



**U.S. Department  
of Transportation**  
Federal Aviation  
Administration

# Advisory Circular

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**Subject:** Automatic Dependent  
Surveillance-Broadcast (ADS-B)  
Operations

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## FOREWORD

The Federal Aviation Administration (FAA) has issued a new rule contained in Title 14 of the Code of Federal Regulations (14 CFR) part 91, §§ 91.225 and 91.227. This rule requires Automatic Dependent Surveillance-Broadcast (ADS-B) Out performance when operating in designated classes of airspace within the U.S. National Airspace System (NAS) after January 1, 2020. This advisory circular (AC) provides users of the NAS guidance on a means of conducting flight operations in accordance with §§ 91.225 and 91.227. The Aeronautical Information Manual (AIM) provides an overview of, and the appendices in this AC provide guidance for, additional operations enabled by ADS-B. Appendix 2 contains a list of ADS-B-related definitions.

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## CHAPTER 1. ADS-B OPERATIONS

**1-1. PURPOSE.** The intent of this advisory circular (AC) is to facilitate operations using Automatic Dependent Surveillance-Broadcast (ADS-B) technology in compliance with Title 14 of the Code of Federal Regulations (14 CFR) part 91, §§ 91.225 and 91.227, which are required after January 1, 2020.

**1-2. AUDIENCE.** This AC applies to all U.S. operators intending to use ADS-B.

**1-3. SCOPE.** This AC contains an overview of the ADS-B system and general operating procedures associated with operations conducted in compliance with the airspace and performance requirements of §§ 91.225 and 91.227. The appendices provide guidance for additional operations enabled by ADS-B.

**a. Obligation.** The information contained in this AC is not mandatory; it describes an acceptable means but not the only means of complying with the applicable regulations. This AC does not change, create, amend, or permit deviation from any regulatory requirement.

**b. Authorization to Conduct ADS-B Out Operations.** There is no authorization required by the Federal Aviation Administration (FAA) to conduct ADS-B Out operations in the airspace specified in § 91.225 (U.S.-designated airspace).

**c. Certification and Installation of ADS-B Out Equipment.**

(1) Guidance associated with the installation and airworthiness approval of ADS-B Out equipment is contained in AC 20-165, Airworthiness Approval of Automatic Dependent Surveillance-Broadcast (ADS-B) Out Equipment for Operation in the National Airspace System (NAS).

**NOTE: Outside the U.S. National Airspace System (NAS), many worldwide air traffic service providers (ATSP) allow the use of ADS-B equipment certified to the European Aviation Safety Agency (EASA) Acceptable Means of Compliance (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, dated February 5, 2008.**

**NOTE: ADS-B equipment installed in accordance with AC 20-165 (TSO-C166b and TSO-C154c) meets the equipment requirements of AMC 20-24. However, AMC 20-24 equipment does not comply with § 91.225.**

(2) Until further notice, ADS-B Out equipment must be installed in accordance with the Flight Standards Service (AFS)/Aircraft Certification Service (AIR) memorandum, Approval for ADS-B Out Systems. A copy of this memorandum can be obtained from the FAA Regulatory and Guidance Library (RGL) Web site at <http://rgl.faa.gov>.

**1-4. CANCELLATION.** This AC and AC 20-165 cancel AC 120-86, Aircraft Surveillance Systems and Applications, dated September 16, 2005.



## CHAPTER 2. OVERVIEW AND SYSTEM DESCRIPTION

**2-1. OVERVIEW.** To accommodate the ever-growing demands placed on the NAS, limitations associated with the current system must be overcome. Beginning with the NAS-wide implementation of ADS-B, the FAA has begun a transformation to both overcome existing limitations and to enable the improvements needed to increase the capacity and efficiency of the NAS while maintaining safety. ADS-B supports these improvements by providing a higher update rate and enhanced accuracy of surveillance information over the current radar-based surveillance systems. In addition, ADS-B enables the expansion of air traffic control (ATC) surveillance services into areas where none existed previously. The ADS-B ground system also provides Traffic Information Service-Broadcast (TIS-B) and Flight Information Service-Broadcast (FIS-B) for use on appropriately equipped aircraft, enhancing the user's situational awareness (SA) and improving the overall safety of the NAS.

### 2-2. ADS-B SYSTEM DESCRIPTION.

**a. ADS-B System Architecture.** The ADS-B system architecture is composed of aircraft avionics and a ground infrastructure. Onboard avionics determine the position of the aircraft, typically by using the Global Navigation Satellite Systems (GNSS) and transmitting this and additional information about the aircraft to ground stations for use by ATC; to ADS-B-equipped aircraft; and to other aviation service providers.

**b. ADS-B Operating Frequencies.** In the United States, the ADS-B system operates on two frequencies: 1090 or 978 Megahertz (MHz). See Chapter 3, Figure 1, Automatic Dependent Surveillance-Broadcast (ADS-B) Airspace Rule (§ 91.225) Diagram, for airspace and frequency requirements.

**(1) 1090 MHz Frequency.** The 1090 MHz frequency is associated with current Mode A, C, and S transponder operations. ADS-B information is included in Mode S transponders' Extended Squitter (ES) transmit messages, and referred to as 1090ES in this AC.

**(2) 978 MHz Frequency.** ADS-B equipment operating on 978 MHz are referred to as Universal Access Transceivers (UAT) in this AC.

