U.S. Department of Transportation
Federal Aviation Administration

Advisory Circular

Subject: Automatic Dependent Surveillance-Broadcast Operations

Date: 3/7/16 **AC No:** 90-114A
Initiated by: AFS-400 **Change:** 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. The appendices provide guidance for the authorization of additional ADS-B Out and ADS-B In operations and their associated aircraft qualification and maintenance requirements.

2. PRINCIPAL CHANGES. This change incorporates new ADS-B guidance related to a technical amendment to § 91.225; equipping type certificated (TC) aircraft, light-sport aircraft (LSA), and experimental aircraft; and preflight requirements in U.S.-designated airspace. This change also modifies guidance for Cockpit Display of Traffic Information (CDTI) Assisted Visual Separation (CAVS).

PAGE CONTROL CHART

Remove Pages	Dated	Insert Pages	Dated
Page i	10/28/14	Page i	3/7/16
Page iii	10/28/14	Page iii	3/7/16
Pages 4 thru 12	10/28/14	Pages 4 thru 17	3/7/16
Appendix 1, Pages 1 thru 4	10/28/14	Appendix 1, Pages 1 thru 4	3/7/16
Appendix 3, Pages 2 thru 4	10/28/14	Appendix 3, Pages 2 thru 4	3/7/16
Appendix 5, Page 3	10/28/14	Appendix 5, Page 3	3/7/16
Appendix 6, Pages 3 and 4	10/28/14	Appendix 6, Pages 3 and 4	3/7/16

John Barbagallo
Deputy Director, Flight Standards Service

U.S. Department of Transportation
Federal Aviation Administration

Advisory Circular

Subject: Automatic Dependent Surveillance-Broadcast Operations

Date: 3/7/16 **AC No:** 90-114A

Initiated by: AFS-400 **Change:** 1

In May 2010, the Federal Aviation Administration (FAA) issued 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 a means of conducting flight operations in accordance with §§ 91.225 and 91.227. The appendices in this AC provide guidance for additional operations enabled by ADS-B, including ADS-B In.

CONTENTS

CHAPTER 1. AUTOMATIC DEPENDENT SURVEILLANCE-BROADCAST 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. The appendices provide guidance for the authorization of additional ADS-B Out and ADS-B In operations and their associated aircraft qualification and maintenance requirements.

1-2. CANCELLATION. This AC cancels AC 90-114 CHG 1, Automatic Dependent Surveillance-Broadcast (ADS-B) Operations, dated September 21, 2012.

1-3. AUDIENCE. This AC applies to all U.S. aircraft operators intending to use ADS-B.

1-4. 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 the authorization of additional ADS-B Out and ADS-B In operations and their associated aircraft qualification and maintenance requirements.

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). However, some International Civil Aviation Organization (ICAO) States do require operators to have an authorization from their respective State of Registry prior to allowing air traffic services in their airspace (see Appendix 1).

c. Certification and Installation of ADS-B Out Equipment. Guidance associated with the installation and airworthiness approval of ADS-B Out equipment is contained in the current edition of AC 20-165, Airworthiness Approval of Automatic Dependent Surveillance-Broadcast (ADS-B) Out Systems.

> **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 current edition of 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. EASA AMC 20-24 is intended for Non-Radar Areas (NRA). However, AMC 20-24 equipment does not comply with § 91.225. EASA's publication, Certification Specifications and Acceptable Means of Compliance for Airborne Communications, Navigation and Surveillance (CS-ACNS), is intended for other than NRAs.**

NOTE: ADS-B equipment installed in accordance with AC 20-165 (Technical Standard Order (TSO)-C166b, Extended Squitter Automatic Dependent Surveillance-Broadcast (ADS-B) and Traffic Information Service-Broadcast (TIS-B) Equipment Operating on Radio Frequency of 1090 Megahertz (MHz), and TSO-C154c, Universal Access Transceiver (UAT) Automatic Dependent Surveillance-Broadcast (ADS-B) Equipment Operating on Frequency of 978 MHz) meets the equipment requirements of AMC 20-24.

1-5. COMMENTS AND SUGGESTIONS. Comments and suggestions for improving this publication should be directed to: Future Flight Technologies Branch (AFS-430), 470 L'Enfant Plaza, SW, Suite 4102, Washington, DC 20024.

CHAPTER 2. OVERVIEW AND SYSTEM DESCRIPTION

2-1. OVERVIEW. Starting with the National Airspace System (NAS)-wide implementation of Automatic Dependent Surveillance-Broadcast (ADS-B), the Federal Aviation Administration (FAA) has begun to facilitate 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 Services-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 3-1, Automatic Dependent Surveillance-Broadcast Airspace Rule (§ 91.225) Diagram, for airspace and frequency requirements.

(1) The 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) The 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 Title 14 of the Code of Federal Regulations (14 CFR) part 91, § 91.225 will be required to transmit (ADS-B Out) the information defined in § 91.227 using Technical Standard Order (TSO)-C166b, Extended Squitter Automatic Dependent Surveillance-Broadcast (ADS-B) and Traffic Information Service-Broadcast (TIS-B) Equipment Operating on Radio Frequency of 1090 Megahertz (MHz), or TSO-C154c, Universal Access

Transceiver (UAT) Automatic Dependent Surveillance-Broadcast (ADS-B) Equipment Operating on Frequency of 978 MHz, 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 other 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 mode C or mode S 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) and the current edition of Advisory Circular (AC) 00-63, Use of Cockpit Displays of Digital Weather and Aeronautical Information.

2-4. USE OF ADS-B IN INFORMATION FOR TRAFFIC SA. This paragraph provides guidance on the use of ADS-B In information for traffic SA. See the appropriate appendices of this AC for guidance on the use of ADS-B In for the more advanced procedures that require FAA authorization. Installation of ADS-B In equipment is not required for compliance with § 91.225 or § 91.227. However, aircraft owners and operators who choose to voluntarily equip with ADS-B In avionics will achieve greater benefit from the technology through improved traffic SA on the ground and in the air.

NOTE: This AC only addresses ADS-B In systems installed in compliance with the current edition of AC 20-172, Airworthiness Approval for ADS-B In Systems and Applications, and meeting the equipment requirements of TSO-C195a (or later revision), Avionics Supporting Automatic Dependent Surveillance-Broadcast (ADS-B) Aircraft Surveillance Applications (ASA).

a. ADS-B In Systems. Most ADS-B In systems will include a flight deck traffic display depicting the relative position and related information of ADS-B-equipped aircraft presented on a plan view. This traffic display is only one component of the input and output devices collectively known as a Cockpit Display of Traffic Information (CDTI). The traffic display may be on a dedicated display or integrated into and presented on an existing display (e.g., navigation display (ND) or multifunction display (MFD)). The terms traffic display and CDTI are used interchangeably when the meaning is clear in context. In many installations, a moving map

depicting key surface elements of the airport may be displayed when on the ground or within a predefined altitude/distance from an airport while airborne.

NOTE: Airborne Traffic Advisory System (ATAS) is an ADS-B In application intended specifically for General Aviation (GA) use that will incorporate an audio traffic alerting capability. There is a configuration in which the display is optional for aircraft that cannot accommodate a display.

b. Operation. The CDTI will display nearby ADS-B Out traffic and may also display TIS-B traffic, depending on the installation and operating airspace. The display may have functionality to allow the pilot to select a target to obtain additional information that might not be automatically displayed, such as distance from own-ship and groundspeed (GS). The system will also provide range selection and declutter functionality. More advanced ADS-B In systems may also include certified functionality to perform ADS-B In procedures described in the appendices of this AC.

NOTE: For traffic SA, pilots are encouraged to incorporate the display in their normal scan to aid in the early detection of nearby traffic when in visual conditions and to aid in understanding the flow and amount of nearby traffic when in instrument conditions. However, the traffic display is not intended to be used for self-separation or to deviate from an ATC clearance. Should questions arise about a potential conflict with traffic while on an instrument flight rules (IFR) clearance, the pilot should query ATC. Pilots are also cautioned to not allow the display to become a distraction from the primary task of flying the aircraft. Finally, pilots are cautioned against unnecessarily communicating on the ATC frequency about traffic observed on the traffic display.

c. Limitations. Pilots should understand the proper use and limitations of their equipment and adhere to the following:

(1) Only use the traffic display to supplement what can be seen out the window (OTW), except when authorized to conduct ADS-B In operations described in the appendices of this AC. Pilots must always conduct OTW scans to see and avoid as required under § 91.113(b).

(2) Unless specifically certified for the function, the traffic display is not intended for collision avoidance or self-separation.

(3) Not all ground and airborne traffic will appear on the traffic display. Only properly equipped ADS-B Out traffic broadcasting on the ADS-B frequency(ies) being received and processed by the onboard avionics will appear. The traffic display can only display properly equipped ADS-B Out traffic broadcasting on the same frequency, and, depending on the equipment installation and operating airspace, ADS-R, TIS-B, and/or Traffic Alert and Collision Avoidance System (TCAS) (if installed) traffic. Additionally, the completeness of the traffic SA information is affected by range, signal quality, and proper installation and function of the ADS-B Out system on the traffic aircraft.

(4) Unless initiated by the controller, pilots should typically not use the call sign or ACID of observed traffic in radio communications, as this could create confusion for both ATC and pilots monitoring the frequency.

(5) In multipiloted aircraft, establish and comply with crew coordination procedures on the use of the CDTI and ADS-B In information to minimize head-down time.

