CHANGE ISSUE – RTCA/DO-242

MASPS for ADS-B Rev. A

Tracking Information (committee secretary only)	
Change Issue Number	55
Submission Date	01/03/02
Status (open/closed/deferred)	Rev A. - CLOSED
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Short Title for Change Issue:	Requirements for reception reliability must also be specified for entire relevant user population.

MASPS Document Reference:		Originator Information:	
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Section number(s)		Phone	703-883-7341
Paragraph number(s)	3.3.3.1	E-mail	sjones@mitre.org
Table/Figure number(s)		Other	

Proposed Rationale for Consideration (originator should check all that apply):	
	Item needed to support of near-term MASPS/MOPS development
	DO-260/ED-102 1090 MHz Link MOPS Rev A
	ASA MASPS
	TIS-B MASPS
	UAT MOPS
	Item needed to support applications that have well defined concept of operation
	Has complete application description
	Has initial validation via operational test/evaluation
	Has supporting analysis, if candidate stressing application
	Item needed for harmonization with international requirements
X	Item identified during recent ADS-B development activities and operational evaluations
	MASPS clarifications and correction item
X	Validation/modification of questioned MASPS requirement item
	Military use provision item
	New requirement item (must be associated with traffic surveillance to support ASAS)

Nature of Issue:		Editorial		Clarity	X	Performance		Functional

Issue Description:

DO-242 operational coverage currently requires a minimum confidence level of 95% for exchange of information supporting an application of interest. Since user equipage features such as antenna gain and transmit power vary, we should acknowledge this in the MASPS requirements by also requiring that 95% of the relevant user population achieve the 95% information exchange confidence level.

Originator's proposed resolution:

The 2nd and 3rd paragraphs of section 3.3.3.1 should have the following additions as shown in blue underlined text:

(*See next page.*)

Originator's proposed resolution (continued):

For all of the scenarios included in Table 3-4, the state vector shall (R3.10) be acquired by 95% of the relevant user population with a 95% confidence by the range specified for the scenario. The state vector report is constantly changing and is important to all applications including the safety critical ones. Algorithms designed to use the state vector reports will assume that the information provided is correct (some applications may even require that the information is validated before using it).

Mode-status (MS) and on-condition (OC) report update periods are not specified directly. The minimum range at which mode-status and on-condition reports shall (R3.11) be acquired by 95% of the relevant user population with 95% confidence is specified in Table 3-4. From this minimum range, combinations of acceptable update periods and receive probabilities for MS and OC reports can be derived for media specific ADS-B implementations.

Other proposed resolutions:

As part of the initial review of this Issue Paper by WG6, Steve Heppe and Bill Harman presented 242A-WP-11-10 on the many ways that a 95% requirement might be measured. This presentation concluded with two alternate proposals for resolving this Issue Paper. These proposals are as follows:

Alternate Proposal #1:

For each of the scenarios included in Table 3-4(a), the state vectors received from at least 95% of the observable user population (radio line-of-sight) shall (RX.XX) be acquired by the range specified for the scenario. The update period following initial state vector acquisition, evaluated over the spatial extent of the operational domain, shall (RX.XX) satisfy the probability and timing requirements in Table 3-4(a).*
*The set of user pairs considered, for which update rate requirements are evaluated, refers to those pairs for which initial data acquisition and reporting (track acquisition) has been achieved. It is recognized that persistent variable factors (e.g., low transmit power, antenna nulls) may cause a small percentage of user pairs to fail initial acquisition at the indicated range. The expectation over spatial domain, rather than population, is intended to avoid excessive weighting of scenario-wide performance evaluations by localized domains of high traffic density.

Alternate Proposal #2:
For each of the scenarios included in Table 3-4(a), the state vectors received from at least 95% of the observable user population (radio line-of-sight) shall (RX.XX) be acquired by the range specified for the scenario, and for all such acquired tracks the update rate shall satisfy the time and probability requirements in Table 3-4(a). It is recognized that persistent variable factors such as dips in antenna gain may cause a small percentage of user pairs to fail to be in-track.

Working Group 6 Deliberations:

January 29, 2002: This Issue Paper was initially reviewed at the January 2002 WG6 meeting. It was agreed that this is a needed clarification of how to interpret the 95% acquisition requirements and will be addressed in DO-242A. After reviewing 242A-WP-11-10 and its alternate proposed resolutions shown above, it was felt by the majority of the group that "Alternate proposal #2" was the best resolution of this IP. The discussion was tabled until the author of the Issue Paper could join the group to discuss these alternative proposals.

