1 Purpose and Scope

2 Functional and Operational Requirements

2.1 General Requirements

2.1.1 ADS-R

ADS-R Service users will receive crosslink information (i.e., ADS-R Messages) on the location of other proximate targets in airspace designated as an ADS-R Service Volume. An ADS-R Service Volume is airspace within line of sight radio frequency coverage from ADS-B radio stations. The user can expect to receive ADS-R Messages from multiple radio stations. A radio station can service one or more ADS-R Service Volumes and a Service Volume can be served by multiple radio stations.

ADS-R Service users are expected to be transmitting ADS-B Messages that are received by the ADS-B radio stations on the ground. The ADS-R Service rebroadcasts ADS-B Messages received on alternate ADS-B data links. The ADS-R Service also uses this information to provide an ADS-R Service Status Message to users indicating when they are operating in an ADS-R Service Volume and should expect to receive ADS-R Messages. The transmitted ADS-R Messages are data link dependent and specified in the appropriate data link ADS-B MOPS.

The ADS-R Service will support the following ASA applications:

- AIRB / Enhanced Visual Acquisition (EvAcq),
- Visual Separation on Approach (VSA),
- Airport Surface Situational Awareness (SURF),
- ~~In-Trail Procedure~~

The ADS-R Service may support the following future ASA applications:

- Surface Indications and Alerts (SURF-IA),
- CDTI-Enhanced Delegated Separation (CEDS),
- Interval Management - Spacing on approach/departure (FIM-S),
- Traffic Situation Awareness with Alerts (TSAA),
- ~~.~~

The ADS-R Service **shall** (R2.xxx) rebroadcast ADS-B Messages received on an alternate ADS-B data link.

2.1.2 TIS-B

TIS-B Service users will receive ground radar derived information (i.e., TIS-B Messages) on the location of other proximate targets in airspace designated as a TIS-B Service Volume. A TIS-B Service Volume is airspace within line of sight radio frequency coverage from both ADS-B radio stations and FAA radars. The user can expect to receive TIS-B Messages from multiple radio stations. A radio station can service one or more TIS-B Service Volumes and a Service Volume can be served by multiple radio stations.

TIS-B Service users are expected to be transmitting ADS-B Messages that are received by the ADS-B radio stations on the ground. The TIS-B Service uses this information to provide a TIS-B Service Status

Message to users indicating when they are operating in a TIS-B Service Volume and should expect to receive TIS-B Messages. The transmitted TIS-B Messages are data link dependent and specified in the appropriate data link ADS-B MOPS.

This MASPS does not impose performance requirements on the TIS-B Service provision subsystem. It is understood that the TIS-B Service will transmit information with the best accuracy, integrity, and latency that is achievable for traffic detected by radar and multilateration surveillance systems.

The TIS-B Service will support the following ASA applications:

- AIRB / Enhanced Visual Acquisition (EvAcq),
- Airport Surface Situational Awareness (SURF).

The TIS-B Service may support the following future ASA applications:

- Surface Indications and Alerts (SURF-IA),
- Traffic Situation Awareness with Alerts (TSAA).

The TIS-B Service **shall** (R2.xxx) use existing ATC surveillance sensors to develop and transmit TIS-B Messages to ADS-B equipped users.

3 Airborne System Performance Requirements

3.1 System Scope and Definition of Terms

3.2 System Descriptions

3.2.1 Aircraft Systems

3.2.1.1 CDTI

3.2.1.2 ASSAP

3.2.1.3 ADS-B Subsystem Description

3.2.1.4 ADS-B Subsystem Requirements

3.2.1.4.1 ADS-B Receive Subsystem Functional Requirements

The ADS-B receive subsystem provides the receiving functionality for surveillance messages transmitted over each ADS-B data link, which includes ADS-B, ADS-R, and TIS-B Messages. It processes received messages and provides the corresponding ADS-B, ADS-R and TIS-B Reports to the ASSAP function. Users equipped with the UAT data link will also receive FIS-B messages; the TIS-B Service Status information is included in this service. Future implementations of the 1090ES data link may also convey TIS-B Service Status.