**c. ADS-B Avionics Operating Modes.** ADS-B avionics can have the ability to both transmit and receive information.

**(1) ADS-B Out.** The transmission of ADS-B information from aircraft is known as ADS-B Out.

**(2) ADS-B In.** The receipt of ADS-B information by an aircraft is known as ADS-B In.

**NOTE: After January 1, 2020, all aircraft operating within the airspace defined in § 91.225 will be required to transmit (ADS-B Out) the information defined in § 91.227 using Technical Standard Order (TSO)-C166b or TSO-C154c avionics.**

**2-3. ADS-B BROADCAST SERVICES.** ADS-B implementation includes three broadcast services: Automatic Dependent Surveillance-Rebroadcast (ADS-R), TIS-B, and FIS-B.

**a. ADS-R.** Because the ADS-B system operates on two separate frequencies (1090 MHz and 978 MHz), there is a need to translate, reformat, and rebroadcast the information from each frequency to enable aircraft operating on the alternate frequency to process and use the other's information. This process is referred to as ADS-R and occurs within the ADS-B ground station.

**NOTE: Aircraft operating on the same ADS-B frequency exchange information directly and do not require ADS-R translation. Aircraft with ADS-B In capability on both UAT and 1090ES do not require ADS-R service.**

**b. TIS-B.** TIS-B is the broadcast of transponder-based traffic information derived from ATC surveillance systems. TIS-B provides ADS-B-In-equipped aircraft with a more complete picture of surrounding traffic in situations where not all aircraft are equipped with ADS-B.

**c. FIS-B.** The FIS-B operates on UAT only and provides ADS-B-In-equipped aircraft with a suite of advisory-only aeronautical and weather information products to enhance the user's SA. Additional information on FIS-B and the products available through the service are provided in the Aeronautical Information Manual (AIM).



### CHAPTER 3. OPERATIONAL CONSIDERATIONS

#### **3-1. U.S. ADS-B AIRSPACE AND EQUIPMENT PERFORMANCE REQUIREMENTS.**

After January 1, 2020, unless authorized by ATC, all aircraft operating in the airspace specified in § 91.225 must meet the equipment performance requirements defined in § 91.227. This chapter describes both the airspace and equipment performance requirements of §§ 91.225 and 91.227. Operators should consider the need to access ADS-B-required airspace and the performance requirements of that airspace when equipping for compliance with §§ 91.225 and 91.227.

**a. Inside Class A Airspace.** Operations in Class A airspace must:

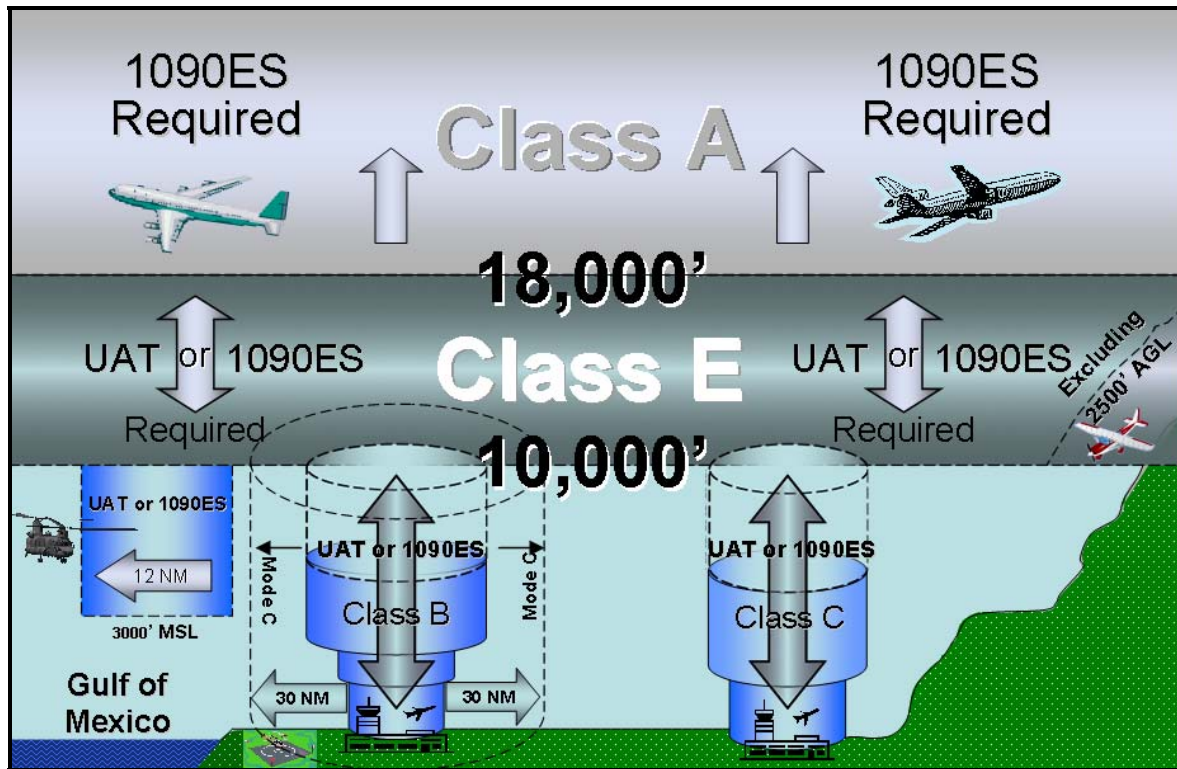
- (1) Meet the equipment requirements in TSO-C166b (1090ES); and
- (2) Meet the equipment performance requirements of § 91.227.