(6) Use of the traffic display does not change pilot or controller responsibilities.

(7) If at any time the presented information becomes unreliable, inoperative, or a distraction, disregard the information presented on the traffic display.

(8) In TCAS-equipped aircraft, ADS-B In traffic display information does not replace guidance from a traffic advisory (TA) and/or Resolution Advisory (RA). RA response needs to be based on the TCAS system guidance and following approved procedures.

CHAPTER 3. OPERATIONAL CONSIDERATIONS

3-1. U.S. AUTOMATIC DEPENDENT SURVEILLANCE-BROADCAST (ADS-B) AIRSPACE AND EQUIPMENT PERFORMANCE REQUIREMENTS. After January 1, 2020, unless authorized by air traffic control (ATC), all aircraft operating in the airspace specified in Title 14 of the Code of Federal Regulations (14 CFR) part 91, § 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 performance requirements in Technical Standard Order (TSO)-C166b, Extended Squitter Automatic Dependent Surveillance-Broadcast (ADS-B) and Traffic Information Service-Broadcast (TIS-B) Equipment Operating on Radio Frequency of 1090 Megahertz (MHz) (1090ES).

(2) Meet the 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 requirements of § 91.227;

(2) Meet the performance requirements in TSO-C166b (1090ES); or

(3) Meet the performance requirements in TSO-C154c, Universal Access Transceiver (UAT) Automatic Dependent Surveillance-Broadcast (ADS-B) Equipment Operating on Frequency of 978 MHz, in the following airspace:

(a) Class B and Class C airspace.

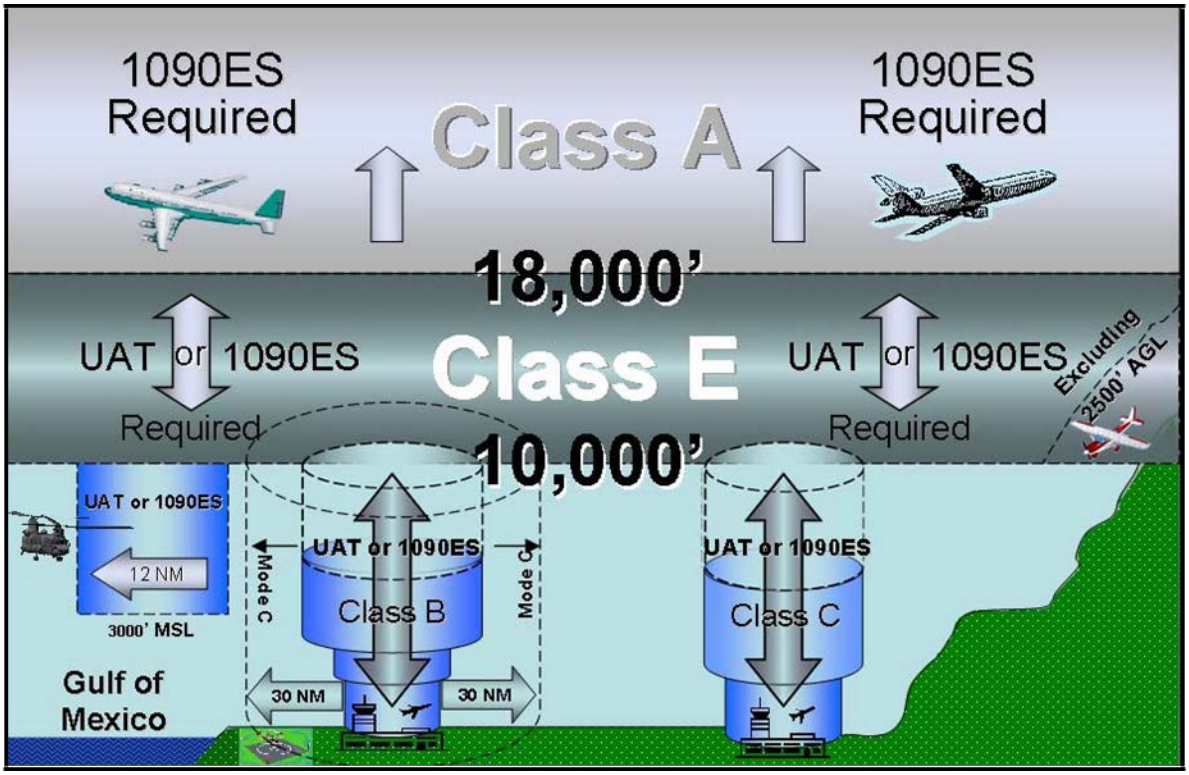
(b) Except as provided for in § 91.225(e), within 30 nautical miles (NM) of an airport listed in part 91 appendix D (Mode C veil), section 1, from the surface upward to 10,000 feet mean sea level (MSL).

(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).

(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 3-1. 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). However, for other aircraft without ADS-B Out, § 91.225(g) requires ATC authorization prior to operation in ADS-B Out-required airspace. Note that when the Federal Aviation Administration (FAA) issues an experimental or special airworthiness certificate to aircraft with an electrical system, that electrical system is considered certified and thus the exception to § 91.225 described above does not apply.

CHAPTER 4. OPERATING PROCEDURES

4-1. GENERAL OPERATING PROCEDURES. This chapter describes the general procedures for Automatic Dependent Surveillance-Broadcast (ADS-B) Out operations in accordance with Title 14 of the Code of Federal Regulations (14 CFR) part 91, § 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), Aircraft/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 the Global Navigation Satellite System (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, as well as result 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. Under 14 CFR part 21, § 21.31, 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 Technical Standard Order (TSO) performance requirements when transmitting ADS-B data.

b. Equipment Qualification Requirements. In order to operate an aircraft in airspace defined in § 91.225, the ADS-B Out equipment installed must meet the performance requirements of the applicable ADS-B TSOs and meet the requirements of § 91.227. Since § 91.225 requires the equipment to be installed, portable ADS-B Out equipment does not comply

with the rule. Under part 21, installed equipment need not be manufactured under a TSO authorization, but must be approved or qualified according to the type of aircraft as follows:

(1) Type-Certificated Aircraft. ADS-B Out systems and equipment installed or used in type-certificated aircraft must have a design approval issued under part 21 or must be installed by field approval, if appropriate. The current edition of AC 20-165, Airworthiness Approval of Automatic Dependent Surveillance—Broadcast (ADS-B) Out Systems, provides guidance on installation of ADS-B Out systems. FAA Policy Memorandum, Installation Approval for ADS-B Out Systems, dated 2016, provides information on how ADS-B systems may be installed by field approval.

(2) Special Light-Sport Aircraft (S-LSA). Equipment installed on S-LSA must be installed in accordance with an applicable consensus standard and must be authorized by the aircraft's manufacturer or a person acceptable to the Federal Aviation Administration (FAA) (see § 21.181).

(3) Experimental Aircraft, Including Experimental Light-Sport Aircraft (E-LSA).

(a) For experimental category aircraft, including E-LSA, there is no FAA approval required for the ADS-B Out system installation. However, to protect all users of the National Airspace System (NAS), it is essential for all aircraft, including experimental and E-LSA, to install equipment that has been adequately designed and tested to meet the equipment’s intended functions of supporting safe air traffic control (ATC) separation services and providing accurate traffic awareness to other aircraft. To meet this requirement, owners of these aircraft may elect to install equipment manufactured under a TSO authorization, in accordance with the installation instructions provided by the manufacturer. Alternatively, owners of these aircraft may elect to install equipment that are not approved under a TSO authorization. For non-TSO equipment, the owner should obtain installation instructions that include a statement of compliance from the applicable avionics manufacturer(s). To qualify non-TSO equipment as compliant for operations in ADS-B airspace defined in § 91.225, the statement of compliance should indicate that when installed in accordance with the installation instructions, the equipment complies with all requirements of § 91.227, and with the performance requirements of the appropriate TSO. While the statement of compliance is important in equipping the aircraft, per § 91.225, correct installation is critical for the equipment to operate properly.

(b) Manufacturers of equipment intended for installation in experimental aircraft and E-LSAs are responsible to perform appropriate engineering efforts to determine that the equipment complies with all § 91.227 and TSO performance requirements before making their statement of compliance. The FAA will not approve or concur with manufacturers’ statements of compliance for this equipment. Manufacturers of this equipment should also consider the guidance in AC 20-165 when creating installation instructions. After making their statement of compliance, manufacturers of experimental aircraft and E-LSA equipment should be prepared to provide in-service product support to include design changes, equipment modifications (or instructions for performing them), and revisions to the installation, operating, and maintenance instructions.

(c) Owners of experimental aircraft should retain the installation instructions from the equipment supplier, including the statement of compliance, in the aircraft records to support the equipment's compliance with the requirements of § 91.225 and § 91.227, and to assist in resolving in-service issues if necessary.

(4) All Aircraft—Importance of Proper Installation. Experience with FAA compliance monitoring of ADS-B Out-equipped aircraft to date has revealed that a large percentage of equipped aircraft have deficiencies with ADS-B Out system performance following initial installations. Many of these deficiencies have been attributed to improper installation and incorrect system configuration. Therefore, the FAA considers it particularly important for equipment manufacturers to provide installation instructions that are as clear and easy to follow as possible and revise these instructions when deficiencies in the instructions are discovered. Installers should adhere to the manufacturer's installation instructions and employ practices that consistently result in ADS-B Out system installations that fully comply with § 91.227 equipment performance requirements.

