Transport Canada Transports Canada

Advisory Circular

Subject:	**Automatic Dependent Surveillance - Broadcast (ADS-B) Operational and Maintenance Considerations**

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1.0 Introduction

(1) This Advisory Circular (AC) is provided for information and guidance purposes. It describes an example of an acceptable means, but not the only means, of demonstrating compliance with regulations and standards. This AC on its own does not change, create, amend or permit deviations from regulatory requirements, nor does it establish minimum standards.

(2) Specific guidance are found in the appendices of this AC.

(3) This AC uses mandatory terms such as “shall”, “requirements” and “is/are required” in order to convey the intent of this and other referenced guidance documents. The term “should” is to be understood to mean that the proposed method of compliance must be used, unless an alternate means of compliance has been determined and approved.

1.1 Purpose

(1) The purpose of this AC is to provide Canadian air operators information pertaining to conduct operations with ADS-B equipped aircraft. It also provides company, training and maintenance requirements with respect to ADS-B equipped aircraft in the accompanying appendices.

1.2 Applicability

(1) This AC is applicable to:

- (a) Canadian air operators holding an Air Operator Certificate (AOC) issued under subparts, 702, 703, 704 and 705 of the *Canadian Aviation Regulations* (CARs), a Private Operator Registration Document (PORD) issued under subpart 604 of the CARs, or Remotely Piloted Aircraft Systems (RPAS) operators that require ADS-B for their the Detect and Avoid (DAA) Function;
- (b) pilots, flight dispatchers, flight followers and other operations personnel employed by the operators listed above;
- (c) TCCA inspectors with certification and safety oversight responsibilities; and
- (d) individuals and organizations that exercise privileges granted to them under an External Ministerial Delegation of Authority.

1.3 Description of changes

(1) This document, formerly AC 700-009, Issue 02, is now reissued as AC 700-009, Issue 03.

(2) The airworthiness considerations previously found in Issue 02 will be found in a forthcoming AC.

(3) The requirements needed to obtain a Special Authorization (SA) have been removed.

(4) Appendices have been added to assist air operators in understanding various requirements for the safe operations of ADS-B equipped aircraft.

2.0 References and requirements

2.1 Reference documents

(1) It is intended that the following reference materials be used in conjunction with this document:

- (a) Part VI Subpart 04 of the *Canadian Aviation Regulations* (CARs)—Private Operators
- (b) Part VII Subpart 0 of the CARs—General

(c) Part VII Subpart 01 of the CARs—Foreign Air Operations

(d) Part VII Subpart 02 of the CARs—Aerial Work

(e) Part VII Subpart 03 of the CARs—Air Taxi Operations

(f) Part VII Subpart 04 of the CARs—Commuter Operations

(g) Part VII Subpart 05 of the CARs—Airline Operations

(h) ICAO Circular 326 Assessment of ADS-B and Multilateration Surveillance to Support Air Traffic Services and Guidelines for Implementation

(i) Federal Aviation Administration (FAA) Advisory Circular (AC) 20-165(B)—Airworthiness Approval of Automatic Dependant Surveillance – Broadcast OUT Systems

(j) FAA AC 90-114(A) Automatic Dependent Surveillance-Broadcast Operations Change 1

(k) AIP Canada (ICAO), Aeronautical Information Publication Part 2 Enroute (ENR)

(l) European Aviation Safety Agency (EASA) CS-ACNS. Certification Specifications (and Acceptable Means of Compliance) for Airborne Communication, Navigation and Surveillance (CS-ACNS)

(m) EASA AMC 20-24. Certification Considerations for the Enhanced ATS in Non-Radar Areas using ADS-B Surveillance (ADS-B-NRA) Application via 1090 MHz Extended Squitter

2.2 Cancelled documents

(1) Not applicable.

(2) By default, it is understood that the publication of a new issue of a document automatically renders any earlier issues of the same document null and void.