**NOTE: Although TSO-C166b incorporates standards for TIS-B equipment, TIS-B equipage (ADS-B In) is not required for compliance with §§ 91.225 and 91.227.**

**b. Outside Class A Airspace.** Operations outside Class A airspace must:

- (1) Meet the equipment performance requirements of § 91.227;
- (2) Meet the requirements in TSO-C166b (1090ES); or
- (3) Meet the requirements in TSO-C154c in the following airspace:
  - (a) Class B and Class C airspace;
  - (b) Except as provided for in § 91.225(e), within 30 nautical miles (NM) of an airport listed in part 91 appendix D (Mode C veil), section 1, from the surface upward to 10,000 feet mean sea level (MSL);
  - (c) Above the ceiling and within the lateral boundaries of a Class B or Class C airspace designated for an airport upward to 10,000 feet MSL;
  - (d) Except as provided for in § 91.225(e), Class E airspace within the 48 contiguous United States and the District of Columbia at and above 10,000 feet MSL, excluding the airspace at and below 2,500 feet above the surface (i.e., mountainous areas); and
  - (e) Class E airspace at and above 3,000 feet MSL over the Gulf of Mexico, from the coastline of the United States out to 12 NM.

**FIGURE 1. AUTOMATIC DEPENDENT SURVEILLANCE-BROADCAST AIRSPACE RULE (§ 91.225) DIAGRAM**



**3-2. EXCEPTIONS TO AIRSPACE REQUIREMENTS.** The requirements of § 91.225(b) do not apply to any aircraft that was not originally certified with an electrical system or that has not subsequently been certified with such a system installed, including balloons and gliders. These aircraft may conduct operations without ADS-B Out in the airspace specified in § 91.225(d)(2) and (4). While the requirements do not apply to these aircraft, the aircraft operator requires the approval of ATC before entering ADS-B-required airspace. Operations specified in § 91.225(d)(2) must be conducted:

- Outside any Class B or Class C airspace, and
- Below the altitude of the ceiling of a Class B or Class C airspace designated for an airport, or 10,000 feet MSL, whichever is lower.

## CHAPTER 4. OPERATING PROCEDURES

**4-1. GENERAL OPERATING PROCEDURES.** This chapter describes the general procedures for ADS-B Out operations in accordance with § 91.225. All operators should use this information when planning and conducting operations requiring ADS-B Out performance.

### **4-2. OPERATOR FAMILIARITY OF THE INSTALLED ADS-B SYSTEM.**

**a. System Operation Familiarity.** All operators should use the applicable Airplane Flight Manual (AFM), Airplane Flight Manual Supplement (AFMS), Rotorcraft Flight Manual (RFM), Rotorcraft Flight Manual Supplement (RFMS), pilot's operating handbook (POH), or other required operating handbooks or manuals, to become familiar with the proper operation of the installed ADS-B system and any procedures expected of the user for indications of reduced performance or failures within the system.

**b. Understanding Failure Indicators within the System.** Because many ADS-B system installations will be upgrades to existing transponders (Mode S), there may be limited ability to indicate ADS-B failures. Mode S transponders with ADS-B functionality may indicate a device failure (loss of transponder/ADS-B) and input failures (loss of position source, such as GNSS) with the same indicator light. Operators should refer to their AFM, AFMS, RFM, RFMS, POH, and other handbooks and manuals for information on the differences between device failures and function failures, and the implications and procedures associated with each failure type.

**c. Transponder Operation and ADS-B Transmissions.** For ADS-B system installations integrated within a transponder that share control features, operators should be aware that disabling the transponder may also disable ADS-B transmissions, resulting in a loss of Secondary Surveillance Radar (SSR) services and Traffic Alert and Collision Avoidance System (TCAS)/TCAS II operation, if so equipped.

### **4-3. ADS-B EQUIPMENT OPERATIONS (U.S.-DESIGNATED AIRSPACE).**

**a. Transmit Requirements.** In accordance with § 91.225(f), each person operating an aircraft equipped with ADS-B Out must operate this equipment in the transmit mode at all times. This equipment operation requirement pertains to all phases of flight operation, including airport surface movement area operations. For ADS-B installations integrated within a transponder, the flight manual, checklists, and any operator's procedures manuals must be updated accordingly with proper ADS-B system operations guidance.

**NOTE: Aircraft must comply with the appropriate TSO requirements when transmitting ADS-B data.**

**b. ATC-Authorized Deviations.** Requests for ATC-authorized deviations from the requirements in § 91.225(g) must be made to the ATC facility that has jurisdiction over the concerned airspace or airport movement area and be made within the time periods specified below:

(1) For operation of an aircraft with inoperative ADS-B equipment to the airport of ultimate destination (including any intermediate stops) to proceed to a place where suitable repairs can be made, or both, the request may be made at any time.

(2) For operation of an aircraft that is not equipped with ADS-B, the request must be made at least 1 hour before the proposed operation.

**4-4. FLIGHT PLANS.** When operating aircraft equipped with ADS-B Out, operators should indicate their ADS-B capability on the flight plan as “RMK/ADSB.”

**4-5. PREFLIGHT REQUIREMENTS (U.S.-DESIGNATED AIRSPACE).** Reserved.

**4-6. FLIGHTCREW ENTRY OF REQUIRED ADS-B DATA.** Operational procedures shall be developed by the operator to address flightcrew entry of the ADS-B message elements required in § 91.227 and as described in subparagraphs 4-6a through d. If the ADS-B avionics system design does not allow for a single point of entry for this information, the AFM/AFMS/RFM/RFMS/POH or other required flight manual must address the requirement to enter the information multiple times through the appropriate system’s interface and to ensure that conflicting aircraft identification information is not transmitted to ATC.

**a. Mode A Code.**

(1) ATC automation relies on the Mode A code to identify aircraft under radar surveillance and to correlate the displayed target to a flight plan. The Mode A code is one element of the transmitted ADS-B message set. Because SSR and ADS-B surveillance will overlap in much of the NAS, correlation of the Mode A code between the transponder and the ADS-B message is necessary to ensure that a single target is resolved and correlated to a flight plan route.