(5) All Aircraft—Equipment Performance During Operation.

(a) If ADS-B Out performance becomes deficient during flight in § 91.225 airspace, ATC may require the aircraft to exit the airspace.

(b) The FAA continuously monitors compliance to the ADS-B Out equipment performance requirements. If FAA monitoring finds noncompliant equipment, aircraft with the noncompliant equipment installed may be denied access to § 91.225 airspace until the noncompliant equipment is corrected. This may require technical assistance from the applicable equipment manufacturers. Depending on the nature and scope of the noncompliance, the FAA may disqualify either an individual aircraft's equipment (e.g., for improperly installed equipment on that specific aircraft), or all aircraft equipped with a certain type of equipment (e.g., for a design- or manufacturing-related equipment performance problem, or a problem traced to deficiencies with the installation, operating, or maintenance instructions, that may affect multiple aircraft).

(c) The FAA provides a service that enables aircraft owner/operators to verify compliance of ADS-B Out equipment performance requirements. Information on this service can be found at https://www.faa.gov/nextgen/equipadsb/. Owner/operators are encouraged to verify equipment performance through this service following installation, modification, or maintenance (to include component software updates) of ADS-B Out systems.

c. ATC-Authorized Deviations. Under § 91.225(g), operators must make requests for ATC-authorized deviations from the requirements in § 91.225 to the ATC facility that has jurisdiction over the concerned airspace or airport movement area 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, operators must make the request at least 1 hour before the proposed operation.

4-4. FLIGHT PLANS (FP). When operating aircraft equipped with ADS-B, operators need to indicate their surveillance equipment code in field 10B of the U.S. Area Navigation (RNAV) and International Civil Aviation Organization (ICAO) FPs.

a. Transponder Codes. The transponder codes for ADS-B are as follows:

(1) E: Mode S, including Aircraft Identification (ACID), pressure-altitude, and Extended Squitter (ES) (ADS-B) capability.

(2) L: Mode S, including ACID, pressure-altitude, ES (ADS-B), and enhanced surveillance capability.

b. Surveillance Codes. The surveillance codes for ADS-B are as follows:

(1) B1: ADS-B with dedicated 1090 megahertz (MHz) ADS-B Out capability.

(2) B2: ADS-B with dedicated 1090 MHz ADS-B Out and In capability.

(3) U1: ADS-B Out capability using Universal Access Transceiver (UAT).

(4) U2: ADS-B Out and In capability using UAT.

c. ICAO FP Block 18 ADS-B Information.

(1) If ADS-B capability filed in item 10 is compliant with TSO-C166b, which is based on RTCA, Inc. DO-260B, include the item “SUR/260B.” If ADS-B capability filed in item 10 is compliant with TSO-C154c, which is compliant with RTCA DO-282B, include the item “SUR/282B.” If ADS-B capability filed in item 10 is not compliant with either TSO-C166b or TSO-C154c, include no “SUR/” information in this flight plan field.

(2) When ADS-B capability is filed in item 10, include CODE/Aircraft address expressed in the form of six hexadecimal characters (e.g., “CODE/HJF34B”).

NOTE: For a complete description of FP filing codes, including field 18, refer to the FAA Flight Planning Information Web site at http://www.faa.gov/about/office_org/headquarters_offices/ato/service_units/enroute/flight_plan_filing.

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

a. Flight Planning Requirements.

(1) Under § 91.103, pilots and operators must use all available information in planning their flight, to ensure that the performance requirements will be met for the duration of the flight. Variations in position source performance affect ADS-B Out in two specific broadcast elements required by § 91.227—Navigation Accuracy Category for Position (NACp) and Navigation Integrity Category (NIC). During certain Global Positioning System (GPS) constellation geometries, some position sources may produce values for NACp and NIC that are less than required by the rule.

(2) Three different variants of GPS receivers are currently in use as a position source that can meet ADS-B Out rule performance requirements, to varying degrees, when adequate numbers of GPS satellites are in view. Selective Availability (SA) is a feature that deliberately degraded the GPS satellite signal, resulting in a less accurate reported position. SA was deactivated in 2000; however, SA-On GPS receivers assume SA is still active (on), thereby unnecessarily inflating integrity and accuracy bounds of the positions that are no longer degraded by SA. Most GPS receivers that are only compliant with TSO-C129 are SA-On receivers. SA-Aware GPS receivers are designed to recognize that SA is inactive and optimize the performance from GPS. GPS receivers that comply with the performance requirements of TSO-C196 are SA-Aware receivers. Satellite Based Augmentation Systems (SBAS) receivers also use the additional signals from geostationary satellites specifically designed for aviation use, improving the quality and robustness of positioning performance. This difference in performance is most pronounced for very precise operations, such as Localizer Performance with Vertical Guidance (LPV) approaches, and for all operations when there are inoperative GPS satellites. GPS receivers complying with TSO-C145 or TSO-C146 are SBAS receivers.

> **NOTE: Some GPS receivers manufactured with a TSO-C129a approval are SA-Aware, and, therefore, have the same NACp and NIC availability as TSO-C196() approved equipment. Operators should check with their GPS receiver supplier to verify whether their installed TSO-C129() GPS receiver is SA-On or SA-Aware.**

> **NOTE: The wide area augmentation system (WAAS) is the designation of the SBAS system available in North America and is the term often used when making reference to SBAS in the United States.**

b. ATC Authorization. It may be necessary for ATC to authorize operations in airspace for which ADS-B Out is required at times when the required performance cannot be met. During interference outages of GNSS (scheduled or unscheduled), the FAA may revert to alternate surveillance, as necessary, for affected areas. ATC will issue a Notice to Airmen (NOTAM) that authorizes such operations and identifies the airspace and time periods that the authorization is in effect. ATC will also issue a NOTAM to authorize performance outages when the FAA-provided preflight availability prediction tool is not available.

c. GPS Performance Prediction. Operators flying aircraft equipped with SBAS (TSO-C145 or TSO-C146) receivers do not need to conduct a preflight availability prediction because the FAA will issue a NOTAM whenever SBAS performance is not adequate. If TSO-C129() or TSO-C196() equipment is used for ADS-B Out, NACp and NIC availability prediction should be performed for the intended route of flight (route and time) using available GPS satellite information.

(1) Prediction Methods. Operators may use any of the following preflight availability prediction methods.

(a) Operators of large fleets of aircraft or users of flight planning programs may wish to use their own preflight availability verification tool. The operator is responsible for selecting a tool that accurately predicts the performance for their aircraft. The tool needs to account for the GPS satellites that are in service at the time of the prediction, and may take into account unique characteristics of the GNSS receiver, aircraft integration or installation; including performance better than required in FAA standards or use of inertial information integrated into the ADS-B Out position source. The FAA does not evaluate or approve a particular tool, but may evaluate the basis of the operator's determination that the tool is appropriate to their aircraft, particularly if its use results in noncompliant flights in airspace where ADS-B Out is required.

(b) Operators may use the FAA-provided preflight availability prediction tool, called the Service Availability Prediction Tool (SAPT) (http://sapt.faa.gov). Refer to the current edition of the SAPT User Guide for specific instructions on its use.

(c) Operators may use a third-party interface, incorporating FAA GPS performance prediction data without altering performance values, to predict NACp/NIC performance outages for the aircraft’s predicted flightpath and times.

(2) Prediction Model Parameters. The operator should use a model appropriate to their equipment, including the type of GPS receiver and the demonstrated capability to track satellites at a given mask angle. When selecting a mask angle, the operator should consider the equipment qualification, installation in the aircraft, and the effects of normal maneuvering. Aircraft are typically qualified with a five degree mask angle, and operational experience has indicated that a two degree mask angle can be achieved by some equipment installations. If using the SAPT, each prediction is valid for the operation within 5 minutes of the plan time and 7.5 NM of the route. The operator may wish to submit additional requests for predictions for varying times around the proposed departure time to ensure compliance at the actual departure time.

(3) Flight Planning Guidance. Predictions can be used for initial flight planning as early as 72 hours prior to the planned departure. However, the operator should conduct a performance prediction as close to departure time as feasible, but with sufficient time to replan the flight or obtain ATC prior approval in the event a segment of the flight will not be compliant. The prediction should be reevaluated prior to flight if a new NOTAM identifies an unscheduled GPS satellite outage.

(4) Resolving Predicted Outages in Performance. Except as provided in the following paragraph, in the event of a predicted loss of performance for any part of the intended flight in the airspace where ADS-B Out is required, the flight must be delayed, canceled, or rerouted to where the requirements can be met.

NOTE: Operators who do not hold FAA Exemption 12555 may request authorization to operate when their ADS-B preflight availability prediction is below the required values using the procedure described in subparagraph 4-3c.

d. NACp and NIC Performance Exemption. Some operators, using TSO-C129-compliant or TSO-C196-compliant GPS receivers for ADS-B Out, may obtain relief under FAA Exemption 12555 through December 31, 2024.

(1) Under the conditions of that exemption, operators with receivers meeting the performance requirements of TSO-C196() may operate in designated airspace for which ADS-B Out is required when the aircraft's NACp and NIC do not meet the performance specified in the rule. For these operations, the operator does not need to conduct any preflight availability prediction.

