

**RTCA Special Committee 186, Working Group 3**

**ADS-B 1090ES MOPS Maintenance**

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**Teleconference**  
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**Issues with “Change 2 to DO-260A” for SIL, NIC and VPL**

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<b>Summary</b>

## Issues with “Change 2 to DO-260A” for SIL, NIC and VPL

During the discussions leading up to the publication of the STP MOPS (RTCA/DO-302) in December 2006, it was determined that there should be a requirement for vertical integrity, as well as horizontal integrity, as a component of the ADS-B System Integrity Level (SIL). In order for such a change to be accepted in the published version of the STP MOPS, it was proposed that Change documents be prepared for the ASA MASPS (RTCA/DO-289), the ADS-B MASPS (RTCA/DO-242A), the 1090ES MOPS (RTCA/DO-260A), the UAT MOPS (RTCA/DO-282A), and for the ICAO SARPs documents for both 1090ES and UAT ADS-B data links. These Change documents were prepared to include the addition of a column for the table defining the SIL parameter to add the meaning for the Vertical Integrity Containment Region or Vertical Protection Limit (VPL), as well as text to clarify the relationship of the SIL and the Navigation Integrity Category (NIC).

With the publication of all of the Change documents mentioned above in December 2006 in preparation for the publishing of the STP MOPS, the changes inserted a dependence on VPL for SIL encoding (for NIC values >8) when previously SIL was defined only in terms of the horizontal integrity limits.

Therefore, if a VPL cannot be provided for those NIC values (9, 10, & 11), then the SIL subfield must be set to a value of ZERO (0). The yellow highlighting in the copy of DO-260A, Table 2-72 below shows what was added in “Change 2 to DO-260A,” and the other Change documents previously identified.

**Table 2-72: “SIL” Subfield Encoding**

SIL Coding		Probability of Exceeding the Horizontal Integrity Containment Radius ( $R_C$ ) Reported in the NIC Subfield Without an Indication	Probability of Exceeding the Vertical Integrity Containment Region (VPL) Without an Indication	Corresponding Hazard Classification
(Binary)	(Decimal)			
00	0	Unknown	Unknown	No Safety Effect
01	1	$\leq 1 \times 10^{-3}$ per flight hour or per sample	$\leq 1 \times 10^{-3}$ per flight hour or per sample	Minor
10	2	$\leq 1 \times 10^{-5}$ per flight hour or per sample	$\leq 1 \times 10^{-5}$ per flight hour or per sample	Major
11	3	$\leq 1 \times 10^{-7}$ per flight hour or per sample	$\leq 2 \times 10^{-7}$ per 150 seconds or per sample	Severe Major/Hazardous

With the publication of the ADS-B MASPS revision “A” in June 2002, Table 2-2; ‘Navigation Integrity Categories (NIC)’ defined the values of NIC for 9, 10 and 11 as having a dependency on VPL. This definition of NIC has therefore been reproduced in the 1090ES MOPS, the UAT MOPS, the ASA MASPS, the STP MOPS, the 1090ES SARPs and the UAT SARPs documents.

This dependency on VPL is shown below in a reproduction of DO-260A, Table 2-70 for “NIC Encoding.” If a VPL cannot be provided, then the highest NIC that can be declared is 8 under all conditions, even if the horizontal position sensor is reporting an HPL equivalent to a NIC=9 or a higher value. The dependence on VPL for higher NIC values in the ADS-B MASPS; DO-242A; Section 2.1.2.12 and Table 2-2 (Note 5) was for the case only when geometric altitude was being reported.

