. Also, TIS-B enabled "uplink" of data.

IP # 3: Does the vertical height integrity (NIC) value need to be the same as the horizontal integrity level so suitably equipped aircraft can perform ACM functions against ADS-B equipped TARGET aircraft?

IP # 4: Edit text of the ADS-B MASPS (DO-242), as needed, to embrace the notion that ADS-B application enabling software, at the discretion of the applicant, can be treated as discrete, modular software.

MASPS for ADS-B Rev. A

Tracking Information (committee secretary only)	
Change Issue Number	38
Submission Date	5/14/01
Status (open/closed/deferred)	TBD
Last Action Date	

Short Title for Change Issue:	Airport surface movement and runway incursion prevention: How will ADS-B determine if a target helicopter is on the ground or in hover. Also, how will other aircraft determine if an airplane has just taken off?
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MASPS Document Reference:		Originator Information:	
Entire document (y/n)		Name	Gary Livack / FAA
Section number(s)		Phone	(202) 267-7954
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Proposed Rationale for Consideration (originator should check all that apply):	
<input type="checkbox"/>	Item needed to support of near-term MASPS/MOPS development
<input type="checkbox"/>	DO-260/ED-102 1090 MHz Link MOPS Rev A
<input type="checkbox"/>	ASA MASPS
<input type="checkbox"/>	TIS-B MASPS
<input type="checkbox"/>	UAT MOPS
<input type="checkbox"/>	Item needed to support applications that have well defined concept of operation
<input type="checkbox"/>	Has complete application description
<input type="checkbox"/>	Has initial validation via operational test/evaluation
<input type="checkbox"/>	Has supporting analysis, if candidate stressing application
<input type="checkbox"/>	Item needed for harmonization with international requirements
<input type="checkbox"/>	Item identified during recent ADS-B development activities and operational evaluations
<input type="checkbox"/>	MASPS clarifications and correction item
<input type="checkbox"/>	Validation/modification of questioned MASPS requirement item
<input type="checkbox"/>	Military use provision item
<input type="checkbox"/>	New requirement item (must be associated with traffic surveillance to support ASAS)

Nature of Issue:	<input type="checkbox"/> Editorial	<input type="checkbox"/> Clarity	<input type="checkbox"/> Performance	<input type="checkbox"/> Functional
<u>Issue Description:</u>				
<p>How will any of the candidate ADS-B data links determine if an aircraft (such as an helicopter) is on the ground or in ground hover just above the airport surface? Also, for aircraft on takeoff, or aircraft that may be doing a “touch and go”, this same issue applies.</p> <p>Technical issue: The use of a baro aided pressure altimeter may not be of sufficient accuracy to provide accurate AGL height data. The MASPS Ad Hoc working group needs to address this issue. (See page 32, paragraph 2.1.2.2.1.2, “Altitude”).</p>				

<u>Originator’s proposed resolution if any (attach additional sheets if necessary):</u>

Note: Attach additional sheets to capture supporting discussion with source and date.

MASPS for ADS-B Rev. A

Tracking Information (committee secretary only)	
Change Issue Number	XXX
Submission Date	5/14/01
Status (open/closed/deferred)	TBD
Last Action Date	

Short Title for Change Issue:	<p>ADS-B enabled “downlink” and “crosslink” of selected airborne and pilot preset parameters. Also, TIS-B enabled “uplink” of data.</p> <p>This issue paper consolidates several earlier submitted IPs that relate to the exchange of additional message set data. These earlier submitted IPs include:</p> <ol style="list-style-type: none"> 1. IP # 4 (make and model) 2. IP # 6 (marking obstacles with Class B3 systems) 3. IP # 7 (message set elements supporting various Appendix E DO-242 applications, such as AUTOMET/E-PIREP data message sets, etc) 4. IP # 13 (broadcast rate) 5. IP # 18 (heading at Vstop) 6. IP # 19 (brake on / off and percentage power, etc.)
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<u>Issue Description:</u>								
<p>This IP consolidates several recommendations made earlier as part of issue papers (IPs) #'s 4, 6, 7, 13, 18, and 19, and adds additional message set elements for consideration. Message sets that apply to several related applications COULD be consolidated under this IP (if it makes administrative sense to do this), include:</p> <p>IP# 4: Make and model. Supports various surface movement and wake vortex modeling applications. These would be part of a downlink airborne parameter (DAP) and a crosslink airborne parameter (CAP). See proposal, below, for a definition of DAP & CAP, which differ from similar European acronyms.</p>								

Issue Description (continued):

IP # 6: Moving and stationary obstacles. Proposed Class B 3 message set elements include: Obstacles -- point, volume, and barrier; fixed and moving, and permanent and temporary. The specific symbology will need to be addressed by SAE G-10, with a first subject matter meeting planned for late July.

IP #7: Broadcast of a variety of DAP & CAP parameters.