(2) Operators conducting operations under Exemption 12555 using TSO-C129-approved GPS receivers that do not meet the performance requirements of TSO-C196, TSO-C145, or TSO-C146 may operate in airspace where ADS-B Out is required when the aircraft's NACp and NIC do not meet the performance specified in the rule, when the FAA determines that other surveillance is available. SAPT will indicate if the FAA has determined that surveillance is predicted to be available during a predicted performance outage. This indication will not be applicable as an FAA authorization more than 2 hours before the planned departure time; preflight availability prediction requests submitted more than 2 hours in advance will be provided with an indication of whether the expected conditions will support the operation. Since the FAA must make the determination that alternate surveillance is predicted to be available, the SAPT is the only tool which can provide this capability. Operators may elect to use a combination of preflight availability prediction tools, to leverage a custom tool for normal flight planning and the SAPT for managing predicted outages under Exemption 12555.

NOTE: The FAA may change the criteria used to determine that surveillance is predicted to be available, considering the required ATC services (e.g., en route or terminal secondary surveillance radar, or primary radar).

4-6. FLIGHTCREW ENTRY OF REQUIRED ADS-B DATA. The operator must develop operational procedures 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 ACID 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 an FP. The Mode A code is one element of the transmitted ADS-B message set. Since 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 an FP 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 Flight Identification (FLT ID).

(1) An aircraft's FLT ID, also known as registration number or the operating company designator followed by the flight number (e.g., AAL3342), is transmitted by the ADS-B Out avionics. The FLT ID is comprised of a maximum of seven alphanumeric characters and also corresponds to the ACID annotated on the ATC FP. The FLT ID is typically entered by the flightcrew during preflight through either a flight management system (FMS) interface (control display unit (CDU)) or transponder control panel (CP). The FLT ID for General Aviation (GA) aircraft is associated with the aircraft's registration number. The aircraft owner can preset the FLT ID to the aircraft's registration number (e.g., N235RA), since it is a fixed value, or the pilot can enter it into the ADS-B Out system prior to flight.

(2) Some ATC systems use transmitted FLT IDs to uniquely identify each aircraft within a given airspace and correlate them with a filed FP for the provision of surveillance and separation services. If the FLT ID is not entered correctly, ATC automation systems may not associate surveillance tracks for the aircraft to its filed FP. Therefore, air traffic services may be delayed or unavailable until this is corrected. Consequently, it is imperative that flightcrews and GA pilots ensure the FLT ID entry correctly matches the ACID annotated in the filed ATC FP prior to departure.

(3) 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 (e.g., 7500, 7600, and 7700). The ICAO

Annex 10, Volume IV, Surveillance Radar and Collision Avoidance Systems, 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 may 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. Transponder IDENT Function. 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. PURPOSE. This appendix provides a description of the Automatic Dependent Surveillance-Broadcast (ADS-B) operations outside of U.S.-designated airspace and guidance to operators seeking Federal Aviation Administration (FAA) authorization to conduct ADS-B operations outside of U.S.-designated airspace.

2. BACKGROUND. Countries around the world are implementing ADS-B technology to enhance or extend the surveillance capability of their air traffic control (ATC) systems. A number of these countries have published new rules that will mandate ADS-B equipage on aircraft operating in certain classes of airspace. Other countries have chosen not to mandate ADS-B equipage, but have designated specific routes and airspace to benefit those who equip voluntarily. A certain subset of these countries further requires that foreign operators obtain operational approval from their State of Registry to access ADS-B airspace. Where U.S. aircraft operators are seeking access to foreign ADS-B airspace where State of Registry operational approval is required, FAA has established a process for obtaining such approval.

3. APPLICABILITY. The following identifies just some of the foreign flight information regions (FIR) where U.S. aircraft operators are required by the cognizant State regulator to have ADS-B Out operational approval. It is provided for administrative planning purposes only. Refer to relevant FIR documentation for the most accurate information.

a. Australia. Operations Specification (OpSpec)/Management Specification (MSpec)/Letter of Authorization (LOA) A153, Automatic Dependent Surveillance-Broadcast (ADS-B) Out Operations Outside of U.S.-Designated Airspace, is not required. Approved ADS-B avionics will be required, for all operations at or above flight level (FL) 290. (Refer to the current edition of Australian Civil Aviation Safety Authority (CASA) Advisory Circular (AC) 21-45, Airworthiness Approval of Airborne Automatic Dependent Surveillance-Broadcast Equipment.

b. Canada. OpSpec/MSpec/LOA A153 is not required. Approved ADS-B avionics will be required when an operator seeks operational benefit from ADS-B Out equipage in the airspace defined in NavCanada, Aeronautical Information Publication (AIP) Canada, Part 2—En Route (ENR), Section 1.6.3, Automatic Dependent Surveillance-Broadcast.

c. China (Sanya). Authorization, per OpSpec/MSpec/LOA A153, is required. A153 is required for all U.S. aircraft operators flying over performance-based navigation routes L642 or M771 at or above FL290 within the Sanya FIR.

d. China (Taipei). Authorization, per OpSpec/MSpec/LOA A153, is required. A153 is required for all U.S.-registered aircraft flying over routes B576 or B591 at or above FL290 within the Taipei FIR. For additional information regarding ADS-B operations within the Taipei FIR, refer to Republic of China Civil Aeronautics Administration AIP Supplement (AIP SUP) 08/14, Revision to Automatic Dependent Surveillance-Broadcast (ADS-B) Out Operation Within Taipei FIR.

e. Europe. OpSpec/MSpec/LOA A153 is not required. Surveillance requirements within the European air traffic management network (EATMN) as well as the upcoming implementation dates are provided in Commission Implementing Regulation (EU) No. 1207/2011, amended by Commission Implementing Regulation (EU) No. 1028/2014. However, an amendment to the current regulation has been endorsed, which proposes a change in the existing implementation dates.

f. Fiji. OpSpec/MSpec/LOA A153 is not required. Fiji has mandated ADS-B equipage only for Fiji-registered aircraft operating in controlled airspace. For additional information regarding ADS-B operations, refer to the current editions of the Civil Aviation Authority of the Fiji Islands (CAAFI) Air Navigation Regulations 1981 and Fiji AIC 04/11, Operation of Foreign Registered Aircraft in Fiji.

g. Hong Kong. OpSpec/MSpec/LOA A153 is required. Authorization, per A153, is required for all U.S. aircraft operators flying over performance-based navigation routes L642 or M771 at or above FL290 within the Hong Kong FIR. Additionally, A153 will be required for all U.S. aircraft flying within the entire Hong Kong FIR at or above FL290. For further information regarding ADS-B operations within the Hong Kong FIR, refer to the current edition of the Hong Kong AIP.

h. India. OpSpec/MSpec/LOA A153 is required for ADS-B Out services. ADS-B Out implementation in India is aimed at providing redundancy where radar surveillance is already available. In addition, ADS-B Out enables the expansion of ATC surveillance services in remote and high terrain areas, oceanic airspace, and also to fill any surveillance gaps over continental India. For additional information regarding ADS-B operations, refer to India Aeronautical Information Regulation and Control (AIRAC) AIP SUP 18/2014, Automatic Dependent Surveillance-Broadcast (ADS-B) Out Based ATS Surveillance Services.

i. Republic of Indonesia. OpSpec/MSpec/LOA A153 is not required. Indonesia has established mandatory aircraft fitment of ADS-B avionics equipment for the operation of any aircraft in Indonesian airspace at or above FL290 after the compliance date of December 31, 2017. Until that date, carriage of ADS-B equipment remains voluntary, though ATC will give preference to ADS-B-equipped aircraft in areas of ADS-B Only surveillance coverage. For additional information, refer to Republic of Indonesia AIRAC AIP SUP 08/15, Automatic Dependent Surveillance-Broadcast (ADS-B) Implementation in Indonesia for ATS Surveillance Separation (Tier – 1).

j. Republic of Seychelles. OpSpec/MSpec/LOA A153 is not required. Approved ADS-B Out equipment will be required in all controlled airspace. For additional information regarding ADS-B operations, refer to Republic of Seychelles AIC 02/2014, Mandatory Carriage of GNSS Navigation Equipment, ADS-B and Mode S Transponders in SEYCHELLES Airspace.

k. Singapore. OpSpec/MSpec/LOA A153 is not required. ADS-B is used to provide ATC separation on ATS routes N891, M753, L642, M771, L644, and N892 at FL290 and above within the Singapore FIR. For additional information, refer to the current edition of the Civil Aviation Authority of Singapore (CAAS) AIP.

l. Vietnam. Authorization, per OpSpec/MSpec/LOA A153, is required. A153 is required for all U.S.-registered aircraft flying over ATS routes L625, M771, N892, L642, M765, M768, N500, and L628 at or above FL290 within the Ho Chi Minh FIR. For additional information regarding ADS-B operations within the Ho Chi Minh FIR, refer to Civil Aviation Authority (CAA) of Vietnam AIC 03/13, Implementation of ADS-B within Ho Chi Minh FIR.

m. Additional Regions. As additional regions are implementing ADS-B, U.S. aircraft operators are advised to monitor the regions applicable to their operation for any changes related to ADS-B requirements and to comply with Title 14 of the Code of Federal Regulations (14 CFR) part 91, § 91.703. Normally, these types of advisories are transmitted through State AIPs and/or AICs.

