Australian Government
Department of Defence

ADVISORY CIRCULAR

AC 005/2016 v2.1

DEFENCE COMPLIANCE WITH CIVIL ADS-B REQUIREMENTS

AB25345019

V2.1 – July 2022

An Advisory Circular is issued by the Authority to promulgate important information to the Defence Aviation community, but does not mandate any action. This includes informing the community on aviation safety / airworthiness matters, information that enhances compliance understanding for existing regulation, or policy guidance for aviation issues not yet regulated that requires further understanding.

Audience

This Advisory Circular (AC) is relevant to:

- Military Air Operators (MAOs)
- Non-Defence Registered Aircraft Sponsors.

Purpose

The purpose of this Advisory Circular (AC) is to provide advice regarding Defence conformance with civil aviation Communication, Navigation and Surveillance (CNS) requirements. Specifically, the scope of this AC is for Automatic Dependent Surveillance – Broadcast (ADS–B) functionality.

Further information

For further information on this AC, contact the Directorate of Aviation Operations (DAVNOPS-DASA) via dasa-davnops.operationalreviews@defence.gov.au.

Status

This AC will remain current until cancelled by DASA.

Version	Date Approved	Approved By	Details
1.0	September 2016	AIRMSHL G Davies (Def AA)	Initial release
2.0	June 2022	GPCAPT D Smith (DAVNOPS)	Removal of PBN and RVSM information, published into its own AC 001/2022
2.1	July 2022	WGCDR M Donnellan	Typographical corrections only

Contents

1 Reference material

1.1 Acronyms

The acronyms and abbreviations used in this AC, or its related material, are defined in the table below.

Acronym	Description
ATSO	Australian Technical Standard Order
FD	Fault Detection
FDE	Fault Detection and Exclusion
ICAO	International Civil Aviation Organisation
TSO	Technical Standard Order

1.2 Definitions

Terms that have specific meaning within this AC, or its related material, are defined in the table below.

Term	Definition
Automatic Dependent Surveillance – Broadcast (ADS–B)	A technology in which an aircraft determines its position via satellite and periodically broadcasts it, enabling it to be tracked. The information can be received by air traffic control ground stations as a replacement for secondary radar. It can also be received by other aircraft to provide situational awareness and self-separation. ADS–B is ‘automatic’ in that it requires no pilot or external input; and ‘dependent’ in that it depends on data from the aircraft's navigation system.
Aircraft address	A unique code of 24 binary bits assigned to an aircraft.
Communications, Navigation, Surveillance and Air Traffic Management systems (CNS/ATM)	Communications, navigation, and surveillance systems, employing digital technologies, including satellite systems together with various levels of automation, applied in support of a seamless global air traffic management system.
Ground Based Augmentation System (GBAS)	A satellite based precision landing system that provides very precise horizontal and vertical positioning guidance during the final stages of an approach. GBAS are commonly composed of one or more accurately surveyed ground stations, which take measurements concerning the GNSS, and one or more radio transmitters, which transmit the information directly to

Term	Definition
	the end user from the ground up thus avoiding the constraints associated with GEO Satellites at high latitudes. Generally, GBAS is localised, supporting receivers within 23 nautical miles, and transmitting in the very high frequency (VHF) band. The shorter the distance between the ground station that calculates the differential corrections to the inbound plane, the higher the accuracy is likely to be.
Global Navigation Satellite System (GNSS)	A system installed in an aircraft to continually determine precise position and time of the aircraft by use of the GPS. Navigation systems to be named GNSS are assessed against a US Federal Aviation Administration (FAA) Technical Standard Order (TSO).
Global Positioning System (GPS)	A GNSS created and maintained by the United States government freely accessible to anyone with a GPS receiver.
Ground-based Regional Augmentation System (GRAS)	A system that supports augmentation through the use of terrestrial radio messages.
Inertial Navigation / Reference System (INS/IRS)	A self-contained navigation system that continually measures the accelerations acting upon the vehicle of which it is part. Suitably integrated, these forces provide velocity and thence position information.
Mode S	A monopulse radar interrogation technique that improves the accuracy of the azimuth and range information of an aircraft, and uses a unique aircraft address to selectively call individual aircraft.
Receiver Autonomous Integrity Monitoring (RAIM)	On-board system providing navigation integrity by detecting the failure of a GNSS satellite. RAIM may be either Fault Detection (FD) or Fault Detection & Exclusion (FDE).
Satellite Based Augmentation System (SBAS)	A system that complements existing GNSS to compensate for certain disadvantages of GNSS in terms of accuracy, integrity, continuity and availability. An example of SBAS is the European Geostationary Navigation Overlay Service (EGNOS). There are stricter safety requirements on GBAS systems relative to SBAS systems since GBAS is intended mainly for the landing phase where real-time accuracy and signal integrity control is critical, especially when weather deteriorates to the extent that there is no visibility (CAT-I/II/III conditions), for which SBAS is not intended or suitable.

Term	Definition
Self-Contained Navigation System	One of the following: INS, IRS or GNSS.
Non-TSO GNSS	Non-TSO GPS receivers are not required to meet any regulatory standards for power supply, installation, lighting, database, integrity monitoring or performance.
TSO-C129	TSO-C129 and the later C129a specify minimum performance standards for approved GPS equipment, including integrity monitoring. Not all TSO-C129 receivers meet requirements for non-precision approaches, and TSO-C129 receivers are not able to take advantage of enhanced GNSS capabilities enabled by SBAS, GBAS or GRAS.
TSO-C145a and TSO-C146a	TSO-C145a is a standard for airborne GPS sensors providing data to flight management systems, while TSO-C146a is for stand-alone GPS receivers. The key improvements over the TSO-C129 standard are RAIM (FDE), the capability to use SBAS augmentation, and a greater standardisation of displays and controls. TSO-C145a and C146a receivers are approved for the same IFR applications as the TSO-C129 generation, but not subject to the same contingency requirements when supported by a suitable prediction of FDE.
TSO C196	TSO C196 specifies minimum performance standards that airborne GPS sensor equipment using aircraft-based augmentation for supplemental navigation must first meet for approval and identification with the applicable TSO marking. TSO-C196b encompasses many of the technical performance improvements in TSO-C145d, but does not include the satellite-based augmentation system (SBAS) technical requirements and SBAS operational advantages.

