RTCA Special Committee 186, Working Group 3

ADS-B 1090 MOPS, Revision A

Meeting #26

Surveillance Integrity Level (SIL)
In Response to Action Item 24-03

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SUMMARY
The FAA believes that SIL needs to include the overall ADS-B system integrity for position information, not just the position source integrity, as defined in DO-260A Change 2.

1.0 BACKGROUND:

- The FAA included an expanded SIL definition in the ADS-B Notice of Proposed Rulemaking
  -- The FAA believes the SIL needs to include the design assurance of the entire ADS-B avionics system, not just the position source.
- This issue paper addresses the SIL changes the FAA feels need to be included DO-260B.

2.0 SIL DISCUSSION

- For ATC to provide separation services, and ASAS to use ADS-B IN targets, the receiver needs to know the design assurance of the position information provided by the transmitting target.

  - From the perspective of the user that is receiving the broadcast position, there is no distinction between potential malfunction of the position sensor, the STP function, or the transmitter – they all have an equivalent effect.

- Certification will not be able to ensure a single design assurance level
  - Most aircraft will have a system design assurance of 10^{-5}
  - Existing ground vehicle transmitters have no design assurance
  - Existing DO-260 transmitters have not demonstrated design assurance
  - Some future VFR systems may only require a design assurance of 10^{-3}
  - Some future advanced applications may require a design assurance of 10^{-7}

- The FAA endorses the current SIL definition to include three potential failure effects, with a minor change in the first characteristic:

1	Aircraft system malfunction (including Design Assurance)	This aspect of the SIL addresses the potential effects of latent failures in the aircraft system that result in broadcast of erroneous position data. This aspect of the SIL is required for compliance with ADS-B In FHA, which identifies the potential impact of an erroneous position report caused by an equipment malfunction. The failure condition applies to the erroneous broadcast of position data parameters (geometric position, including velocity, or position quality data), including the potential effects of failures from all related aircraft ADS-B related components.
2	Position Error as it relates to NIC	Addresses the potential effects of position errors when there are no aircraft equipment malfunctions or position service signal-in-space failures. This aspect of the SIL indicates the probability that a position report will exceed the NIC containment region without an indication.
3	GNSS Signal-In-Space Error	This aspect of the SIL addresses the potential effects of failures in the GNSS positioning services. This parameter addresses the probability that a GNSS signal-in-space error causes a position error that exceeds the NIC without an indication within 10 seconds.

3.0 PROPOSED DO-260B CHANGES: (§2.2.3.2.7.1.3.13, §2.2.3.2.7.2.9, §A.1.4.9.14 and §A.1.4.10.9)

The "SIL" (Surveillance Integrity Level) subfield is a 2-bit ("ME" bits 45 -46, Message bits 77 - 78) field that shall be used to define the probability of the integrity containment region described by the NIC subfield being exceeded ~~for~~ by the ~~selected geometric position source~~ADS-B system, including any external signals used by the ~~source~~system. The SIL subfield will be encoded in accordance with Table 2-72, as specified in the Aircraft Operational Status Message. For installations where the SIL value is being dynamically updated, if an update has not been received from an on-board data source for SIL within the past 5 seconds, then the SIL subfield shall be encoded as a value of ZERO (0), indicating "Unknown."

The probability specified by the SIL subfield is the largest likelihood of any one of the following occurring when a valid geometric position is provided by the selected position source:

a. ~~a position source equipment~~an equipment malfunction (per hour).
b. the per sample probably of a position ~~source~~ error larger than the horizontal or vertical integrity containment region associated with the NIC value(s), or,
c. for GNSS, the probability of the signal-in-space causing a position error larger than the horizontal or vertical containment region associated with the NIC value(s) without an indication (see note 2 below Table 2-72), within a time period determined by the positioning source, as indicated in Table 2.72.

3.1 Additional Proposed Change: Note 6 for Tables 2-72 and A-17:

Note 6: Since the SIL is intended to reflect the integrity of the ~~navigation source of the~~ position information broadcast, the SIL value transmitted should be indicative of the true integrity of the ADS-B position data.

3.2 Additional Proposed Change: Other applicable areas of the MOPS.