4. AUTHORIZATION TO CONDUCT ADS-B OPERATIONS OUTSIDE OF U.S.-DESIGNATED AIRSPACE WHERE STATE OF REGISTRY OPERATIONAL APPROVAL IS REQUIRED. FAA authorization is required for all U.S. aircraft operators seeking access to foreign ADS-B airspace where State of Registry operational approval is required. This appendix provides guidance to operators on the process and documentation required when requesting issuance of this authorization.

NOTE: For FAA authorization, refer to FAA Order 8900.1, Flight Standards Information Management System (FSIMS), Volume 3, Chapter 18, Section 3, OpSpec/MSpec/LOA A153.

a. Initial Request for Authorization. U.S. aircraft operators seeking to conduct ADS-B Out operations outside of U.S.-designated airspace need to first contact their assigned FAA office to indicate their intent. At the time of the operator's initial request, the FAA will provide the operator with an OpSpec/MSpec/LOA A153 Application Checklist (found in the A153 guidance section of the Web-based Operations Safety System (WebOPSS) or at http://www.faa.gov/nextgen/programs/adsb/ under Quick Links), which must be completed and included with attached support documents when submitting a formal request for authorization.

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. The operator must submit a letter of request for issuance of authorization to the assigned PI. The letter of request should include the following information:

(a) Type of aircraft (make, model, and series (M/M/S)).

(b) Airplane registration number(s) and serial number(s).

(c) Areas of intended operation.

NOTE: The guidance contained in subparagraph 4b of this appendix will also be annotated on the OpSpec/MSpec/LOA A153 Application Checklist provided to the operator by the applicable FAA field office.

(2) Airplane Flight Manual (AFM) Compliance Documentation. The operator will provide a copy of the AFM, Aircraft/Airplane Flight Manual Supplement (AFMS), Airplane Operations Manual (AOM), or pilot's operating handbook (POH), as appropriate, which states that the aircraft's ADS-B Out system complies with any of the following:

(a) Section 91.227.

(b) The current edition of AC 20-165, Airworthiness Approval of Automatic Dependent Surveillance Broadcast (ADS-B) Out Systems.

(c) 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, (until rescinded) or Certification Specifications and Acceptable Means of Compliance for Airborne Communications, Navigation and Surveillance (CS-ACNS).

NOTE: The following is an example of an AFM statement for an ADS-B system that complies with § 91.227: "The installed ADS-B Out system has been shown to meet the equipment requirements of 14 CFR § 91.227."

NOTE: ADS-B Out systems approved per previous versions of AC 20-165 must have any variances, with subsequent revisions of that guidance, resolved through the FAA/manufacturer issue paper process. Such systems do not require revision of existing AFM, AFMS, AOM, POH, Flight Operations Manual (FOM), or equivalent AC 20-165 compliance statements.

NOTE: The requirements in this appendix meet all of the operational, training, and maintenance considerations of AMC 20-24.

(3) Proposed Operations Area. A copy of OpSpec/MSpec B050, Authorized Areas of En Route Operation, Limitations, and Provisions, annotating the authorized en route areas where OpSpec/MSpec/LOA A153 will be used (not applicable to part 91 operators).

(4) Part 91 Operators. A statement that the operator's pilots have knowledge of current air traffic ADS-B directives for the intended areas of en route operation and will comply with § 91.703.

(5) OpSpec/MSpec/LOA A153. A copy of the completed OpSpec/MSpec/LOA A153, as applicable.

NOTE: The local Flight Standards Service (AFS) field office will conduct a review of the applicant's submitted proposal using the OpSpec/MSpec/LOA A153 Application Checklist. When compliance with all applicable requirements has been demonstrated, the PI will issue A153.

APPENDIX 2. ADS-B IN-TRAIL PROCEDURE

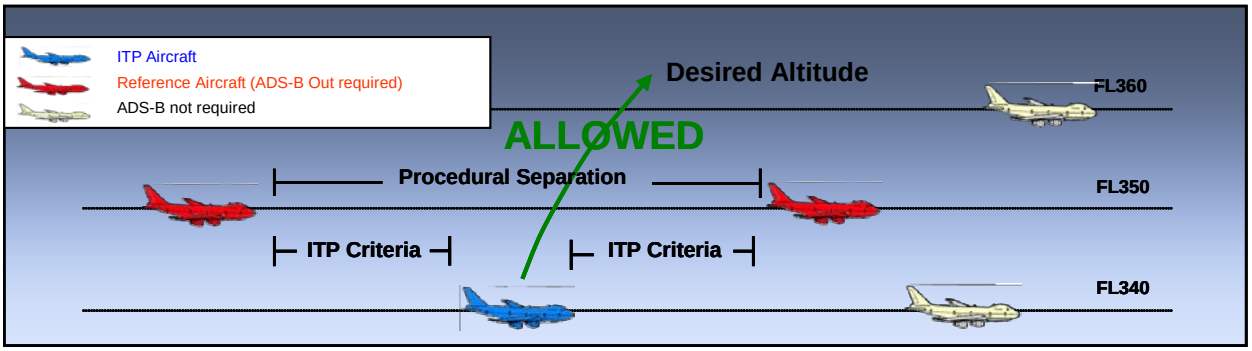
1. PURPOSE. This appendix provides a description of the Automatic Dependent Surveillance-Broadcast (ADS-B)-enabled In-Trail Procedure (ITP) and guidance to operators seeking Federal Aviation Administration (FAA) authorization to conduct ITP operations.

2. BACKGROUND. The ITP is designed primarily for use in nonradar oceanic airspace to enable appropriately equipped ADS-B In aircraft to perform flight level (FL) changes previously unavailable with procedural separation minima applied. The improved traffic information available to ADS-B In-equipped aircraft allows ITP maneuvers to occur safely with reduced separation minima applied. ITP will enable flightcrews to execute FL changes to improve ride comfort, avoid weather, or obtain more favorable winds to improve fuel economy and arrival times.

a. ITP Scenario. Appendix 2, Figure A2-1, Reduction of Aircraft Separation Minima with In-Trail Procedure, illustrates a basic ITP scenario. The ITP aircraft (blue) wishes to climb from FL340 to 360 between two reference aircraft (red) where procedural separation minima is applied. Using onboard ADS-B In and ITP equipment, the ITP aircraft can determine if the necessary criteria can be met and, if so, request air traffic control (ATC) approval to execute the desired FL change using reduced separation minima between the two reference aircraft.

b. ATC Responsibility. ATC maintains separation responsibility throughout the ITP maneuver, and resumes the appropriate separation minima at its completion. The reduced ITP separation may only be applied between a qualified ITP aircraft and no more than two reference aircraft for the duration of the maneuver. Reference aircraft do not require ADS-B In equipment and are only required to be transmitting an ADS-B Out signal of sufficient quality.

FIGURE A2-1. REDUCTION OF AIRCRAFT SEPARATION MINIMA WITH IN-TRAIL PROCEDURE



3. ITP TERMINOLOGY.

a. Closing Groundspeed (GS) Differential. The difference between the ITP aircraft's GS and a reference aircraft's GS that results in a reduction of the ITP distance.

b. Closing Mach Speed Differential. The difference in Mach speed between the ITP aircraft and the reference aircraft that results in a reduction of the ITP distance.

c. ITP Aircraft. An aircraft operated by a flightcrew authorized to conduct an ITP.

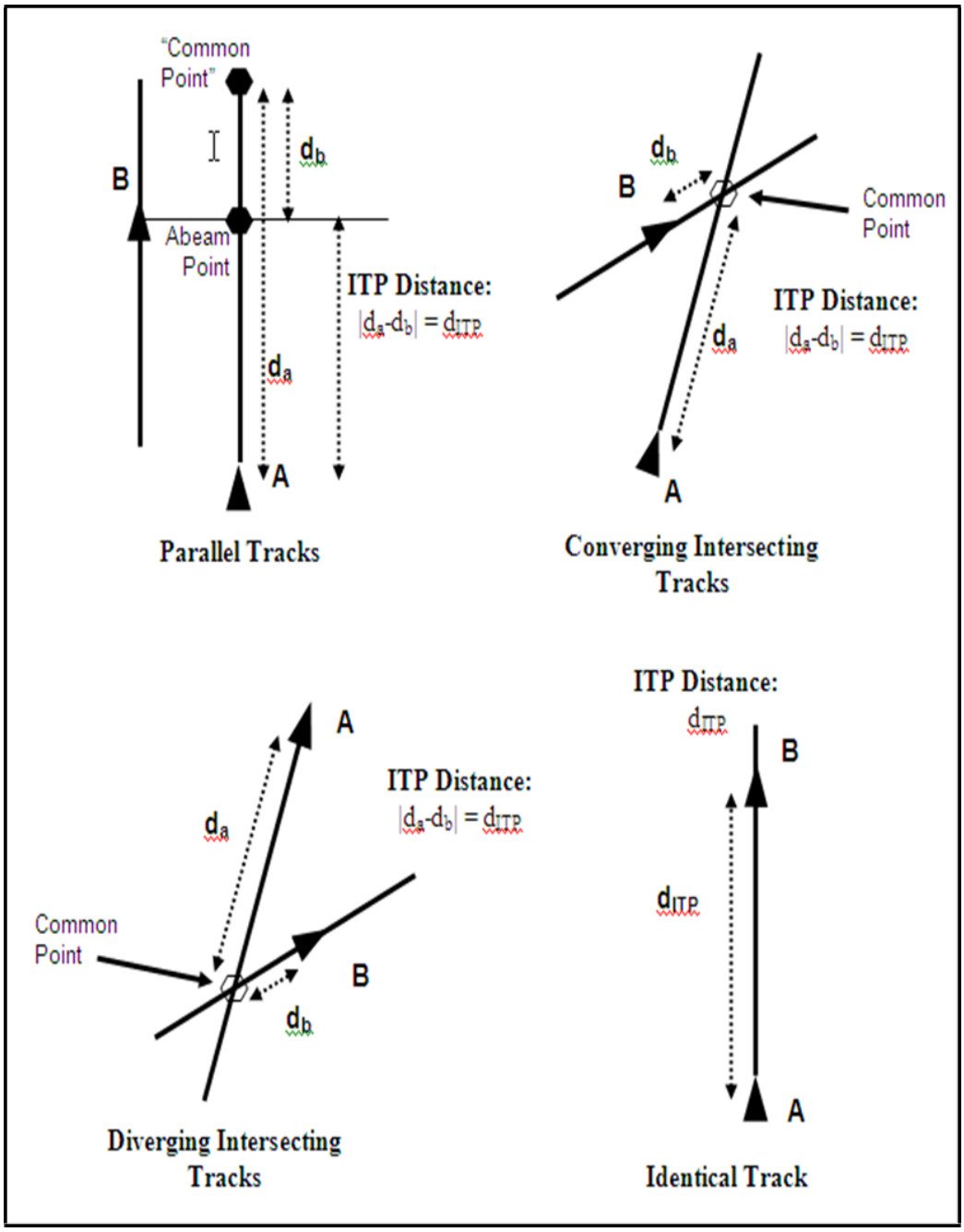
d. ITP Criteria. A set of conditions that must be satisfied prior to initiating or executing an ITP clearance.