1.3 References

A. Civil Aviation Order 20.18 – *Aircraft equipment: Basic operational requirements - Instrument 2014* of 29 Aug 16

B. Minute – DACPA – *ADS–B Airspace of 24 Feb 16* (AB26455761)

C. Airservices website - *Aircraft Navigation Modernisation Program*

D. Letter – CAF to CEO CASA and CEO ASA – *Defence Statement of Intent – ADS-B Compliance* of 22 Nov 11 (AB6066586)

E. (Defence) *Airworthiness Design Requirements Manual* (ADRM)

F. Letter – CAF to CCDG and CEO DMO – *Defence Statement of Intent: Performance Based Navigation* of 02 Aug 13 (AB14868531)

Unless specified otherwise, all regulation references in this AC refer to the Defence Aviation Safety Regulation (DASR).

2 Introduction

2.1 Background

2.1.1 Among other roles, ICAO coordinates advancements in global Air Traffic Management (ATM) between member nations, to provide improved global aviation safety outcomes. Over the last decade, ATM systems have progressively moved from reliance on ground-based surveillance (ie radar) and non-surveillance-based controls (ie procedural separation), to aircraft-based broadcasting of aircraft position in three dimensions to compatible air and ground receiving stations (ie ADS–B). This improves aircrew situational awareness and aircraft self-separation.

2.1.2 IAW Ref A, CASA is implementing ADS–B as a legislated requirement, using a phased approach. While Ref B advises that Defence has retained its right to apply an exemption to State aircraft, Defence also recognises that any non-compliance with Ref A may impact Defence aviation operations, particularly in airspace not managed by Airservices Australia. Accordingly, Defence compliance is required where practicable, in order to retain operational flexibility.

2.1.3 The advice contained within this AC provides direction on achieving the required Defence ADS-B related outcomes.

2.2 Scope

2.2.1 This AC applies to all Defence registered aircraft. Non-Defence Registered Aircraft operated by, or on behalf of Defence, are expected to have achieved compliance via the civil system of ADS-B assessment and approval.

2.3 Related Aircraft Systems

2.3.1 Similar Defence obligations for the implementation of civil-based Performance Based Navigation (PBN) and Reduced Vertical Separation Minima (RVSM) are discussed in AC 001/2022.

3 ADS-B Compliance

3.1 Civil ADS-B Approach and Compliance

3.1.1 The Global Navigation Satellite System (GNSS) mandate discussed at Ref C has allowed Airservices Australia to implement the Aircraft Navigation Modernisation Program. The program will allow the reduction of ground-based navigation aids by approximately 50%, through the decommissioning of about 190 ground-based aids. While the remaining navigation aids will form the Backup Navigation Network (BNN), their limited numbers and wide geographical spacing may not be capable of sustaining historical navigation services.

3.1.2 All existing Australian civil-registered Instrument Flight Rules (IFR) aircraft were therefore expected to have achieved ADS–B compliance by 02 Feb 17.[1] Defence aircraft were expected to comply with ADS-B carriage IAW Ref D.

3.2 Defence ADS-B Approach and Compliance

3.2.1 Ref D assured CASA that Defence was cognisant of civil ADS-B requirements, and that necessary ADS–B equipment would be fitted to Defence aircraft by 2018, with the exception of those aircraft scheduled for withdrawal from service between circa 2018-2020.

3.2.2 Airworthiness design requirements for Defence aircraft required to operate in ADS-B airspace are defined in Ref E. Compliance achieved for the Australian airspace IAW this AC would likely also address the majority of international obligations. However, as noted in Ref F, there remains a possibility that technical requirements for Defence ADS-B operations in **foreign airspace** may not be satisfied through compliance with CASA-mandated ADS-B requirements. Consequently, before a decision is made on the minimum technical capabilities of Defence aircraft expected to operate in foreign airspace, the need for an ADS-B capability in excess of the minimum CASA requirement should be established.[2] To assist, the research paper *Mission Effectiveness and European Airspace: U.S. Air Force CNS/ATM Planning for Future Years*[3] covers many European CNS/ATM topics, and includes specific reference to potentially additional foreign ADS-B requirements and USAF operational tasking areas.

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1 More information regarding civil ADS-B implementation is available through the CASA website.

2 For example, requirements for transmitted ADS-B data messages.

3 Available at Obj ID D5575572.

3.2.3 **ADS-B installation considerations**. Accurate aircraft position and flight parameters derived from GNSS are critical to the effective operation of ADS-B. This is usually provided by a TSO-certified GNSS, however accuracy requirements for ADS-B are usually more stringent than the navigation requirement, and therefore limited options may exist for ADS-B compliance. In these cases, ADS-B compliance based on assessments of GNSS ‘functional equivalency’ may be possible, and should be investigated before modifying the aircraft to install TSO-certified systems.

4 AC Validity Period

4.1.1 This AC will remain in force until an audit of Defence aircraft validates Defence compliance with the intent of Ref D.