

CHANGE ISSUE – RTCA/DO-242

MASPS for ADS-B Rev. A

Tracking Information (committee secretary only)	
Change Issue Number	58
Submission Date	2/08/02
Status (open/closed/deferred)	Rev A - CLOSED
Last Action Date	2/22/02

Short Title for Change Issue:	New note needed for Table 3-4(a) conditionally relaxing 3 second update period for short ranges.
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MASPS Document Reference:		Originator Information:	
Entire document (y/n)		Name	Stephen Heppe
Section number(s)		Phone	703-589-1522
Paragraph number(s)	3.3.3.1	E-mail	Steveheppe@adsi-m4.com
Table/Figure number(s)	Table 3-4 (a)	Other	

Proposed Rationale for Consideration (originator should check all that apply):	
<input type="checkbox"/>	Item needed to support of near-term MASPS/MOPS development
	DO-260/ED-102 1090 MHz Link MOPS Rev A
X	ASA MASPS
	TIS-B MASPS
	UAT MOPS
<input type="checkbox"/>	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
X	Item needed for harmonization with international requirements
X	Item identified during recent ADS-B development activities and operational evaluations
X	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:	<input type="checkbox"/>	Editorial	<input type="checkbox"/>	Clarity	X	Performance	X	Functional
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Issue Description:

This is a summary of discussions that have occurred over several years. It is a continuation in part of Issue Paper 35. However, it was felt that the issue documented here – the relaxation of update requirements for short-range some applications – went beyond IP35’s request to delete or clarify Note 7 of Table 3-4 in DO-242. Therefore, IP35 was resolved with the deletion of Note 7 and this Issue Paper was authored.

Background

At the start of deliberation for Rev A, an issue paper (IP03) was submitted regarding the necessary update rate for Aid to Visual Acquisition. The suggestion was that an update period of 3 seconds (95%) at 3 nm was not operationally needed, and a slower update period was appropriate. Consensus was achieved for a slower update period for Aid to Visual Acquisition.

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Issue Description (continued):

Background (continued)

Separately, it was recognized that the wording of Note 7 has contributed to confusion regarding the true requirement embodied in the MASPS (IP35). Some investigators interpreted the note as providing a means to interpolate between two requirements identified in the Table (i.e., the requirements for updates at 95% confidence and 99% confidence), while other investigators interpreted the note as specifying the entire requirement referenced to a 99% criterion. Also, it was recognized that regardless of interpretation, the formula embedded in Note 7 failed to match the “end-point” of the probability domain at 95% contained in the body of the Table.

Furthermore, it was recognized that the overall structure of Table 3-4 was less than ideal, and an effort was undertaken to re-cast the Table based on range bins rather than applications per se (IP46).

During the current Rev A effort, numerous attempts have been made to clarify the note, accommodate the consensus regarding update rate for Aid to Visual Acquisition (and equivalent applications), and conform to the new structure for the Table.

Also, it was recognized that ACAS requirements¹ represent a stressing application at short range, and are themselves variable with distance and dynamical scenario (i.e., targets that are closing are of more concern than targets that are receding). The minimum operational performance requirements for ACAS depend on range and range rate, both in the horizontal and vertical domains. Recent activity in ICAO/AMCP/WG-M has identified a possible method by which an ADS-B system could accommodate variable received update rates required for an ACAS system at short range. This too has affected the discussion. It was recognized, at the January 2002 meeting of WG6 in Seattle, that a variable update rate scheme was potentially feasible but that certification issues would remain to be worked-out.

Meeting Consensus

The aggregate effect of these factors has been to recast Note 7 in the following form (according to consensus reached by the participants in Seattle):

13. Requirements for applications at ranges less than 10 nm are under development. The 3-second update period is required for aircraft pairs with horizontal separation less than [1.1 nm] and vertical separation less than [1000] feet. The 3 second update period is also required to support ACM for aircraft pairs within 3 nm lateral separation and 6000 feet vertical separation that are converging at a rate of greater than 500 feet per minute vertically or greater than 6000 feet per minute horizontally. The update period can be reduced to once per 5 seconds (95%) for aircraft pairs that are not within these geometrical constraints and for applications other than ACM. Requirements for ACM are under development. Requirements for future applications may differ from those stated here.

Discussion

The geometric constraints define a pair of concentric “hockey pucks” in 3-D space centered on ownship (the receiver). All targets in the inner hockey puck are required to be observed (SV updates received) at the high rate. This inner hockey puck is similar to a geometry defined for ACAS. It is intended to ensure that closely-spaced aircraft pairs operate with the high rate even if they are not converging. This condition might exist, for example, with stationkeeping and other cooperative maneuvers. This guarantees that the high update rate is already in effect if one of the aircraft starts to blunder and encroach on the separation distance.

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¹ The terminology for ACAS is evolving toward ACM.

Issue Description (continued):

Discussion (continued)

The outer hockey puck is intended to ensure that “intruders” are observed at the high update rate with long look-ahead times. Simulation work by Jonathan Hammer (Mitre/CAASD) indicates that a variable update rate with these parameters works in an equivalent manner (i.e., provides equivalent warning times) to a system which applies the high update rate all the time. It is up to a system developer, wishing to implement variable update rates, to solve the certification issues and ensure that these performance levels are achieved.

This suggested wording of the proposed Note 13 allows Aid to Visual Acquisition to operate at a relaxed transmission rate at short range. ADS-B systems supporting ACM can also operate at a relaxed transmission rate at short range, but are required to operate at a high rate during specific geometric and dynamical conditions. The proposed note makes clear that requirements are evolving and future requirements could be more stringent. The proposed note avoids the difficulties of interpretation associated with the original Note 7, and in fact does not apply to medium and long-range applications at all. It conforms to the new structure of the Table.

Recommendation

It is recommended that the square brackets be removed, and the wording adopted, for Rev A. Further refinement and analysis can take place during Rev B as needed.

Originator’s proposed resolution:

Adopt the new text for the note shown above under “Meeting Consensus”, which clarifies the update rate for short-range applications. The new text would be placed as Note 13 to Table 3-4(a). The original Note 7 would be deleted to close IP35.

Working Group 6 Deliberations:

January 29, 2002: The topic of this Issue Paper was first discussed by WG6 at their January meeting in Seattle in connection with trying to resolve IP35. It was agreed by all in attendance that a new Issue Paper was needed to discuss the conditional relaxation of update requirements for some short-range applications. An action item was given [AI 11-6] to produce this Issue Paper prior to the February, 2002 WG6 meeting so that it could be considered for revision A.

February 22, 2002: Final wording of the new note was reviewed and accepted by WG6 at their February meeting. Therefore, this Issue Paper will be addressed in Revision A, and this new note will close this Issue Paper.

Working Group 6 Final Resolution:

Note 12 of Table 3-4(a) in the draft DO-242A sent to RTCA on March 4, 2002 reads as follows:

12. *Requirements for applications at ranges less than 10 NM are under development. The 3-second update period is required for aircraft pairs with horizontal separation less than [1.1 NM] and vertical separation less than [1000 feet]. The 3 second update period is also required to support ACM for aircraft pairs within 3 NM lateral separation and 6000 feet vertical separation that are converging at a rate of greater than 500 feet per minute vertically or greater than 6000 feet per minute horizontally. The update rate can be reduced to once per 5 seconds (95%) for aircraft pairs that are not within these geometrical constraints and for applications other than ACM. Requirements for ACM are under development. Requirements for future applications may differ from those stated here.*