e. ITP Distance. The distance between the ITP aircraft and reference aircraft as defined by the difference in distance to an aircraft calculated common point along a projection of each aircraft's track in front of or behind the aircraft, as appropriate. (See Appendix 2, Figure A2-2, In-Trail Procedure Distances Illustrated.) For the case where aircraft are on parallel tracks, the ITP distance is measured along the track of one of the aircraft using its calculated position and the point abeam the calculated position of the other aircraft. This measurement technique is similar to the method described in the International Civil Aviation Organization (ICAO) Doc 4444, Procedures for Air Navigation Services—Air Traffic Management (PANS-ATM), section 5.4.2.6.4.

f. ITP Equipment. The onboard avionics required to support an ITP.

g. Reference Aircraft. Aircraft (no more than two) transmitting valid ADS-B data that meet specified criteria and are referenced as part of an ITP clearance request to ATC.

FIGURE A2-2. IN-TRAIL PROCEDURE DISTANCES ILLUSTRATED



4. ITP CONCEPT. The ITP concept is based on the aircraft satisfying specific initial conditions and the flightcrew promptly and correctly executing the requested procedure once approved. The initial conditions are the ITP speed/distance criteria, the relative altitude criteria, the similar track criteria, and the closing Mach differential, as well as the accuracy and integrity of the ADS-B data transmitted from participating aircraft. (See Appendix 2, Table A2-1, In-Trail Procedure Initiation/Maneuver Criteria (Reference RTCA DO-312).) The procedure further requires that the ITP aircraft maintain constant Mach and climb or descend at a minimum of 300 feet per minute (fpm) during the maneuver. With these criteria, an ITP aircraft should never

come closer than the 10-nautical-mile (NM) separation minimum to a reference aircraft while passing through their altitude(s).

a. ITP Distance and GS Differential Criteria. The initial distance criteria values, 15 NM and 20 NM, were selected so that when an FL change at 300 fpm and constant Mach number is maintained with the respective maximum 20 or 30-knot (kts) closing GS differential, the distance between the aircraft should not become less than the ITP minimum separation of 10 NM.

b. Relative Altitude Criteria. The reference aircraft may not be more than 2,000 feet above or below the ITP aircraft.

c. Similar Track Criteria. The ITP aircraft and any reference aircraft must be on similar tracks. Similar tracks are defined here as less than 45 degrees from one another. (See Appendix 2, Figure A2-3, Similar Track.)

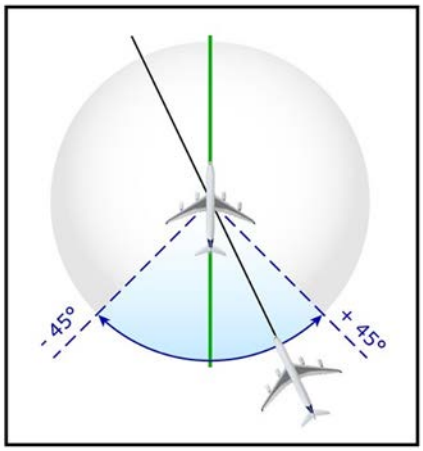
d. Mach Differential. In order to ensure an acceptable closure throughout the ITP maneuver, the controller may not issue an ITP clearance if the closing Mach differential is greater than 0.06 Mach. This Mach differential check accounts for potentially unsafe closure rates due to abnormal or adverse wind gradient conditions at the intermediate altitudes. The Mach number check may be achieved by:

- Using the cruise Mach numbers of the ITP and reference aircraft where the Mach number technique is being used;
- Requesting Mach numbers from the ITP and reference aircraft; or
- Any other methodology determined appropriate and acceptable by the regulatory authority and the air navigation service provider (ANSP).

e. ADS-B Data Quality Criteria. Only ADS-B Out aircraft broadcasting data of sufficient quality may be used as reference aircraft for ITP. Own-ship data quality must also be sufficient to ensure safe separation. The data quality criteria are:

- Position accuracy for ITP and reference aircraft—ITP and reference aircraft data with horizontal position accuracies of at least 0.5 NM (95 percent);
- Position integrity for ITP and reference aircraft—ITP and reference aircraft data with horizontal position integrity bounds of 1.0 NM at 1x10E-05; and
- Velocity accuracy for ITP and reference aircraft—ITP and reference aircraft data with horizontal velocity accuracies of at least 10 meters/second (m/s) (19.4 kts), 95 percent.

FIGURE A2-3. SIMILAR TRACK



5. ITP DESCRIPTION. To properly conduct an ITP, a qualified flightcrew must use ADS-B In avionics specifically certified to assist in verifying the initial conditions and a graphical display to monitor the relative position(s) of nearby aircraft. The procedure will only be conducted in airspace with appropriately trained ATC personnel, ITP compatible automation, and approved ITP separation minima available. The following are the steps necessary to conduct an ITP:

a. Flightcrew Verifies Initial Criteria. Using approved avionics, the ITP flightcrew verifies that their own-ship and the reference aircraft meet initial qualifying criteria. The onboard ITP avionics will indicate to the flightcrew whether all initiation criteria are satisfied.

b. Flightcrew Requests ITP. If the criteria are satisfied, the flightcrew requests the ITP clearance using the appropriate phraseology. Direct Controller Pilot Communication (DCPC) is required; currently, only Controller-Pilot Data Link Communication (CPDLC) is being used in locations where ITP are approved. Preformatted messages for requesting and approving ITP have not yet been developed. Flightcrews must use standardized free text messages as described in Appendix 2, Table A2-2, Flightcrew Standardized Free Text Controller-Pilot Data Link Communication Message Set for In-Trail Procedure, and Table A2-3, Controller Free Text Controller-Pilot Data Link Communication Message Set for In-Trail Procedure, until further notice. It is essential that the correct message elements be included in the correct format to allow the controller or automation system to properly evaluate the request. Improperly formatted or incomplete requests may be unnecessarily denied.

NOTE: ATC must not issue an ITP clearance to any aircraft unless that aircraft has initiated the request.

c. Controller Issues Clearance. Upon receipt of an ITP request, the controller:

(1) Confirms the ITP aircraft and the reference aircraft are on the same track.

(a) Same-track criteria are not the same as the similar-track criteria, which are checked by the ITP aircraft flightcrew.

(b) Same-track includes the concept of similar-track (i.e., ITP aircraft and reference aircraft are traveling in the same direction with less than a 45-degree relative track angle between the aircraft), but also includes a check on whether or not the lateral protection areas overlap (e.g., lateral separation cannot be applied). This check can only be done by the controller who knows what separation standard is being applied between the aircraft.

(2) Confirms that no more than two reference aircraft have been identified in the request and are identified correctly; that is, that the Aircraft Identification (ACID) of each reference aircraft in the ITP request exactly matches the corresponding aircraft's filed flight plan (FP).

(3) Ensures both the ITP aircraft and reference aircraft are not maneuvering and not expected to maneuver during the ITP.

NOTE: A change of course (only) to remain on the same route would not be considered a maneuver, provided the course change is less than 45 degrees and the aircraft remain in a same track configuration.

(4) Verifies that the closing Mach differential is no greater than 0.06 Mach.

(5) Verifies that there are no conflicts at the requested altitude.