(2) It is imperative that the ATC-assigned transponder code is identical to the one in the ADS-B Out message. A preferable design configuration is one that provides the pilot a single point of entry for the Mode A code in both the transponder and the ADS-B Out avionics. If there is no single point of entry provided for the Mode A code into the transponder, then the AFM or operating handbook must address the requirement to enter the Mode A code into both systems separately.

**NOTE: Transmission of conflicting transponder and ADS-B Mode A codes will result in erroneous traffic conflict alerts within the ATC automation system.**

**b. Aircraft’s Call Sign/Flight ID.**

(1) The AFM or POH should provide specific instructions for entering the registration number or flight plan call sign, sometimes referred to as the flight ID. The term “aircraft call sign” means the radiotelephony call sign assigned to an aircraft for voice communications purposes. For General Aviation (GA) aircraft, the aircraft call sign is normally associated with the aircraft registration number (tail number) and may be preset. For airline and commuter aircraft, it is usually composed of the company name and flight number (and therefore not linked

to a particular airframe). The airline flight ID entered into the flight management system (FMS)/multipurpose control and display unit (MCDU) must exactly match the aircraft ID in the ATC flight plan.

(2) For operations using variable call signs (e.g., Lifeguard), the operator should verify with equipment manufacturers that this capability is available in the avionics and should obtain guidance for the proper procedures to enter variable call sign codes.

**c. Emergency Status.**

(1) This ADS-B message element and transponder code alerts ATC that the aircraft is experiencing emergency conditions and indicates the type of emergency. The appropriate emergency code should be entered into the transponder (i.e., 7500, 7600, and 7700). The ICAO Annex 10, Volume IV emergency codes (general emergency, no communications, and unlawful interference) are required by § 91.227.

(2) ADS-B systems integrated within a transponder will automatically set the applicable emergency status when code 7500, 7600, or 7700 is entered into the transponder.

(3) ADS-B systems not integrated with the transponder or systems with optional emergency codes require the appropriate emergency code to be entered through a separate pilot interface. Flightcrews must ensure that both emergency codes (ADS-B and transponder) are identical.

**d. Aircraft's "IDENT."** The required AFM or POH will provide specific instructions on how the "IDENT" feature will be activated in specific installations, including any installations with multiple "IDENT" features.



## **APPENDIX 1. ADS-B OUT OPERATIONS OUTSIDE OF U.S.-DESIGNATED AIRSPACE**

**1. Overview.** ADS-B provides air traffic control (ATC) with a means of surveillance outside of U.S.-designated airspace, which allows application of reduced separation standards for more efficient use of the airspace. Currently, ADS-B provides surveillance coverage in several regions of the world, including portions of Australia, Canada, and in the Asia-Pacific region. Additional International Civil Aviation Organization (ICAO) regions and Member States are expected to implement ADS-B in their airspace and/or on specific airways and routes in the future.

**2. Authorization to Conduct ADS-B Out Operations Outside of U.S.-Designated Airspace.** FAA authorization is required for all U.S. operators to conduct ADS-B Out operations outside of U.S.-designated airspace. This appendix provides guidance to operators on the process and documentation required when requesting issuance of this authorization.

**NOTE: As applicable, authorization under FAA Order 8900.1, Flight Standards Information Management System (FSIMS), Volume 3, Chapter 18, Section 3, Part A Operations Specifications—General, operations specification (OpSpec) A353 and a regional authorization (e.g., OpSpec B050) may be necessary to conduct ADS-B operations in areas outside of U.S.-designated airspace.**

### **a. Initial Request for Authorization.**

(1) U.S. operators seeking to conduct ADS-B Out operations outside of U.S.-designated airspace must first contact their assigned FAA office to indicate their intent. When making the initial request, the operator should be prepared to provide the following:

(a) Documented compliance of applicable requirements;

(b) The proposed plan to conduct operations under the authorization; and

(c) The identification of the appropriate point(s) of contact (POC) for coordination during the FAA authorization process.

(2) At the time of the operator's initial request, the FAA will provide the operator with information for obtaining relevant guidance and documents, as well as the proper content and format of the documentation required when submitting the formal request.

### **b. Required Documentation for Submission of Formal Request.**

(1) **Documentation Guidance.** The following paragraph provides general guidance on the documentation required for submission of a formal request for issuance of this authorization. At the discretion of the operator's assigned principal inspector (PI), additional information may be required based on any unique aspects of specific operations.

**(2) Letter of Request for Issuance of Authorization.** The operator must submit a letter of request to the assigned PI requesting issuance of the authorization. The letter of request should include statements indicating the following:

- (a) Proposed region(s) of operation;
- (b) Type of aircraft (make, model, and series (M/M/S)) to be used in the operations;
- (c) Description of ADS-B Out equipment to be used;
- (d) Revision of aircraft qualification documents (Airplane Flight Manual (AFM), pilot's operating handbook (POH), etc.);
- (e) Establishment of applicable operational procedures and practices;
- (f) Revision of applicable operations manuals and checklists;
- (g) Revision of ADS-B Out system maintenance procedures;
- (h) Establishment of periodic maintenance for the ADS-B Out system;
- (i) Revision of minimum equipment list (MEL), if applicable;
- (j) Revision of pilot training; and
- (k) Revision of dispatcher training, if applicable.

**c. Compliance Documentation.** Operators must submit documentation that demonstrates compliance with European Aviation Safety Agency (EASA) Acceptable Means of Compliance (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, dated February 5, 2008. Documentation should include:

**(1) Aircraft Qualification Documentation.** Documentation from the aircraft manufacturer stating in the AFM/AFMS, POH that the proposed aircraft complies with EASA AMC 20-24. Deviations, as stated in EASA AMC 20-24, must be included or referenced.