(*continued on next page*)

Working Group 6 Deliberations ***(continued)***:

February 4, 2002: A telecon was held to discuss this Issue Paper. After everyone agreeing on how this requirement is to interpreted, wording was agreed to for the two paragraphs shown above from DO-242. This resolution was to read as follows:

"For each of the scenarios included in Table 3-4(a), the state vectors from at least 95% of the observable user population (radio line-of-sight) supporting that application shall (RX.XX) be acquired and achieve the time and probability update requirements specified for the operational ranges. The state vector report is constantly changing and is important to all applications including the safety critical ones. Algorithms designed to use the state vector reports will assume that the information provided is correct (some applications may even require that the information is validated before using it).

Mode-status (MS) and on-condition (OC) report update periods are not specified directly. For each of the scenarios included in Table 3-4(a), the MS and OC reports from at least 95% of the observable user population (radio line-of-sight) supporting that application shall (RX.XX) be acquired and achieve the time and probability update requirements specified for the operational ranges. From this minimum range, combinations of acceptable update periods and receive probabilities for MS and OC reports can be derived for media specific ADS-B implementations."

February 22, 2002: A final review of this Issue Paper was conducted by WG6 at their February meeting in Arlington, VA. Due to a reorganization of the requirements within 3.3.3.1 "Report Accuracy, Update Interval, and Acquisition Range", the above agreed to wording had to be changed slightly. (This reorganization included breaking MS and OC requirements into separate subparagraphs from the SV and MS requirements, and the explicit defining of required OC update periods.)

Also, it was determined that wording was needed to emphasize that a significant majority of the "remaining 5%" that might not be acquired at the acquisition range are expected to be acquired within some distance of the 95% acquisition range.

The final resolution, therefore is that specified below in the "Final Resolution" as it is found in 242A-WP-12-01. This wording was agreed to by WG6 and will be the final resolution of this Issue Paper.

WG6 Final Resolution Found on next page.

Working Group 6 Final Resolution:

The following is from the draft DO-242A sent to RTCA on March 4, 2002. Text directly affected by this Issue Paper is shown in blue for each of the subparagraphs listed.

3.3.3.1.1 State Vector Report Acquisition, Update Interval, and Acquisition Range

For each of the scenarios included in Table 3-4(a), the state vectors from at least 95% of the observable user population (radio line-of-sight) supporting that application **shall** (R3.10) be acquired and achieve the time and probability update requirements specified for the operational ranges. For the remaining 5% of the user population that has not been acquired at the 95% specified range, they will be acquired with high probability (99%) within the coast interval specified in Table 3-4(a). The state vector report is constantly changing and is important to all applications, including the safety critical ones. Algorithms designed to use the state vector reports will assume that the information provided is correct. (Some applications may even require that the information is validated before using it.)

3.3.3.1.2 Mode-Status Acquisition, Update Interval, and Acquisition Range

Mode Status (MS) acquisition range requirements are derived from the sample scenarios of Chapter 2, and are specified in Table 3-4(a). For each of the equipage classes included in Table 3-4 (a), the mode status reports from at least 95% of the observable (radio line of sight) population **shall** (R3.14) be acquired at the specified range. For the remaining 5% of the user population that has not been acquired at the 95% specified range, they will be acquired with high probability (at least 80%) within twice the MS reduced (99%) acquisition range specified in Table 3-4(a). (10 NM for A0, 20 NM for A1, 40 NM for A2, and 90 NM for A3).

3.3.3.1.3 Air-Referenced Velocity Acquisition, Update Interval, and Acquisition Range

Air referenced velocity (ARV) update periods and acquisition range requirements are summarized in Table 3-4(b). These requirements are specified in terms of acquisition range and required update interval to be achieved by at least 95% of the observable user population (radio line of sight) supporting ARV on-condition reports within the specified acquisition range or time interval. For the remaining 5% of the user population that has not been acquired at the 95% specified range, they will be acquired with high probability (99%) within twice the nominal update period specified in Table 3-4(b).

3.3.3.1.4 TSR and TCR Acquisition, Update Interval, and Acquisition Range

Target State and Trajectory Change report update periods and acquisition range requirements are summarized in Table 3-4(c). These requirements are specified in terms of acquisition range and required update interval to be achieved by at least 95% of the observable user population (radio line of sight) supporting TS and TC on-condition reports within the specified acquisition range or time interval. For the remaining 5% of the user population that has not been acquired at the 95% specified range, they will be acquired with high probability (99%) within twice the nominal update period specified in Table 3-4(c).