(6) If appropriate, issues an ITP clearance.

d. Flightcrew Reassesses Criteria. Upon receiving the ITP clearance, the flightcrew confirms that all criteria are still satisfied. If the criteria are not satisfied or there has been a loss of traffic information, the flightcrew must immediately reject the ATC clearance and terminate the maneuver. Additionally, if the FL, reference aircraft, or type of maneuver (ITP versus standard FL change) does not exactly match their request or if the flightcrew receives an ITP clearance without requesting one, they must not perform the maneuver and should verify with ATC to confirm the clearance.

e. Flightcrew Executes ITP. If the criteria are still met, the flightcrew accepts the clearance and begins the requested climb or descent without delay. While executing the maneuver, the flightcrew is expected to maintain their flight-planned route, assigned Mach number (or current Mach, if none is assigned), and minimum Vertical Speed (VS) of 300 fpm and ensure they execute only the maneuver for which they have been cleared. The maneuver is complete once the flightcrew reports to ATC that they have reached the new FL.

NOTE: Once the ITP maneuver has been initiated, it must be completed. Should reference aircraft data be lost or ITP display fail during the maneuver, the flightcrew should continue the maneuver to the assigned altitude using the appropriate Mach number and 300 fpm minimum VS. Upon completion of the maneuver, notify ATC of the ITP data loss.

f. Approved ITP Variations. An ITP can be conducted with a maximum of two reference aircraft. The reference aircraft may not be more than 2,000 feet of altitude above or below the ITP aircraft, but there is no limit on the amount of altitude change the ITP aircraft

may request. The reference aircraft both may be behind or ahead of the ITP aircraft or one may be ahead and one behind. Appendix 2, Figure A2-4, In-Trail Procedure Climb/Descent Variations, depicts the approved ITP variations.

g. Contingency Procedures. The ITP maneuver has been extensively tested both in flight and in computer simulations with consideration given to a variety of environmental and aircraft performance factors. A temporary breach of the 10-NM ITP distance does not constitute an inherently unsafe procedure and should not be the sole factor when considering abandoning the procedure. No new contingency procedures are prescribed for ITP. If, in the pilot's judgment, the ITP maneuver (i.e., reaching the newly assigned altitude) cannot be successfully completed once the climb or descent has been initiated, he or she shall:

(1) Contact ATC and request an alternative clearance as soon as practicable given flightcrew workload and flight conditions.

(2) Inform ATC of any action the flightcrew is taking or requesting. Because of the many variables, the CPDLC message should be in the "free text" format.

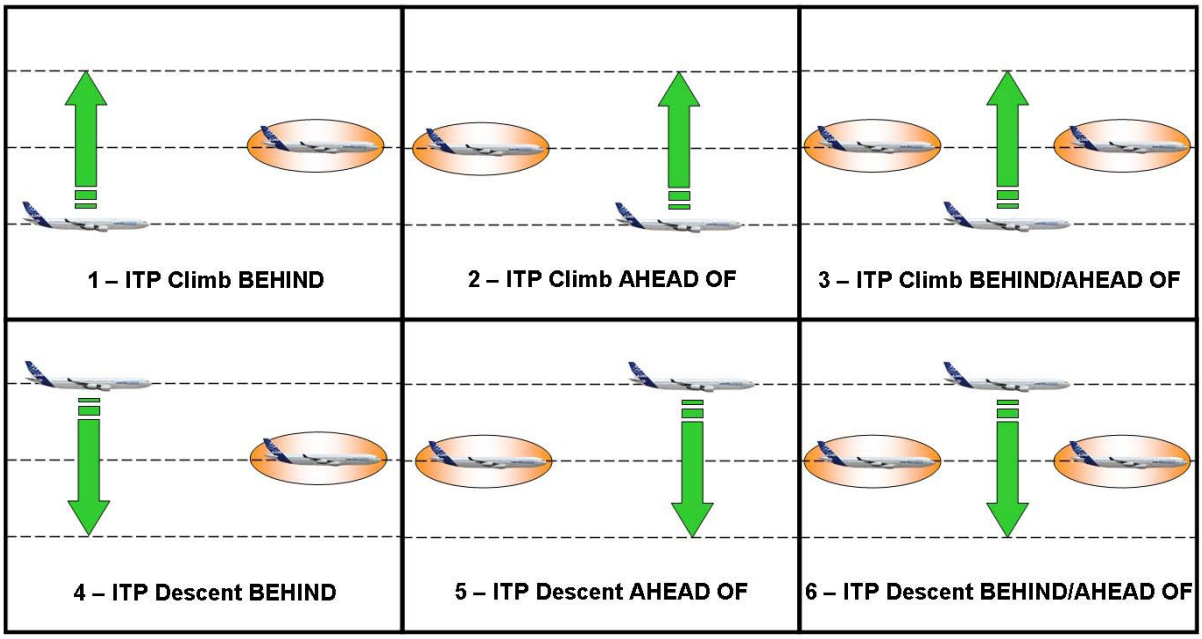
(3) Comply with regional contingency procedures appropriate to the circumstances, or as listed in ICAO Doc 4444, Procedures for Air Navigation Services—Air Traffic Management (PANS-ATM), section 15.2.

h. ITP Distance. Except when one aircraft is directly in trail of another, the ITP distance is not the same as the direct line distance between those two aircraft. (See paragraph 3, ITP Terminology, for the exact description, and Appendix 2, Figure A2-2, for examples.) Since the ITP software will be designed to calculate and display ITP distance information, extensive training on the subject is not necessary. However, it is important to emphasize that range and ITP distance are different. Consequently, a lack of understanding could lead the flightcrew to misidentify the correct reference aircraft(s) when requesting an ITP clearance. Training should include examples of the various ITP distance geometries depicted in Figure A2-2.

(1) Lateral Traffic Filters. Some ITP avionics incorporate a lateral traffic filter. The function of the traffic filter is to eliminate any targets beyond a predetermined lateral distance of own-ship's track from consideration as a potential reference aircraft. This is intended to prevent the flightcrew from misidentifying incorrect reference aircraft during their ITP request. The filter is most useful when in an organized track environment or where traffic may be on a parallel user-preferred route. Incorrect use may result in unnecessarily denied ITP requests. Training should include recommended technique for its use.

(2) ITP Initiation Criteria. Traffic displayed as an ADS-B In target may not be made available as a valid ITP reference aircraft because it does not meet one or more ITP initiation criteria. Some of the criteria, such as position accuracy, are not displayed to the flightcrew. Training should include a discussion of the initiation criteria, which criteria are known to the flightcrew, and examples of when a displayed ADS-B In target is not an eligible ITP reference aircraft. See Appendix 2, Table A2-1, for ITP initiation criteria.

FIGURE A2-4. IN-TRAIL PROCEDURE CLIMB/DESCENT VARIATIONS



6. AUTHORIZATION TO CONDUCT ITP. FAA authorization is required for all U.S. aircraft operators to conduct ITP operations using ADS-B In. This appendix provides guidance to operators on the process and documentation required when requesting issuance of this authorization.

> **NOTE: For FAA authorization, refer to FAA Order 8900.1, Flight Standards Information Management System (FSIMS), Volume 3, Chapter 18, Section 3, Operations Specification (OpSpec)/Management Specification (MSpec)/Letter of Authorization (LOA) A354, Automatic Dependent Surveillance-Broadcast (ADS-B) In-Trail Procedure (ITP).**

> **NOTE: Operators may already hold other ADS-B In authorizations. There is no need to submit documentation for ITP requirements that duplicate specific requirements for previous ADS-B In authorizations. The ITP application may include references to those duplicate requirements instead.**

a. Initial Request for Authorization. U.S. aircraft operators seeking to conduct ITP must first contact their assigned FAA office to indicate their intent. At the time of the operator's initial request, the FAA will provide the operator with an ITP Application Checklist, which must be completed with attached supporting documents.

b. Required Documentation for Submission of Formal Proposal.

(1) Documentation Guidance. The following section provides general guidance on the documentation required for submission of a formal ITP proposal. At the discretion of the operator's assigned principal inspector (PI), additional information may be required based on any unique aspects of their specific operation. The operator must submit a letter of request for

issuance of authorization to the assigned PI. The letter of request should include the following information:

(a) Type of aircraft (make, model, and series (M/M/S)).

(b) ADS-B equipment complies with Technical Standard Order (TSO)-C195a, Avionics Supporting Automatic Dependent Surveillance-Broadcast (ADS-B) Aircraft Surveillance Applications (ASA), or later, or as approved for ITP by the Administrator.

(c) Installation complies with the current edition of Advisory Circular (AC) 20-172, Airworthiness Approval for ADS-B In Systems and Applications.

(d) Manufacturer's name of the ADS-B In software.

(e) Proposed region(s) of operation (not applicable to Title 14 of the Code of Federal Regulations (14 CFR) part 91 operations).

NOTE: The guidance contained in subparagraph 6b of this appendix will also be annotated on the ITP Using ADS-B In Application Checklist provided to the operator by the applicable FAA field office.

(2) Airplane Flight Manual (AFM) Compliance Documentation. Operators must submit documentation that demonstrates that their aircraft have an ADS-B In system that meets the performance standards of TSO-C195a or later, or as approved for ITP by the Administrator.

(3) Proposed Operations Area. Authorizations to conduct ITP will be limited to specific regions of the world where the ANSP offers ITP and those procedures are determined to be acceptable to the Administrator. Routes or airspace where ITP may be authorized will be published in Aeronautical Information Publications (AIP). Include in your request a description, by flight information region (FIR) and ANSP, of the operational areas where you propose to conduct ITP. If the operator holds an OpSpec/MSpec B050 authorization, a draft B050 paragraph that includes the operational areas where you propose to conduct ITP, including applicable notes, must be submitted.

(4) Operational Procedures. As applicable, company manuals must address any ITP-specific requirements of the proposed region(s) of operation.