**NOTE: ADS-B equipment installed in accordance with the current edition of AC 20-165, Airworthiness Approval of Automatic Dependent Surveillance-Broadcast Out Equipment for Operation in the National Airspace System (NAS), meets the equipment requirements of EASA AMC 20-24. See AMC 20-24 for any additional maintenance, operational, and training considerations.**

**(2) Operational Procedures and Practices.** As applicable, company manuals must address the special characteristics of the proposed region of operation.

**(3) Operations Manuals and Checklists.** The AFM, Airplane Flight Manual Supplement (AFMS), Aircraft Operating Manual (AOM), Flight Operations Manual (FOM),



POH, and associated checklists, as applicable to the specific operator, must include information to be used for the specific operation requested and be carried on the aircraft. The operations manual (or equivalent) should include a system description, operational and contingency procedures, and training elements for use of the ADS-B NRA application. Operations manuals should indicate that Direct Controller Pilot Communications (DCPC) must be available at all times (e.g., very high frequency (VHF), Controller-Pilot Data Link Communication (CPDLC), etc.). Operations manuals and checklists should indicate that when there is not an independent flight deck control selection between the ADS-B Out on/off function and the ATC transponder on/off function, the crew must be fully aware that disabling the ADS-B function will also disable transponder and Traffic Alert and Collision Avoidance System (TCAS) functions.

**(4) Maintenance Procedures.** The operator must submit documentation indicating the proposed maintenance procedures that address the instructions for continued airworthiness (ICA) provided by the manufacturer of the installed ADS-B equipment. Maintenance procedures must include a periodic verification check of aircraft-derived data used by the ADS-B system. Maintenance procedures must also include periodic verification (using suitable ramp test equipment or other acceptable means) that the correct ICAO 24-bit address assigned to each aircraft is being transmitted by the ADS-B system.

**(5) Establishment of Periodic Checks of the ADS-B Out System.** The operator should provide documentation that indicates that periodic checks for the installed ADS-B Out system are established.

**(6) Revision of MEL.** The operator must submit documentation for proposed MEL (if used) revisions that address appropriate dispatch procedures of the aircraft with the ADS-B Out system inoperative or partially inoperative.

**(7) Pilot Training.** Pilots conducting operations under this authorization must be trained in the use and limitations of the installed ADS-B system, unless one of the crewmembers is an ADS-B-trained check airman, as appropriate. Operators must submit documentation that details the method and content of the pilot training to be conducted. Pilot training must address the following:

- ADS-B operating procedures;
- Flight planning;
- MEL procedures;
- Human factors;
- ADS-B phraseology applicable to specific regions of operation (see Table 1, Canadian-Specific Surveillance Phraseology, and Table 2, Australian-Specific Surveillance Phraseology);
- ADS-B system operation, including normal/abnormal procedures;
- Correct entry of ICAO aircraft ID as applicable to the flight;
- Operational procedures regarding the transmission of the generic emergency code (i.e., 7700) in cases when the flightcrew actually selected a discrete emergency code (e.g., 7500, 7600);
- Handling of data source errors (e.g., discrepancies between navigation data sources); and

- Incident reporting procedures.

**(8) Dispatcher/Flight Follower Training.** Operators must submit a detailed description of the proposed dispatcher/flight follower (if required/used) training to be conducted. Dispatcher/flight follower training must address the following:

- Dispatch of aircraft with the ADS-B system unserviceable or partially unserviceable.
- Flight planning, fuel loading, and route change procedures associated with ADS-B operations.
- ADS-B ICAO region-specific requirements.

### **3. Canada-Specific Requirements.**

**a. Transport Canada Requirements.** See the current edition of Transport Canada AC 700-009, Automatic Dependent Surveillance-Broadcast, Paragraph 6.2, Foreign Air Operators, for information related to the ADS-B requirements of foreign operators.

**b. NAV CANADA Requirements.** See the current edition of Aeronautical Information Circular (AIC) 21/09, Air Traffic Flow Management in the Vicinity of Hudson Bay as a Result of Automatic Dependent Surveillance-Broadcast Out Implementation, for information related to NAV CANADA ATC services supported by ADS-B.

**4. Australia-Specific Requirements.** See the current editions of Australia AIC H09/11, Transition to Satellite Technology for Navigation and Surveillance; Australia Civil Aviation Safety Authority (CASA) Civil Aviation Order (CAO) 20.18, Aircraft Equipment—Basic Operational Requirements, regarding avionics requirements; and CAO 82.5, Condition on Air Operators' Certificates Authorising Regular Public Transport Operations in High Capacity Aircraft, for information related to the ADS-B requirements of certificated foreign operators.

**5. Asia-Pacific-Specific Requirement.** Singapore issued AIC 14/10, Introduction to Automatic Dependent Surveillance Broadcast (ADS-B) Out Service within Parts of the Singapore FIR, dated December 28, 2010, informing aircraft operators regarding the Civil Aviation Authority of Singapore's (CAAS) plan to implement ADS-B operations after 2013 within portions of the Singapore flight information region (FIR). See CAAS AIC 14/10 for specific airways that will require ADS-B within Singapore's FIR.

