

## CHANGE ISSUE

# ASA MASPS REV -

Tracking Information (committee secretary only)	
Change Issue Number	7
Submission Date	2/3/03
Status (open/closed/deferred)	CLOSED
Last Action Date	4/23/03

Short Title for Change Issue:	Proposal to add additional Integrity Levels, i.e. SIL values
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MASPS Document Reference:		Originator Information:	
Entire document (y/n)		Name	Tony Warren
Section number(s)		Phone	206-373-2677
Paragraph number(s)		E-mail	<a href="mailto:Anthony.w.warren@boeing.com">Anthony.w.warren@boeing.com</a>
Table/Figure number(s)		Other	Boeing ATM

Proposed Rationale for Consideration (originator should check all that apply):	
X	Item needed to support of near-term MASPS/MOPS development
X	DO-260/ED-102 1090 MHz Link MOPS Rev A
X	ADS-B MASPS
X	TIS-B MASPS
X	UAT MOPS
X	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
X	MASPS clarifications and correction item
	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	X	Clarity		Performance	X	Functional
<u>Issue Description:</u>								
<p>DO-242A ADS-B MASPS introduced the use of the SIL parameter with four defined values to accommodate different levels of horizontal position integrity, i.e. none, integrity risk = <math>1 \times 10^{-3}</math> per hour, Integrity risk= <math>1 \times 10^{-5}</math> per hour, and integrity risk= <math>1 \times 10^{-7}</math> per hour. The integrity levels were intended to support applications with minor level hazard (<math>10^{-3}</math>), major level hazard (<math>10^{-5}</math>), and severe major hazard level (<math>10^{-7}</math>). However, there are two main problems with the current SIL designations:</p> <p>(1) Some of the applications such as Enhanced Visual Acquisition do not need an integrity risk of <math>10^{-3}</math> per hour, i.e. a reduced level of <math>10^{-2}</math> per hour is sufficient for these applications. A TIS-B system supported by a radar surveillance would be able to support such applications at larger ranges from the radar if permitted to broadcast a SIL value corresponding to the <math>10^{-2}</math> level rather than the more stringent SIL=1 level corresponding to <math>10^{-3}</math> integrity risk.</p> <p style="text-align: center;"><i>(continued on next page)</i></p>								

Issue Description (continued):

(2) There are a number of applications where the safety criterion is more appropriate stated as a per operation basis rather than a per hour basis. For example, Enhanced Visual Approaches is an operation which is only valid during a limited time on the order of 0.1 hour or less. Similarly, the Eurocontrol Crossing and Passing Operation for Package 1 is only critical during a 5 minute time period prior to and following the time of closest approach. For such applications, a safety criterion of , say,  $10^{-5}$  per operation is functionally equivalent to a desired integrity risk of  $10^{-4}$  per hour, since the operation only lasts on the order of 0.1 hour. Consequently, intermediate values of integrity risk are necessary to adequately specify minimum integrity risk levels for a given application, i.e.  $10^{-2}$ ,  $10^{-4}$ , and  $10^{-6}$  levels of integrity risk (per hour basis). The SIL definition should be modified to allow a user to broadcast such levels when appropriate.

Originator's proposed resolution:

Although there are many possible solutions, the simplest of which is to allow a 3 bit SIL definition, the problem of backward compatibility with DO-242A and DO-260A suggests that a slightly different approach is needed. The author suggests the definition of a new SIL\_E enhancement bit taking the values zero and one that will allow all of the desired integrity levels to be represented. The Table below shows how the combination of SIL as defined currently and the SIL\_E enhancement bit would work to define integrity risk levels that differ by one order of magnitude rather than two as in the current standards.

Table 1: Integrity risk levels with proposed SIL and SIL\_E parameters

SIL parameter value	SIL_E = 0	SIL_E = 1
0	Unknown	$1 \times 10^{-2}$ per hour
1	$1 \times 10^{-3}$ per hour	$1 \times 10^{-4}$ per hour
2	$1 \times 10^{-5}$ per hour	$1 \times 10^{-6}$ per hour
3	$1 \times 10^{-7}$ per hour	Reserved or $1 \times 10^{-8}$ per hour ??

With the above definitions, a DO-242A system would only broadcast SIL values corresponding to the second column, i.e. SIL\_E would be set to zero by default, and interpreted correctly by an ASA MASPS compatible ADS-B or TIS-B receive system (proposed new standard). Similarly, a newer system broadcasting with a SIL\_E set to one would be interpreted conservatively according to the second column by a DO-242A system, and could only perform those paired operations compatible with the older SIL definition.

The value of such a SIL/ SIL\_E enhancement for TIS-B is that it would make the Basic CDTI functions doable at the lower criticality level of  $1 \times 10^{-2}$  rather than  $10^{-3}$  per hour. This means that the Containment radius derived from field test histograms or from Monte Carlo tracking studies will be smaller than would be necessary to bound integrity for the current SIL=1 level.

For ADS-B applications, the value of such an enhancement is that for applications such as approach operations and conflict resolution operations over a small time frame, the surveillance performance requirements for integrity level and possibly for NIC can be somewhat reduced, minimizing design and certification costs to that appropriate for the application categories desired by users.

Working Group 4 Deliberations:

**April 22, 2003:** This Issue Paper was reviewed and discussed by WG4 at the WG4 meetings held April 22 & 23, 2003 at RTCA, Inc. WG4 agreed to address the proposals of this Issue Paper. This Issue Paper is therefore considered CLOSED. Among the agreed items for this Issue Paper by WG4:

- It was agreed that receiving subsystems shall be required to interpret a third “SIL Supplement” bit.
- On the transmit subsystem, only the 4 levels of SIL defined in DO-242A will be required, but the 3<sup>rd</sup> “SIL Supplement” bit will be optional with a note stating the probable operational benefits of looser SIL requirements for some applications.
- SIL certification level for applications should be on the transmit side and that receiving subsystems can extrapolate exposure rate from received SIL values that are based on per hour of operation.