**Table 2-70: Navigation Integrity Category (NIC) Encoding**

NIC Value	Containment Radius (R <sub>C</sub> ) and Vertical Protection Limit (VPL)	Airborne		Surface	
		Airborne Position TYPE Code	NIC Supplement Code	Surface Position TYPE Code	NIC Supplement Code
0	R <sub>C</sub> unknown	0, 18 or 22	0	0, 8	0
1	R <sub>C</sub> < 20 NM (37.04 km)	17	0	N/A	N/A
2	R <sub>C</sub> < 8 NM (14.816 km)	16	0	N/A	N/A
3	R <sub>C</sub> < 4 NM (7.408 km)	16	1	N/A	N/A
4	R <sub>C</sub> < 2 NM (3.704 km)	15	0	N/A	N/A
5	R <sub>C</sub> < 1 NM (1852 m)	14	0	N/A	N/A
6	R <sub>C</sub> < 0.6 NM (1111.2 m)	13	1	N/A	N/A
	R <sub>C</sub> < 0.5 NM (926 m)	13	0		
7	R <sub>C</sub> < 0.2 NM (370.4 m)	12	0	N/A	N/A
8	R <sub>C</sub> < 0.1 NM (185.2 m)	11	0	7	0
9	R <sub>C</sub> < 75m and VPL < 112 m	11	1	7	1
10	R <sub>C</sub> < 25m and VPL < 37.5 m	10 or 21	0	6	0
11	R <sub>C</sub> < 7.5m and VPL < 11 m	9 or 20	0	5	0

The draft of the Notice of Proposed Rule Making (Docket No. FAA-2007-29305; Notice No. 07-15) published by the FAA on October 5, 2007 indicates that the FAA wants to require a minimum value of NIC=7 and SIL=2 or 3 for the ADS-B Out function.

Boeing objects to these changes in SIL definition. A transmitted SIL value of 0 would severely limit the usefulness of that aircraft’s ADS-B Out data set as many applications for ADS-B Out will require a minimum SIL value of 2 or better. Thousands of aircraft worldwide are certified under both FAA (FAA Guidance Document 91-RVSM) and

ICAO rules to operate in RVSM airspace at 1000' adjacent flight level spacing without a VPL output from the altimetry system. Since the FAA ADS-B program does not plan to make changes to these flight level separation standards, it seems unreasonable to require more stringent vertical data integrity standards for ADS-B than those already in effect.

Similarly, the dependency of NIC on VPL is an artificial limitation on the ADS-B system performance. This would limit the NIC value that can be declared to a maximum value of 8 when the aircraft's true horizontal integrity performance might be a NIC value of 9 or greater.

The FAA and Eurocontrol's Segment 1 program is focused on deployment of infrastructure and approvals for non-radar airspace (NRA) applications. Both of these limitations will unfairly penalize operators who will be attempting to equip with DO-260A equipment early and gain near term benefits in that non-radar airspace where the key ADS-B performance requirements are in the horizontal plane only. The NRA Safety, Performance and Interoperability Requirements document; RTCA/DO-303, does not contain any vertical data integrity requirements. ADS-B applications, whether ground based or ADS-B In, that truly require airborne vertical data integrity limits will take much longer to be generated and approved. When those ADS-B In applications that require vertical integrity data are approved and ready to be deployed NAS wide, these dependencies on the airborne vertical integrity limits could be revisited. Until then, they are premature and should be withdrawn.

#### Summary:

1. The definition of SIL (Table 2-72) in DO-260A (1090ES MOPS) should adhere to the original released table without the VPL column.
2. The definition of SIL (Table 2-5) in DO-242A (ADS-B MASPS) should adhere to the original released table without the VPL column.
3. The definition of SIL (Table 2-44) in DO-282A (UAT MOPS) should adhere to the original released table without the VPL column.
4. The definition of SIL (Table 3-8) in DO-289 (ASA MASPS) should adhere to the original released table without the VPL column.
5. The definition of SIL (Table 2-5) in DO-302 (STP MOPS) should adhere to the original released table without the VPL column.
6. The definition of SIL in the appropriate tables of the 1090ES and UAT SARPs documents should adhere to the original released table without the VPL column.
7. The definition of NIC as defined in Table 2-2 of DO-242A, Note 5, and in Table 3-5 of Change 1 to DO-289, Note 2, should only enforce a dependence on VPL when geometric altitude is being reported. This should also be properly reflected in Table 2-70 of DO-260A, Table 2-17 of DO-282A, Table 2-14 of DO-302 and the appropriate tables for NIC definition in the UAT and 1090ES SARPs.