### **6. Related Documents.**

**a. ICAO Regional Guidance.** Regulatory guidance and general information for ADS-B Out operations for specific ICAO regions can be found in the following publications:

(1) FAA Order 8900.1, Flight Standards Information Management Systems (FSIMS), Volume 3, Chapter 18, Section 3, Part A Operations Specifications—General, Operations Specifications/Management Specifications/Letter of Authorization A353, Automatic Dependent Surveillance-Broadcast (ADS-B) Operations Outside of U.S.-Designated Airspace, current edition;

(2) 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, dated February 5, 2008;

(3) TCCA AC 700-009, Automatic Dependent Surveillance-Broadcast, current edition;

(4) NAV CANADA AIC 21/09, Air Traffic Flow Management in the Vicinity of Hudson Bay as a Result of Automatic Dependent Surveillance-Broadcast Out Implementation, current edition;

(5) CASA CAO 20.18, Aircraft Equipment—Basic Operational Requirements, current edition;

(6) CASA CAO 82.5, Condition on Air Operators' Certificates Authorising Regular Public Transport Operations in High Capacity Aircraft, current edition; and

(7) CAAS AIC 14/10, Introduction to Automatic Dependent Surveillance Broadcast (ADS-B) Out Service within Parts of the Singapore FIR, current edition.

**b. Additional Information.** For additional information regarding specific NRA operations, contact the following organizations or individuals:

(1) Contact the Flight Technologies and Procedures Division (AFS-400) by phone at 202-385-4586 or by e-mail at 9-AWA-AVS-ADS-Programs-AFS/AWA/FAA.

(2) For additional information on 14 CFR parts 121 and 135 special authorizations (300-series OpSpecs), contact the Air Transportation Division (AFS-200) at 202-267-8166.

(3) For additional information on 14 CFR parts 91 and 125 special authorizations (300-series OpSpecs/management specifications (MSpec)/letters of authorization (LOA)), contact the General Aviation and Commercial Division (AFS-800) at 202-267-8212.

**TABLE 1. CANADIAN-SPECIFIC SURVEILLANCE PHRASEOLOGY**

<b>Existing “Radar” Phraseology</b>	<b>New Generic “Surveillance” Phraseology</b>
<b>RADAR SERVICE TERMINATED</b> (non-radar routing if required)	<b>SURVEILLANCE SERVICE TERMINATED</b> (non-surveillance routing if required)
<b>RADAR SERVICE TERMINATED DUE TO</b> (reason)	<b>SURVEILLANCE SERVICE TERMINATED</b> <b>DUE TO</b> (reason)
<b>SECONDARY RADAR OUT OF SERVICE</b>	<b>ADS-B SURVEILLANCE OUT OF SERVICE</b> <b>DUE TO</b> (reason)
<b>MODE CHARLIE NOT VALIDATED</b>	<b>PRESSURE ALTITUDE NOT VALIDATED</b>
<b>MODE CHARLIE IS INVALID</b>	<b>PRESSURE ALTITUDE IS INVALID</b>
<b>RADAR SERVICE TERMINATED</b>	<b>SURVEILLANCE SERVICE TERMINATED</b>
<b>RESUME POSITION REPORTS</b>	<b>RESUME POSITION REPORTS</b>
(aircraft IDENT) <b>RADAR IDENTIFIED</b> (position if required)	(aircraft IDENT) <b>IDENTIFIED</b> (position if required)
(aircraft IDENT) <b>RADAR IDENTIFICATION</b> <b>LOST</b>	(aircraft IDENT) <b>IDENTIFICATION LOST</b>
<b>POINT OUT</b> (position) (identification/Secondary Surveillance Radar (SSR) code) (track and altitude) (other information)	<b>POINT OUT</b> (position) (identification/SSR code) (track and altitude) (other information)
	<b>CONFIRM ADS-B ELIGIBLE?</b> and if necessary— <b>UNABLE TO ISSUE</b> <b>CLEARANCE INTO ADS-B</b> <b>EXCLUSIONARY AIRSPACE, MAINTAIN</b> (altitude)
	<b>NEGATIVE ADS-B DUE TO EQUIPMENT</b> <b>FAILURE</b>
	<b>IF ABLE, CHANGE YOUR FLIGHT ID TO</b> <b>(FLIGHT ID)</b>
<b>IF YOU READ</b> , (appropriate instructions), then—(Action) <b>OBSERVED, WILL</b> <b>CONTINUE RADAR CONTROL</b>	<b>IF YOU READ</b> , (appropriate instructions), then—(Action) <b>OBSERVED, WILL</b> <b>CONTINUE SURVEILLANCE CONTROL</b>
	<b>(ACID) READING YOU ON 7700</b>
	<b>CONFIRM THE NATURE OF YOUR</b> <b>EMERGENCY</b>

**TABLE 2. AUSTRALIAN-SPECIFIC SURVEILLANCE PHRASEOLOGY**

<b>Existing “Radar” Phraseology</b>	<b>New Generic “Surveillance” Phraseology</b>
<b>IDENTIFICATION TERMINATED</b> (reason)	<b>IDENTIFICATION TERMINATED</b> (reason)
<b>PRIMARY RADAR OUT OF SERVICE</b>	<b>ADS-B OUT OF SERVICE</b> (reason)
<b>SECONDARY RADAR OUT OF SERVICE</b>	<b>ADS-B OUT OF SERVICE</b> (reason)
<b>ADVISE TRANSPONDER CAPABILITY</b>	<b>ADVISE ADS-B CAPABILITY</b>
<b>NEGATIVE TRANSPONDER</b>	<b>NEGATIVE ADS-B</b>
<b>RE-ENTER MODE S AIRCRAFT IDENTIFICATION</b>	<b>RE-ENTER ADS-B AIRCRAFT IDENTIFICATION</b>
<b>SQUAWK IDENT</b>	<b>TRANSMIT ADS-B IDENT</b>
<b>STOP SQUAWK</b>	<b>STOP ADS-B TRANSMISSION</b>
<b>SQUAWK CHARLIE</b>	<b>TRANSMIT ADS-B ALTITUDE</b>
<b>STOP SQUAWK CHARLIE WRONG INDICATION</b>	<b>STOP ADS-B ALTITUDE TRANSMISSION</b> (reason)



## APPENDIX 2. DEFINITIONS

The following terms have the meaning listed when used in this AC:

**a. Automatic Dependent Surveillance-Broadcast (ADS-B).** ADS-B is a function on an aircraft or vehicle that periodically broadcasts its state vector (horizontal and vertical position, horizontal and vertical velocity) and other information.

