European Union Aviation Safety Agency

ADS-B certification

Disclaimer:
This publication provides recommendations and examples, further to the applicable regulation, certification specifications, and AMCs. They have no legal value and are only advisory.

Should I choose CS-ACNS, or AMC 20-24 as part of the certification / compliance basis for installation of ADS-B (for a new TC or a change to a TC/STC)?

Answer

The intents of CS-ACNS and AMC 20-24 are different. The former provides the means to comply with the rules set forth in the Commission Implementing Regulation (EU) No 1207/2011 (amended by (EU) No 1028/2014) ('SPI regulation') and supports applications where the ADS-B could be used to replace Radar (RAD) applications with a 3 Nm separation between aircraft. The latter is intended to support Non-Radar Areas (NRA) applications, with a 5 Nm separation and less stringent integrity and continuity needs.

For certification of ADS-B installations, CS-ACNS applies to aircraft with a maximum certified take-off mass exceeding 5700 kg or having a maximum cruising true airspeed capability greater than 250 knots.

Compliance to CS-ACNS (including book 2) has to be demonstrated for the initial airworthiness and changes to those aircraft. For a new TC, CS-ACNS is expected to be part of the certification basis.

For other aircraft, the applicant may elect to use AMC 20-24 instead of CS-ACNS.

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Link:
https://www.easa.europa.eu/lt/faq/44267

What are the differences between CS-ACNS and AMC 20-24 regarding requirements for ADS-B?

Answer

There are several differences in terms of parameters required, continuity of the function, ES version used, as shown in this non-exhaustive list:

	CS-ACNS	AMC 20-24
PARAMETERS		
ICAO 24 bit address	Mandatory	Mandatory
Aircraft identification	Mandatory	Mandatory
Mode A code (incl. disabling function)	Mandatory	Mandatory
Special position indication (SPI or IDENT)	Mandatory	Mandatory
Emergency status (incl. emgy indication)	Mandatory	Mandatory*
Barometric Pressure altitude (incl NICbaro	Mandatory	Mandatory
ADS-B version number	Mandatory, ≥ 2	Mandatory
Horizontal position (incl. NIC, NACp, SDA & SIL)	Mandatory	Mandatory*
Horizontal Velocity (E/W,N/S & Hdg/Trk gnd, HRD, NACv)	Mandatory	Recommended
Geometric Altitude (HAE) (incl. GVA)	Mandatory	Not Required
ADS-B Emitter category	Mandatory	Not Required
Aircraft length and width	Mandatory	Not Required
GNSS antenna offset	Mandatory	Not Required
Vertical rate (Hybrid, Baro, Baro-inertial or GNSS)	Mandatory	Not Required
Selected Altitude (MCP/FCU incl status)	If available	Not Required
Selected Heading	Not Required	Not Required
Barometric pressure setting	If available	Not Required
ACAS traffic status (incl. RA active (TCAS II) etc)	If available	Not Required
ACAS installed & operating RA capable (TCAS II)	If available	Not Required
CONTINUITY	'remote'	≤ 2E-4 / F.H.
INTEGRITY	'major' or 'minor' **	≤ 1E-5 / F.H. for hor. Pos.

*: permissible deviations exist

**: dependant upon the parameter. Some parameters are limited to minor due to the historical classification of mode A/C installations.

The term 'remote' corresponds to quantitative probability of 1E-5 / F.H.

The terms 'major' and 'minor' are Failure Condition classifications corresponding to quantitative probability objectives of respectively 1E-5 and 1E-3 / F.H.

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Should a change to type design installing ADS-B out capability be classified as Minor or Major?

Answer

Due to the ‘major’ failure effect associated to ADS-B Integrity and Continuity conditions (due to potential disrupting effects at ATC level) and the novelty of the function and potential extension of the operational capabilities, the changes that use CS-ACNS are expected to be classified as Major.

However, changes using only AMC 20-24 may be classified as Minor if certain conditions are met:

- The transponder is ETSO-2C112b approved and complies with the requirements of ED-102/DO-260 or DO-260A, and
- The GNSS receiver is approved under any of ETSO C-129A, TSO C-129, TSO C-129A, ETSO C-145/C-146, or TSO C-145A/C146A, and
- The interface between the transponder and GNSS received is direct (no routing through other equipment).

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What does the Continuity requirement imply and how is Continuity calculated?

Answer

‘Continuity’ means the probability that a system will perform its required function without unscheduled interruption (e.g. system failure).

In practice, the Continuity of the ADS-B out system should be assessed with common industry methods. In particular:

- The assessment should encompass all equipment contributing to the ADS-B function and not just the transponder.
- The reliability of each component contributing to the function (e.g. transponder, control panels, position and velocity source) has to be considered,
- The probability of failure of the power source failure has to be considered,

- Common modes have to be considered.

In case of multiple sources or systems, a temporary indicated loss allowing the pilot to switch from one source or ADS-B system to the other is acceptable and not considered as a continuity event.

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Our analysis show that the Continuity meets the Implementing Rule / AMC 20-24 requirement, but not the CS-ACNS requirement.

Answer

CS-ACNS requires compliance to a qualitative probability of ‘remote’, which corresponds to a quantitative probability of 1E-5 / F.H. This is more challenging to meet than the Implementing Rule Annex II and AMC 20-24 figure (2E-4 / F.H.).

A deviation to this requirement may be accepted on a case-by-case basis and under conditions by the Agency after review of the compliance data. Such a deviation is published by EASA under reference ‘Deviation Request CS-ACNS#1’.

No deviations to the requirements of the Implementing Rule will be granted.

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Is a dedicated ADS-B failure annunciator required in the instrument panel?

Answer

CS ACNS.D.ADSB.090 requires that a means is provided to indicate the non-operational status or failure of the ADS-B Out system without undue delay.

This can be an indicator dedicated to an ADS-B failure, however a single transponder failure indicator may be acceptable if the crew are able to distinguish between ADS-B device or function failures and other transponder failures using

suitable troubleshooting procedures.

AMC 20-24 does not contain an equivalent requirement.

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What are the requirements on the GNSS source?

Answer

The requirements are described in AMC 20-24 and CS-ACNS.

Note that:

- Position and velocity information must come from the same source.
- ETSO-C129A is the minimum equipage qualification in Europe.
- For compliance with CS-ACNS, the applicable ETSOs (C129a/196/145/146) alone does not guarantee that the unit is suitable as an ADS-B position source. Further demonstration is required (see in particular AMC1 ACNS.D.ADSB.070 and .080).
- The System Design Assurance (SDA) parameter can be set to 2 without analysis if the GPS and ADS-B unit are both approved (to either ETSO C129a, C196(), C145(), C146()) and directly connected (i.e. direct wiring from GPS to receiver with no routing through other equipment). Aircraft with other architectures require a system safety analysis to set the SDA.

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Can a standalone GNSS receiver (i.e. a receiver not used for navigation) be used as position source, for input to the transponder, to meet the ADS-B mandate in Europe?

Answer

AMC1 CS ACNS.D.ADSB.090(a) states that the data transmitted by the active ADS-B transmit unit should be consistent with the data displayed to the flight crew.

Consistency may be demonstrated by using a compliant GNSS sensor connected to the transponder and the navigation equipment (i.e. transponder and navigation equipment receive the same data from the GNSS source) .

Where this is not possible, consistency may be demonstrated by the installation of a standalone GNSS receiver connected (only) to the transponder providing the GNSS receiver is approved to ETSO-C145c or C146c (or later ETSO amendments). Note: Operational Class 1, 2, or 3 of RTCA DO-229D, satisfy the ‘consistency’ criteria.

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