2.3 Definitions and abbreviations

(1) The following **definitions** are used in this document:

(a) **ADS-B**: means Automatic Dependent Surveillance Broadcast System and is a surveillance system that uses a global navigation satellite system, aircraft avionics, and ground and/or space-based infrastructure to accurately and quickly transmit flight information. This includes aircraft identification, position, altitude, and velocity between aircraft and air traffic control. This signal can be captured on the ground or in space for surveillance purposes (ADS-B-out) or on-board other aircraft for air traffic situational awareness (ADS-B-in) and airborne separation assistance.

(b) **ADS-B In:** means the receipt, processing, and display of ADS-B transmissions. ADS-B In is necessary to utilize ADS-B traffic and broadcast services.

(c) **ADS-B Out:** means the transmission of an aircraft's position, altitude, velocity, and other information to other aircraft and air traffic control (ATC) ground or space-based surveillance systems.

(d) **ADS-C**: Automatic Dependent Surveillance - Contract (ADS-C) uses the same systems on board the aircraft to automatically transmit similar information - aircraft position, altitude, speed, elements of navigational intent and meteorological data - only to one or more specific Air Traffic Services (ATS) Unit or Aeronautical Operational Control (AOC) facilities for surveillance and/or route conformance monitoring. ADS-C functions similarly to ADS-B but the data is transmitted based on an explicit contract between ATS and an aircraft. This contract may be a demand contract, a periodic contract, an event contract

and/or an emergency contract. ADS-C is most often employed in the provision of ATS over transcontinental or transoceanic areas which see relatively low traffic levels

(e) **ADS-B-NRA**: means enhanced air traffic services in Non-Radar Areas using ADS-B surveillance.

(f) **ADS-B Links:** means is a link-translation and rebroadcast function of the ADS-B ground system that allows both ADS-B frequencies (1090 Extended Squitter (ES) and 978 megahertz (MHz)) to share information

(g) **ADS-B-RAD**: means the addition of ADS-B surveillance in areas where radar services/surveillance also exist.

(h) **Extended Squitter (ES):** means how ADS-B messages are transmitted from a Mode Select (Mode S) transponder. ES is a long message that Mode S transponders transmit automatically, without interrogation by radar, to announce the own-ship (i.e. position) aircraft's presence to nearby ADS-B-equipped aircraft and ground stations.

(i) **Global Navigation Satellite System (GNSS):** means the generic term for a satellite navigation system, such as the Global Positioning System (GPS), that provides autonomous worldwide geospatial positioning and may include local or regional augmentations.

(j) **Universal Access Transceiver (UAT):** means a wideband multipurpose data link intended to operate globally on a single channel with a channel signaling rate of just over 1 megabit per second (Mbps). By design, UAT supports multiple broadcast services including ADS-B.

(2) The following **abbreviations** are used in this document.

(a) **AMC**: means Acceptable Means of Compliance

(b) **ATS**: means Air Traffic Services

(c) **CARs**: *Canadian Aviation Regulations*

(d) **EASA**: means European Aviation Safety Agency

(e) **GNSS**: means Global Navigation Satellite System

(f) **GPS**: means Global Positioning System

(g) **RPAS:** means Remotely Piloted Aircraft Systems

3.0 Background

(1) ADS-B is a technology that uses GNSS, aircraft avionics, and ground or satellite-based infrastructure to accurately and quickly transmit flight information between aircraft and ATC. ADS-B consists of two functions: ADS-B-out and ADS-B in. ADS-B out, defined as the capability necessary to transmit ADS-B messages, is the core of the operational system. The ability to receive and display ADS-B messages and broadcast services, both from the ground, space or directly from other aircraft is called ADS-B in.

(2) The system is automatic since it functions without intervention from the flight crew as long as the necessary avionics are in place, connected and functioning. Contrary to the independent primary radar system, ADS-B is dependent because it requires the aircraft systems to provide aircraft state information, such as position, altitude and velocity.

(3) The implementation of ADS-B has significant benefits that include the following:

(a) application of 5 nautical miles lateral separation based on a surveillance system in lieu of procedural separation minima;

(b) fuel savings related to the opportunity for more user preferred trajectories; and

(c) enhanced safety in the air through increased areas of surveillance coverage.

(4) Canadian registered aircraft wishing to operate in the US and Europe will need to comply with associated regulations specified by the associated regulatory organizations.