1. Sub-item #8: AUTOMET / E-PIREPS
2. Sub-item # 9: Wake vortex modeling
1. Sub-item # 25: Crash, Fire, and Rescue needs, e.g., Souls on board, fuel on board

An additional IP # 7 issue needs to be transferred to SC-186, WG-2, TIS-B WG, for resolution.

IP # 13: Update rate.

IP # 18: Heading at V Stop.

IP # 19: Power and brake cues for “time critical” alerting for runway incursion protection. (Have reviewed about 50 Class A runway incursion incidents and about five runway incursion accidents reports. A variety of message set elements have been identified, which is the subject of a separate slide set presentation, “Proposed Role of ADS-B for Data Communications.” (See 242A-WP-5-01).

Originator’s proposed resolution if any:

The following is an initial effort to rework all of the above message set elements, along with others, into a single IP. What’s needed is analysis to specify the recommended update rates, e.g., every minute, upon occurrence, etc.

The following usage codes are used in this proposal:

1. D = Downlink / broadcast of data
2. C = Crosslink / broadcast (i.e., between aircraft) of data between aircraft
3. U = Uplink of data from the ground-to-the-air (e.g., TIS-B)

Note: Any of the above message sets could be automatically broadcast at an established, preset rate, or broadcast when “triggered” by the broadcast message of a nearby aircraft (either in the air or on the ground) and in the immediate vicinity. Example: ELT function is triggered by an aircraft flying overhead, and ELT ADS-B function broadcasts a message once every 10-20 seconds, for 5 minutes. Then ceases.

ADS-B Message Set Data Expansion

Other than DO-242, Section # 2. 1. 2. 3. 1, at present, there are no other specifically defined ADS-B enabled message set elements. It is therefore suggested that the MASPS Ad Hoc group define these message sets (working with SC-186, WG-1, SC-193, and others), along with the frequency / rate of broadcasting this information. Clearly, some information will need to be broadcast, say, every minute or two, while other information, such as time-critical runway incursion-related data, will need to be broadcast at a much higher rate.

Examples of Potential Limited Communications Message Set Elements:

1. Aircraft specific make / model data (D / C / U).

(This message set is presently suggested in IP # 4)

Originator's proposed resolution if any (continued):

2. Type of obstacle (e.g., point, volume, and barrier; fixed versus moving; permanent versus temporary) (C / U)

(This message set is presently suggested in IP # 6)

3. The AUTOMET / E-PIREP message set elements as defined in DO-252. Note: These message elements would be in addition to the "routine" ADS-B enabled aircraft position and ID reports.

(These message set elements are presently suggested in IP # 7)

As FYI, the seven DO-252 FIS message set elements that may be candidates for a combined ADS-B and AUTOMET / E-PIREP message set include:

- Static air temperature
- Wind speed / direction (i.e., the wind field velocity vector)
- Humidity
- Icing
- Turbulence
- Wind shear, and
- Liquid water content.

All seven of these data elements (or just winds, temperature, and turbulence messages) could be broadcast at varying refresh rates, for use in the following airspace regimes:

- ◆ En route air-to-air. (Especially helpful in oceanic / remote areas, and when aircraft are flying across ATC sector boundaries)
- ◆ En route and terminal area air-to-ground. (For use by ground automation such as CTAS and for input to NWS's RUC and SNIP models)
- ◆ Terminal area air-to-air. (For wake vortex modeling and to provide wind field data to other aircraft to assist with FMS "4D" arrivals, parallel approaches, etc.)
- ◆ Terminal area air-to-ground. (For generating new terminal area FIS products) (D)

4. Aircraft heading at Vstop (while on the airport surface) (D / C / U)

(This message set is presently suggested in IP # 18)

5. Runway Incursion alerting. Four possible candidates include:

- Brakes on / off (D / C)
- Percentage of engine power (D / C)
- Aircraft lights on / off
- Intended destination on the airport (e.g., the parking area, gate, runway, hold-short point) (D/C)

(Note: The first two were suggested under IP # 19. A more extensive listing of runway incursion message sets are included in Ken Staub's IP # 19 presentation)

6. Air / ground state: Is the aircraft physically on the ground or above the surface? (D / C)

(This message set is presently suggested in a draft IP associated with this working paper)

7. Actual aircraft weight (D / C) (Needed for wake vortex modeling)

Originator's proposed resolution if any (continued):

8. Downlink of specific flight planning and intent information (transmitted each time the aircraft enters a new TIS-B coverage area):

- Airport of departure (D)
- Airport of intended landing (D)
- ATC Flight Plan (ICAO format) (D)
- ADCUS (intended point of departure, arrival, ETA) (D)
- FMS pre-programmed flight plan (including multiple waypoints for arrival and departure intent / routings) (D / C)
- Student pilot (C / D)
- Hearing impaired pilot (C / D)
- Not voice radio equipped (C / D)

(Note: Those data sets above with a "C" would also broadcast those specified data sets periodically, say, once every 2-5 minutes, exact time TBD).