3.2.1.4.1.1 Message Reception

The ADS-B receive subsystem is expected to receive the appropriate link specific signal in space, detect and correct bit errors as appropriate, and conduct appropriate link specific monitoring functions. Additional requirements for the data link specific processing will be found in the ADS-B MOPS for each data link. (289-3.3.1.1) ~~{There are no requirements in this section excluding the reception and processing of version 0/DO-260 messages. Should there be?}~~

The ADS-B receive subsystem shall (R3.xxx) receive link dependent messages from all ADS-B transmit subsystems within the application coverage volumes per section ~~xxx~~3.4.3. (289R2.24, 289R3.165) ~~{The coverage volumes for ADS-B air-to-air applications are presented in section 3.2 of DO-289. We may need to reference corresponding section in this MASPS when available.}~~

The ADS-B receive subsystem shall (R3.xxx) receive link dependent messages from the ADS-R transmit subsystem within the corresponding Service Volume(s) where the ADS-R Service is being provided. (289R2.24, 289R3.165) {The service volumes where ADS-R is provided may or may not fully support all air-to-air applications as presented in section 3.2 of DO-289. We may need to reference corresponding section in this MASPS when available.}

The ADS-B receive subsystem shall (R3.xxx) receive link dependent messages from the TIS-B transmit subsystem within the corresponding Service Volume(s) where the TIS-B Service is being provided. (289R2.24, 289R3.165) {The service volumes where TIS-B is provided may or may not fully support all air-to-air applications as presented in section 3.2 of DO-289}

The ADS-B receive subsystem, for UAT data link users only, shall (R3.xxx) receive FIS-B messages from the FIS-B transmit subsystem within the corresponding Service Volume(s) where the TIS-B Service is being provided to get TIS-B Service Status information.

3.2.1.4.1.2 Message Processing

The ADS-B receive subsystem shall (R3.xxx) correlate, collate, decompress, re-partition, decode, or otherwise manipulate as necessary to reconstitute the ADS-B, ADS-R, TIS-B, and FIS-B Reports, as appropriate for each data link. (286R3.4-02) ~~{it should be noted that this is currently a requirement that is not adhered to by current avionics and may not be support in the ASAP – needs discussion}~~

> *Note* *Additional requirements for the data link specific processing will be found in Section §3.5 of these MASPS and in the ADS-B MOPS for each data link.*

The ADS-B receive subsystem should not track, extrapolate or otherwise manipulate received surveillance data, other than as necessary to assemble complete ADS-B, ADS-R and TIS-B Reports. (289-2.4.3.3)

> ***Note****: It is the responsibility of ASSAP to perform the traffic tracking function, including correlation, registration, smoothing, extrapolation, coasting.*

The ADS-B receive subsystem shall (R3.xxx) assemble ADS-B, ADS-R and TIS-B reports containing State Data (see Table xxx) and ID/Status (Table xxx), and when required, application specific information for all received data. (289R3.166) ~~{State Data and ID/Status was in table 3-18 of DO-289}{it should be noted that this is currently a requirement that is not adhered to by current avionics and may not be support in the ASAP – needs discussion}~~{The correct table number for above is in WP25-10 and is still labeled Table 3-18}

The ADS-B receive subsystem shall (R3.xxx) update and pass all appropriate ADS-B, ADS-R, TIS-B or FIS-B reports to ASSAP each time any new (changed) information is received over the data link. (289R2.25, 289R3.167)

3.2.1.4.2 ADS-B Receive Subsystem Performance Requirements

3.2.1.4.2.1 Message Reception and Processing Rate

The ADS-B receive subsystem shall (R3.xxx) successfully receive and process ADS-B, ADS-R, TIS-B, or FIS-B messages to achieve the minimum report update rate required to each application (or ASA

Capability Level?) described in Table Table 3.4.3.3.1.1a~~xxx~~. {~~Table referenced is 2-3 in DO-289.~~ Need to standardize terminology re: application ~~or ASA Capability Level.~~}

3.2.1.4.2.2 Processing Latency

Data processing latencies are addressed at the ADS-B system level in section xxx, thus there are no ADS-B receive subsystem latency requirements. However, it should be noted that more important than total latency is the amount of uncompensated latency of the data.