(5) The Appendices to this AC provide air operators requirements as follows:

(a) Appendix A - Operator Requirements;

(b) Appendix B - Training Requirements;

(c) Appendix C – Maintenance Requirements.

(6) RPAS Operators operating under CARs provision 903.03 are not necessarily required to have an operations manual. However, in order to use ADS-B applications, the operator should develop similar training and procedures to the ones described in the Appendices.

(7) Installation approval requirements will be found in a forthcoming AC. Provisions exist for aircraft equipped with ADS-B Out systems as minimum equipment for surveillance service airspace as depicted in AIP Canada (ICAO). In Canada, space-based ADS-B technology supplements the current ground-based radar to leverage benefits of ADS-B.

4.0 Certification

(1) A forthcoming AC will contain certification requirements of ADS-B In and Out installations.

5.0 Information management

(1) Not applicable.

6.0 Document history

(1) AC 700-009, **Issue 02,** RDIMS 5670710 ((E), 5670748 (F), dated 2011-03-11 — Automatic Dependent Surveillance – Broadcast;

(2) AC 700-009, **Issue 01**, RDIMS 4042921 (E), 4225136 (F), dated 2007-02-01 — Automatic Dependent Surveillance – Broadcast.

7.0 Contact us

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Appendix A – Operator Requirements

Company Operations Manual

(1) The Company Operations Manual (COM) shall include a system description, operational and contingency procedures and training elements for use of the ADS-B.

(2) Operators operating under the provisions of ICAO Annex 6 Part II “International General Aviation – Aeroplanes” are not required to have an operations manual. However, in order to use ADS-B applications, the operator should develop similar training and procedures to the ones described in this guidance material.

(3) Air operators shall ensure that the ADS-B considerations are contained in each of the following:

(a) Company Operations Manual (COM), including any constituent parts of the COM, pursuant to subsections 702.82(1) or 703.105(1) or 704.121(1) or 705.135(1) of the CARs as applicable to their operation;

(b) Standard operating procedures (SOPs), pursuant to subsections 702.84(1) or 703.107(1) or 704.124(1) or 705.138(1) of the CARs as applicable to their operation;

(c) Maintenance control manual (MCM), pursuant to subsection 706.08 (1) of the CARs; and

(d) Minimum equipment list (MEL), pursuant to section 605.07 of the CARs.

Note: All operators with an approved MEL shall include ADS-B equipped aircraft in their MEL.

Appendix B – Training Requirements

(1) The air operator shall establish and maintain a ground and flight training program that is:

(a) designed to ensure that each person who receives training acquires the competence to perform the person's assigned duties; and

(b) approved by the Minister in accordance with the Commercial Air Service Standards (CASS).

(2) The air operator’s approved training program shall ensure that flight crew are thoroughly familiar with all relevant aspects of ADS-B and its applications. At a minimum, flight crew training should address:

(a) general understanding of ADS-B operating procedures;

(b) specific ADS-B associated phraseology;

(c) general understanding of the ADS-B technology;

(d) characteristics and limitations of the flight deck human-machine interface, including an overview of ADS-B environment and system descriptions;

(e) the need to use the ICAO defined format for entry of the Aircraft Identification or Aircraft Registration marking as applicable to the flight;

(f) operational procedures regarding the transmission of solely the generic emergency flag in cases when the flight crew actually selected a discrete emergency code;

(g) indication of ADS-B transmit capability within the ICAO flight plan but only when the aircraft is certified;

(h) handling of data source errors;

(i) incident reporting procedures;

(j) crew resource management and associated human factors issues.

Appendix C – Maintenance Requirements

(1) Maintenance tests should include a periodic verification check of aircraft derived data including the ICAO 24 bit aircraft address using suitable ramp test equipment. The check of the 24 bit aircraft address should be made also in the event of a change of state of registration of the aircraft.

(2) Maintenance tests should check the correct functioning of system fault detectors (if any).

(3) Maintenance tests at ADS-B transmit system level for encoding altitude sensors should be based on requirements set out by the manufacturer

(4) Periodicity for the check of the ADS-B transmitter should be established based on manufacturer recommendations.