9. Special aircraft surveillance codes (e.g., for use by DEA, FBI, SS, DOD, etc.) (D / C / U)

10. Communication frequency being monitored (D / C)

11. Stuck mike indicator (D)

12. Cancel flight plan (for GA), especially at non-towered airports

13. Baro altitude / GPS vertical height conformance monitoring. (Useful for RVSM and ACM integrity monitoring) (D)

14. Altitude ground position "self-test" function for ATC conformance monitoring to validate V-NAC. (D / U)

(Note: The above functionality may be needed to allow GA ADS-B systems a means to test / validate the encoder function of the ADS-B system)

15. Squawk ADS-B "Ident" feature (U) (For use when aircraft is VFR, and aircraft's ADS-B system is operating in anonymous mode of operation).

16. ATC requested "Stop broadcasting ADS-B Altitude" (U)

17. Local altimeter uplink (U).

(Note: Could be FIS-B or TIS-B enabled).

18. Terminal area (daily / hourly) cumulative noise exposure levels (U)

19. Special Use Airspace:

- Temporary Flight Restricted (TFR) airspace (e.g., its dimensions) (U)
- TFR date when effective (U)
- Times when active (U)

- Dimensions of Special Use Airspace (SUA) (actual) (U)
- SUA date when effective (U)
- Actual times when "hot" and "cold" (U)

- From civil aircraft -- The time estimate when the aircraft expects to enter / exit the SUA (D/C)

Originator's proposed resolution if any (continued):

19. Special Use Airspace (continued):

- From DOD aircraft -- Military Training Route (MTR) "intent" information (D/C)
- From DOD aircraft -- the actual MTR being flown (i.e., broadcast route ID) (D/C)

20. Emergency / Priority Status Codes

Section # 2. 1. 2. 3. 1, page # 38 of the ADS-B MASPS, presently defines six emergency / priority status codes, along with two spares, for a total of eight. Expand this section to include at least the following additional message set information:

Indication of special need:

- Souls on board (D / C)
- Fuel on board (D / C)
- Type fuel on board (D / C)
- Event time (C)

In addition to the above list, there may be additional data link message elements (part of a multi-purpose data link) not considered in this write-up. They include message elements unique to:

- TIS-B (ground-to-air uplink) (U)
- FIS-B (ground-to-air uplink) (U)
- DGPS augmentation signals (ground-to-air uplink) (U)
- Runway-in-use landing threshold wind reporting (ground-to-air) (U)

Note: Attach additional sheets to capture supporting discussion with source and date.

MASPS for ADS-B Rev. A

Tracking Information (committee secretary only)	
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Submission Date	5/14/01
Status (open/closed/deferred)	TBD
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Nature of Issue:	<input type="checkbox"/> Editorial	<input type="checkbox"/> Clarity	<input type="checkbox"/> Performance	<input type="checkbox"/> Functional
<u>Issue Description (attach additional sheets if necessary):</u>				
<p>How might the revised version of the ADS-B MASPS (DO-242A) be drafted so as to ensure that the vertical height integrity value is at the same “level” as the horizontal NIC level so that ACM can be accomplished. If we do not address this interoperability issue now, especially for Capstone 2 avionics, we may end up deploying systems that will not have the adequate vertical height attributes to act as the TARGET aircraft / system for ACM equipped aircraft. What might happen is with many systems deployed, we then might realize that these already deployed systems (e.g., Capstone 2 and future) are not backwards compatible (in vertical NIC) and thus would need to upgrade their systems to be targets for other aircraft equipped with ACM systems.</p>				

<u>Originator’s proposed resolution if any (attach additional sheets if necessary):</u>

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MASPS for ADS-B Rev. A

Tracking Information (committee secretary only)	
Change Issue Number	40
Submission Date	5/14/01
Status (open/closed/deferred)	TBD
Last Action Date	

Short Title for Change Issue:	Edit text of the ADS-B MASPS (DO-242), as needed, to embrace the notion that ADS-B application enabling software, at the discretion of the applicant, can be treated as discrete, modular software. Might there be a process so that modular ADS-B software could receive a TSO, and be transportable to other hardware platforms?
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Issue Description:								
<p>Recently, RTCA published DO-255 (i.e., the Avionics Computer Resource). This RTCA DO document allows for the use of partitioned software. The issue is whether the ADS-B MASPS group needs to insert specific enabling language into the 242A document so implementators may, at their option, certify the various ADS-B “tools”, i.e., the enabling software as modular. Restated, what provisions, if any, are needed in DO-242A so as to allow specific implementators the opportunity to incorporate modular software into their designs?</p> <p>A specific recommendation might be to allow ADS-B software configurable items to be certified at a specific DO-178B criticality level. Is there a way to relate the various ADS-B applications to some kind of software criticality matrix? Might it be possible to integrate them into “classes” such as those that support situational awareness only, those that support spacing applications, and those that support separation assurance? If enabled by DO-242A, such an approach could significantly reduce the certification burden by allowing for re-use of certification code. Additionally, it could also reduce the need for submittal of identical data for use in look-alike systems.</p>								

Originator’s proposed resolution if any (attach additional sheets if necessary):
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