**b. ADS-B Airspace.** The airspace specified in 14 CFR part 91, § 91.225.

**c. ADS-B In.** ADS-B In is the receipt, processing, and display of ADS-B transmissions. ADS-B In is necessary to utilize ADS-B traffic and broadcast services (e.g., Flight Information Service-Broadcast (FIS-B) and Traffic Information Service-Broadcast (TIS-B)).

**d. Automatic Dependent Surveillance-Rebroadcast (ADS-R).** ADS-R 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.

**e. ADS-B Out.** Transmission of an aircraft's position, altitude, velocity, and other information to other aircraft and air traffic control (ATC) ground-based surveillance systems.

**f. Extended Squitter (ES).** ES is how ADS-B messages are transmitted from a Mode Select (Mode S) transponder. ES is a long message (e.g., format DF=17) that Mode S transponders transmit automatically, without interrogation by radar, to announce the own-ship aircraft's presence to nearby ADS-B-equipped aircraft and ground stations.

**g. Flightcrew.** One or more cockpit crewmembers required for the operation of the aircraft.

**h. Flight Information Service-Broadcast (FIS-B).** FIS-B is a ground broadcast service provided over the Universal Access Transceiver (UAT) data link. The FAA FIS-B system provides pilots and flightcrews of properly equipped aircraft with a cockpit display of certain aviation weather and aeronautical information.

**i. Global Navigation Satellite System (GNSS).** 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. Global Positioning System (GPS).** GPS is a U.S. satellite-based radio navigation system that provides a global positioning service. The service provided by GPS for civil use is defined in the GPS Standard Positioning System Performance Standard, 4th edition.

**k. International Civil Aviation Organization (ICAO).** A United Nations organization that is responsible for developing international standards and for recommending practices and procedures covering a variety of technical fields of aviation.

**l. ICAO 24-Bit Address.** Address assigned to each aircraft transponder or ADS-B transmitter. For aircraft equipped with Mode S transponders, their replies to Traffic Alert and Collision Avoidance System (TCAS) interrogations and their ADS-B transmissions should use the same 24-bit address, allowing correlations by Airborne Surveillance and Separation Assurance Processing (ASSAP).

**m. Mode A.** One of a possible 4,096 identification codes that are transmitted from an aircraft transponder or ADS-B transmitter to ground-based radars or ADS-B ground stations. Secondary radars interrogate the aircraft transponder for the Mode A code. In ADS-B, the aircraft includes its Mode A code as part of a transmitted ADS-B message. The Mode A code is also known as the squawk code for the aircraft. The Mode A (military Mode 3) is used in ATC for associating flight plans with surveillance data.

**n. Mode C.** The encoded barometric altitude from an onboard pressure sensor is contained in the Mode C. This altitude information is transmitted by the aircraft transponder in response to an appropriate interrogation from a secondary radar system. The Mode C is used by ATC to determine the altitude of the reporting aircraft.

**o. Mode S.** A Secondary Surveillance Radar (SSR) system that operates using addressed interrogation on 1030 MHz, and the transponder replies on 1090 MHz. Mode S systems interrogate for aircraft identity (Mode A), altitude (Mode C), and other aircraft-specific information. The aircraft transponder replies with the requested information. Mode S supports a two-way frequency and an ADS-B service known as ES.

**p. Position Source.** The onboard avionics equipment that provides the latitude, longitude, geometric altitude, velocity, position and velocity accuracy metrics, and position integrity metric. Additionally, the position source may provide the vertical rate parameters.

**q. Secondary Surveillance Radar (SSR).** A radar sensor that listens to replies sent by transponders carried on onboard airborne targets. SSR sensors, in contrast to primary surveillance radar (PSR) sensors, require the aircraft under surveillance to carry a transponder.

**r. Surveillance.** Detection, tracking, characterization, and observation of aircraft, other vehicles, weather, and airspace status information and phenomena for the purposes of conducting flight operations in a safe and efficient manner. The primary purposes of traffic surveillance (as distinct from all surveillance functionality) are to control the flow of aircraft, to provide situational awareness (SA) for pilots and controllers, and to separate aircraft.

**s. Traffic Information Service-Broadcast (TIS-B).** TIS-B is a ground broadcast service provided from an ADS-B ground system network over the UAT and 1090ES links that provides position, velocity, and other information on traffic that is detected by airport surface detection equipment (ASDE), SSR, or Wide Area Multilateration (WAM), but that is not transmitting an ADS-B position. TIS-B service will always be deployed with the ADS-R service so that a complete traffic picture is provided for both non-equipped and alternate-link-equipped aircraft.

**t. Transponder.** The airborne radar beacon receiver/transmitter portion of the ATC radar beacon system (ATCRBS) or Mode S that automatically receives radio signals from interrogators



on the ground and selectively replies with a specific reply pulse or pulse group only to those interrogations being received on the mode to which it is set to respond.

**u. Universal Access Transceiver (UAT).** UAT is 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 FIS-B and TIS-B, in addition to ADS-B.