{Here is some proposed text for the referenced section (new draft 3.3.1):
The total latency is the time difference between the Time of Applicability (TOA) of information at the transmitting aircraft to the display of this information on the receiving aircraft. Some data latency can be compensated with extrapolation techniques; however, there will always be a small amount of uncompensated latency that needs to be minimized.

The maximum total latency from the TOA of position and velocity information in the transmitting aircraft (ADS-B) or ground radio station (ADS-R and TIS-B) and display of this position/velocity information in the receiving aircraft *shall* (Rx.xxx) be less than 5 seconds to support the following applications: {This requirement is consistent with the FAA final Program Requirements (fPR) for SBS, version 3.0, 23 July 2010}

- AIRB / Enhanced Visual Acquisition,
- Enhanced Visual Approach,
- Traffic Situation Awareness with Alerts (TSAA),
- Airport Surface Situational Awareness (SURF),
- Surface Indications and Alerts (SURF-IA),
- CDTI-Enhanced Delegated Separation (CEDS),
- Interval Management - Spacing on approach/departure (FIM-S),
- In-Trail Procedure.

The maximum total latency from update of ID/Status information in the transmitting aircraft/vehicle to display of this information in the receiving aircraft *shall* (Rx.xxx) be less than 30 seconds. {This requirement is consistent with the FAA final Program Requirements (fPR) for SBS, version 3.0, 23 July 2010}

The maximum update interval of ADS-R or TIS-B Service Status information in the receiving aircraft *shall* (Rx.xxx) be less than 30 seconds. {This requirement is consistent with the FAA final Program Requirements (fPR) for SBS, version 3.0, 23 July 2010}

Note: The update interval is the time between successive updates of particular information.}

The maximum uncompensated latency of measured geometric position data in the transmitting aircraft/vehicle to the display of this information in the receiving aircraft *shall* (Rx.xxx) be no more than 0.6 seconds. {This requirement is consistent with the FAA final Program Requirements (fPR) for SBS, version 3.0, 23 July 2010}

3.2.1.4.2.3 Processing Capacity

The ADS-B receive subsystem shall (R3.xxx) be capable of processing the expected traffic within the coverage volume for each application ~~(or ASA Capability Level?)~~ described in Table 3.4.3.3.1.1a~~Table xxx~~. (289R2.26) {~~Table referenced is 2-3 in DO-289.~~ Need to standardize terminology re: application ~~or ASA Capability Level~~.}

{Do we also need a requirement re Message Processing Capacity in accordance with expected traffic densities?}

3.2.1.4.2.4 Receiver Reliability

The continuity risk and integrity risk requirements of Table xxx shall (R3.xxx) be met by the ADS-B receive subsystem. (289R3.168) {Table reference to 3-13 in DO-289}

Table xxx: ADS-B Receive Subsystem Continuity Risk and Integrity Risk Requirements (Per flight hour)

	ASA Capability Level			
Feature	**Basic**	**Intermediate**	**Advanced 1**	**Advanced 2**
Subsystem Continuity Risk	10^{-3}	10^{-3}	10^{-4}	10^{-4}
Subsystem Integrity Risk	10^{-3}	10^{-3}	10^{-5}	10^{-5}

Notes for Table 3-13:

1. *Subsystem Integrity Risk is the probability, per flight hour, that a given subsystem will have an undetected failure and consequently, that the subsystem will provide misleading information.*
2. *Subsystem continuity risk is the probability per hour, that, given that the subsystem was operating at the start of the hour or operation, that the subsystem will fail to be available through the remainder of the hour or operation*

3.2.1.4.2.5 Information Integrity

The probability that receive subsystem introduces an error into an ADS-B Message that is received shall (R3.xxx) not exceed 10^{-5} per message. {rate consistent with the FAA Critical Services Spec}

The probability that receive subsystem introduces an error into an ADS-R Message that is received shall (R3.xxx) not exceed 10^{-5} per message. {rate consistent rate with the FAA Critical Services Spec}

The probability that ADS-B receive subsystem introduces an error into a TIS-B Message that is received shall (R3.xxx) not exceed 10^{-5} per message. {rate consistent rate with the FAA Essential Services Spec}