

RTCA Special Committee 186, Working Group 3
EUROCAE WG-51, SG-1

ADS-B 1090ES MOPS Maintenance

Meeting #25

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Action Item 24-10 Response
Fail/Warn Declaration for ADS-B OUT

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Summary

This Working Paper addresses the possibility of a new Fail/Warn declaration for ADS-B OUT.
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Fail/Warn Declaration for ADS-B Out

It's readily identified that system failures, including certain ADS-B Out failures, need to be identified to the flight crew, as well as to maintenance personnel. Reference FAR 25.1309(c) and CS 25.1309(c) which state:

FAR 25.1309 - Equipment, systems, and installations

(c) Warning information must be provided to alert the crew to unsafe system operating conditions, and to enable them to take appropriate corrective action. Systems, controls, and associated monitoring and warning means must be designed to minimize crew errors which could create additional hazards.

CS 25.1309 – Equipment, systems, and installations

(c) Information concerning unsafe system operating conditions must be provided to the crew to enable them to take appropriate corrective action. A warning indication must be provided if immediate corrective action is required. Systems and controls, including indications and annunciations must be designed to minimise crew errors, which could create additional hazards.

Specific questions regarding failure declaration to the flight crew need to be addressed:

- 1) What types of ADS-B Out failures need to be annunciated to the flight crew?
- 2) What form of annunciation to the flight crew?

To answer the first question, the list of ADS-B Out parameters was reviewed to determine whether annunciation to the flight crew was necessary, or desired, if specific aircraft parameters were not transmitted by the ADS-B transmitter. Table 1 below lists each ADS-B Out parameter and proposes whether an annunciation to the flight crew is warranted.

Table 1

Aircraft Parameter	Data Source(s)	Annunciate to Flight Crew? (YES/NO)
The length and width of the aircraft	Strapping or Aircraft Database	NO
Lateral/Longitudinal/Position & Position Integrity Data	GPS FMS IRS	YES
Barometric pressure altitude	Air Data Computer	YES
Velocity (from navigation position sensor)	GPS FMS IRS	NO
TCAS II /ACAS installed and in Resolution Advisory (RA) Mode	TCAS Computer	NO
TCAS II /ACAS RA is Active	TCAS Computer	NO
Mode 3/A transponder code (including Emergency Code)	ATC/TCAS Control Panel	YES

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Aircraft Parameter	Data Source(s)	Annunciate to Flight Crew? (YES/NO)
Flight ID/Call Sign	FMS	YES
IDENT	ATC/TCAS Control Panel	YES
ICAO 24 Bit Address	Strapping or Aircraft Database	YES
Emitter Category (based on aircraft weight)	Strapping or Aircraft Database	YES
ADS-B IN Capable	Strapping or Aircraft Database	YES
Geometric Altitude	GPS	YES
Version Indicator (DO-260/DO-260A/DO260B)	Transponder	NO

To answer the second question (“What form of annunciation to the flight crew?”), there appears to be two possible options for aircraft whereby the transponder is the ADS-B transmitter are the same hardware:

Option 1: Use existing Transponder failure annunciation

Option 2: Implement a new “ADS-B OUT” failure annunciation

Option 1: Use existing Transponder failure annunciation

- “TRANSPONDER” advisory message displayed on 747-400/757/767/777/787 EICAS Display
- XPDR FAIL light on the ATC/TCAS Control Panel on 737-100 – 737-900
- Indicates there is either an internal transponder failure or an external input failure into the transponder (e.g. altitude input failure, control panel input failure, antenna failure, etc.)

Option 2: Implement a new “ADS-B OUT” failure annunciation

- Would require a new “ADS-B OUT” advisory message for those aircraft with EICAS
- Would require a new “ADS-B FAIL light on the ATC/TCAS Control Panel on 737-100 – 737-900, and other aircraft without an EICAS-type of alerting system
- Indicates there is either an internal ADS-B transmitter failure or an external input failure into the ADS-B transmitter (e.g. altitude input failure)

Recommendations

It is recommended that the existing TRANSPONDER failure annunciations be used for the following reasons:

1. The transponder is the ADS-B OUT transmitter

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2. The same types of failures (i.e. transponder failure, or input data failure) will result in the same effect
3. Only the input failures in Table 1 would set the TRANSPONDER failure annunciation.
4. The cost/schedule impacts to change existing ATC/TCAS control panels and add new EICAS messages out-weigh any perceived benefit for having a dedicated ADS-B OUT failure annunciation.

In addition, the Flight Crew Operations Manual would indicate that even though a “TRANSPONDER” message is displayed, not all ADS-B OUT messages are failed, and that ADS-B OUT data received by ATC is considered valid unless otherwise notified by ATC.

NOTE: Similar wording is currently in the Flight Crew Operations Manual for the GND PROX SYS advisory message. The GPWS has multiple inputs and multiple modes whereby a missing input parameter (e.g. glideslope data) may fail one of the six GPWS modes (e.g. GLIDESLOPE Mode 5), but none of the other GPWS modes.

Also, for Onboard Maintenance System (e.g. CMC/CFDS) equipped aircraft, maintenance messages should be generated for missing input buses into the Transponder/ADS-B transmitter. This can be addressed via label 35x maintenance labels to be identified in the ARINC 718 transponder characteristic.