### **APPENDIX 3. RELATED REGULATIONS AND READING MATERIAL**

#### **1. RELATED 14 CFRs.** You can find the CFRs online at [www.gpoaccess.gov/ecfr](http://www.gpoaccess.gov/ecfr).

- Part 1, § 1.1, General Definitions.
- Part 21, § 21.50, Instructions for Continued Airworthiness and Manufacturer's Maintenance Manuals Having Airworthiness Limitations Sections.
- Part 61, Certification: Pilots, Flight Instructors, and Ground Instructors.
- Part 91:
  - Section 91.1, Applicability;
  - Section 91.103, Preflight Action;
  - Section 91.130, Operations in Class C Airspace;
  - Section 91.131, Operations in Class B Airspace;
  - Section 91.135, Operations in Class A Airspace;
  - Section 91.217, Data Correspondence Between Automatically Reported Pressure Altitude Data and the Pilot's Altitude Reference;
  - Section 91.225, Automatic Dependent Surveillance-Broadcast (ADS-B) Out Equipment and Use (see RIN 2120-A192);
  - Section 91.227, Automatic Dependent Surveillance-Broadcast (ADS-B) Out Equipment Performance Requirements (See RIN 2120-A192); and
  - Subpart K (Part 91K), Fractional Ownership Operations.
- Part 121, Operating Requirements: Domestic, Flag, and Supplemental Operations.
- Part 125, Certification and Operations: Airplanes Having a Seating Capacity of 20 or More Passengers or a Maximum Payload Capacity of 6,000 Pounds or More; and Rules Governing Persons On Board Such Aircraft.
- Part 133, Rotorcraft External-Load Operations.
- Part 135, Operating Requirements: Commuter and On Demand Operations and Rules Governing Persons On Board Such Aircraft.
- Part 137, Agricultural Aircraft Operations.

#### **2. RELATED READING MATERIAL.**

- You can find this and other ACs on the FAA Web site at [http://www.faa.gov/regulations\\_policies/advisory\\_circulars](http://www.faa.gov/regulations_policies/advisory_circulars).
- Inspectors can access FAA Order 8900.1, Flight Standards Information Management System (FSIMS), through <http://fsims.avs.faa.gov>. Air carriers, operators, and the public can access Order 8900.1 through <http://fsims.faa.gov>.
- You can find a current list of Technical Standard Orders (TSO) on the FAA Regulatory and Guidance Library (RGL) Web site at <http://rgl.faa.gov>.

**a. FAA Guidance Material (current editions):**

(1) AC 20-165, Airworthiness Approval of Automatic Dependent Surveillance-Broadcast Out Equipment for Operation in the National Airspace System (NAS);

(2) AC 20-172, Airworthiness Approval for ADS-B In Systems and Applications;

(3) FAA Order 8900.1, Flight Standards Information Management Systems (FSIMS), Volume 3, Chapter 18, Section 3, Part A Operations Specifications—General, Operations Specifications/Management Specifications/Letter of Authorization A353, Automatic Dependent Surveillance-Broadcast (ADS-B) Operations; and

(4) Aeronautical Information Manual (AIM).

**b. FAA TSOs:**

(1) TSO-C112(), Air Traffic Control Radar Beacon System/Mode Select (ATCRBS/Mode S) Airborne Equipment;

(2) TSO-C129(), Airborne Supplemental Navigation Equipment Using the Global Positioning System (GPS);

(3) TSO-C145(), Airborne Navigation Sensors Using the Global Positioning System Augmented by the Satellite Based Augmentation System;

(4) TSO-C146(), Stand-Alone Airborne Navigation Equipment Using the Global Positioning System Augmented by the Satellite Based Augmentation System;

(5) TSO-C154c, Universal Access Transceiver (UAT) Automatic Dependent Surveillance-Broadcast (ADS-B) Equipment Operating on Frequency of 978 MHz;

(6) TSO-C166b, Extended Squitter Automatic Dependent Surveillance-Broadcast (ADS-B) and Traffic Information Service-Broadcast (TIS-B) Equipment Operating on the Radio Frequency of 1090 Megahertz (MHz);

(7) TSO-C195, Avionics Supporting Automatic Dependent Surveillance-Broadcast (ADS-B) Aircraft Surveillance Applications (ASA); and

(8) TSO-C196(), Airborne Supplemental Navigation Sensors for Global Positioning System Equipment Using Aircraft Based Augmentation.

**3. INTERNATIONAL PUBLICATIONS (current editions).**

**a. Asia-Pacific.** Civil Aviation Authority of Singapore (CAAS), Aeronautical Information Circular (AIC) 14/10, Introduction to Automatic Dependent Surveillance Broadcast (ADS-B) Out Service within Parts of the Singapore FIR.

**b. Australia.**

(1) Australia AIC H09/11, Transition to Satellite Technology for Navigation and Surveillance;

(2) Civil Aviation Safety Authority (CASA) Civil Aviation Order (CAO) 20.18, Aircraft Equipment—Basic Operational Requirements; and

(3) CASA CAO 82.5, Condition on Air Operators' Certificates Authorising Regular Public Transport Operations in High Capacity Aircraft.

**c. Canada.**

(1) Transport Canada AC 700-009, Automatic Dependent Surveillance-Broadcast; and

(2) NAV CANADA AIC 21/09, Air Traffic Flow Management in the Vicinity of Hudson Bay as a Result of Automatic Dependent Surveillance Broadcast Out Implementation.

**d. Europe.**

(1) 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, dated February 5, 2008;

(2) The European Organization for the Safety of Air Navigation (EUROCONTROL), Flight Crew Guidance for Flight Operations in ADS-B Only Surveillance Airspace, dated February 7, 2008;

(3) EUROCONTROL, Guidance for the Provision of Air Traffic Services Using ADS-B in Non Radar Airspace (NRA), dated January 28, 2008; and

(4) International Civil Aviation Organization (ICAO) Asia and Pacific Offices ADS-B Implementation and Operations Guidance Document, current edition.