(5) Operation Manuals and Checklists. The certificate holder/operator/program manager (as applicable) must submit information (e.g., Airplane Operations Manual (AOM) bulletin or equivalent) to the flightcrews describing ADS-B to include:

- ITP system description;
- Normal procedures;
- En route procedures using ITP;
- Communications; and
- Non-normal or contingency procedures.

(6) Maintenance Requirements. See Appendix 4 for applicable maintenance requirements.

(7) Revision of Minimum Equipment List (MEL). See Appendix 4 for applicable MEL requirements.

(8) Pilot Training. Submit applicable portions of proposed ITP-specific pilot training material and include a description of the methods used to conduct, evaluate, and manage the training. The following contains the recommended information to be included in pilot training material:

(a) General understanding of ADS-B In operations (i.e., technology, capabilities, and limitations).

(b) ITP system operation, including:

- Normal procedures;
- Non-normal and/or contingency procedures;
- ITP flight planning considerations;
- ITP dispatch considerations (as applicable);
- MEL considerations (as applicable);
- ITP terminology, including proper formulation of a CPDLC ITP request/clearance; and
- ITP equipment limitations.

(c) Explanation of ITP distance as distinct from aircraft range, using select scenario-based examples (see Appendix 2, Figure A2-2, for ITP distance geometries).

- ITP directly in trail of a reference aircraft;
- ITP aircraft on a crossing track of reference aircraft—diverging;
- ITP aircraft on a crossing track of reference aircraft—converging; and
- ITP aircraft on a parallel track of reference aircraft.

(9) Dispatch/Flight Follower Training. Submit applicable portions of proposed ITP-specific dispatch/flight planning training material to include any appropriate updates to the dispatch operations manual, or equivalent, as well as a description of the methods used to conduct, evaluate, and manage training. The following contains the recommended information to be included in dispatch/flight planning training material:

- General understanding of ADS-B In operations;
- Dispatch of aircraft with the ITP system unserviceable;
- How flight planning codes are affected with ADS-B unserviceable;
- Flight planning, fuel loading, and route change procedures associated with ITP operations;
- Equipment requirements; and
- Approved ITP routes and airspace.

NOTE: Dispatch/flight follower training is not required for part 91 operations. However, as the pilot is responsible for flight planning, the pilot should consider these items prior to flight.

TABLE A2-1. IN-TRAIL PROCEDURE INITIATION/MANEUVER CRITERIA (REFERENCE RTCA DO-312)

In-Trail Procedure (ITP) Speed/Distance Criteria	ITP Distance ≥ 15 nautical miles (NM) and Closing Groundspeed (GS) Differential ≤ 20 knots (kts) ITP Distance ≥ 20 NM and Closing GS Differential ≤ 30 kts
Relative Altitude Criteria	Difference in altitude between the ITP and Reference Aircraft is less than or equal to 2,000 feet
Similar Track Criteria	Difference in track angles between ITP and Reference Aircraft less than ± 45 degrees
Position Accuracy for ITP and Reference Aircraft	ITP and Reference Aircraft data with horizontal position accuracies of at least 0.5 NM (95%)
Position Integrity for ITP and Reference Aircraft	ITP and Reference Aircraft data with horizontal position integrity bounds of 1.0 NM at 1x10E-05
Velocity Accuracy for ITP and Reference Aircraft	ITP and Reference Aircraft data with horizontal velocity accuracies of at least 10 meters/second (m/s) (19.4 kts) 95%
Closing Mach Differential (Air Traffic Control (ATC) Crosscheck)	Closing Mach Differential equal or less than 0.06 Mach

TABLE A2-2. FLIGHTCREW STANDARDIZED FREE TEXT CONTROLLER-PILOT DATA LINK COMMUNICATION MESSAGE SET FOR IN-TRAIL PROCEDURE

In-Trail Procedure (ITP) Type (number and relative position of reference aircraft)	FREE TEXT Message Element Content
1 reference aircraft (ahead)	"ITP [Distance] BEHIND [Aircraft FLT ID]"
1 reference aircraft (behind)	"ITP [Distance] AHEAD OF [Aircraft FLT ID]"
2 reference aircraft (both ahead)	"ITP [Distance] BEHIND [Aircraft FLT ID] AND [Distance] BEHIND [Aircraft FLT ID]"
2 reference aircraft (both behind)	"ITP [Distance] AHEAD OF [Aircraft FLT ID] AND [Distance] AHEAD OF [Aircraft FLT ID]"
2 reference aircraft (one ahead and one behind)	"ITP [Distance] BEHIND [Aircraft FLT ID] AND [Distance] AHEAD OF [Aircraft FLT ID]"

To request an ITP climb or descent, the flightcrew will send a Controller-Pilot Data Link Communication (CPDLC) REQUEST CLIMB TO [altitude] or REQUEST DESCENT TO [altitude] message, as applicable, with the following verbiage added to FREE TEXT as listed in Table A2-2.

Example of ITP request message: REQUEST CLIMB TO FL360 ITP 25 NM BEHIND SIA228 AND 21 NM AHEAD OF AFR008.

NOTE: This standardized free text message set will be used until an appropriate message set is implemented.

TABLE A2-3. CONTROLLER FREE TEXT CONTROLLER-PILOT DATA LINK COMMUNICATION MESSAGE SET FOR IN-TRAIL PROCEDURE

In-Trail Procedure (ITP) Type (number and relative position of reference aircraft)	FREE TEXT Message Element Content
1 reference aircraft (ahead)	"ITP BEHIND [Aircraft FLT ID]"
1 reference aircraft (behind)	"ITP AHEAD OF [Aircraft FLT ID]"
2 reference aircraft (both ahead)	"ITP BEHIND [Aircraft FLT ID] AND BEHIND [Aircraft FLT ID]"
2 reference aircraft (both behind)	"ITP AHEAD OF [Aircraft FLT ID] AND AHEAD OF [Aircraft FLT ID]"
2 reference aircraft (one ahead and one behind)	"ITP BEHIND [Aircraft FLT ID] AND AHEAD OF [Aircraft FLT ID]"

To grant an ITP request, the controller will send an uplink message containing CLIMB TO AND MAINTAIN [altitude] or DESCEND TO AND MAINTAIN [altitude] containing the text in Table A2-3:

Example of ITP clearance message: ITP BEHIND SIA228 AND AHEAD OF AFR008 CLIMB TO FL360 REPORT LEVEL FL360.

NOTE: The controller should never issue an ITP clearance unless one has been requested by a flightcrew.

NOTE: This standardized free text message set will be used until an appropriate message set is implemented.

APPENDIX 3. CAVS USING ADS-B IN

1. PURPOSE. This appendix describes Cockpit Display of Traffic Information (CDTI) Assisted Visual Separation (CAVS) and provides guidance to operators seeking Federal Aviation Administration (FAA) authorization to conduct CAVS operations.

2. BACKGROUND. When a flightcrew accepts responsibility to maintain visual separation from another aircraft, they must maintain constant visual surveillance of that aircraft and notify air traffic control (ATC) if they can no longer do so. Additionally, the flightcrew accepts the responsibility for wake turbulence separation from that aircraft. Though the weather must be visual meteorological conditions (VMC), other environmental conditions may prevent them from maintaining constant visual surveillance of the traffic, such as when the traffic is landing toward a rising or setting sun. Additionally, distances and closure rate to an aircraft directly ahead can be difficult to judge, such that managing spacing and avoiding wake turbulence can be difficult.

3. CAVS CONCEPT. CAVS is an Automatic Dependent Surveillance-Broadcast (ADS-B) In application that assists the flightcrew in maintaining separation from ADS-B Out-equipped aircraft during visual separation. Currently, CAVS may only be used during the approach phase of flight when cleared by ATC to maintain visual separation from specific traffic. Because of the accuracy and integrity of displayed traffic on ADS-B In systems approved for CAVS, CAVS information may be used as a substitute for continuous visual observation of traffic-to-follow (TTF) under specified conditions. CAVS does not relieve the pilot of the responsibility to see and avoid other aircraft. ATC maintains separation responsibility from all other aircraft and for the orderly flow of traffic to the runway. Currently, there is no new phraseology associated with CAVS and approved for the use of CAVS. ATC will be unaware that a flightcrew is using CAVS. CDTI traffic information does not replace any traffic advisories (TA) and/or Resolution Advisories (RA) provided by the aircraft's Traffic Alert and Collision Avoidance System (TCAS). RA response must be based on the TCAS display and approved procedures.

4. CAVS ARRIVALS. Traffic information from the CDTI is used to augment out-the-window (OTW) visual contact with an aircraft a flightcrew is assigned to follow. This will enable them to accept separation responsibility from that aircraft. Once the flightcrew has visually acquired and accepted a visual approach clearance behind TTF, the pilot may use the lead aircraft traffic information on the CDTI as a means for maintaining separation while performing a visual approach. As done today with a visual approach clearance, no specific spacing assignments will be made by ATC. The procedure can be conducted behind all aircraft weight categories.

5. CAVS DESCRIPTION. Flightcrews are reminded that CAVS is a visual separation procedure. If at any time the traffic information provided by CAVS equipment becomes unreliable, inoperative, or distracting, its use should be discontinued immediately.

NOTE: Although aircraft call signs are displayed on the CDTI, flightcrews should not use the call sign or Aircraft Identification (ACID) (Flight Identification (FLT ID)) of observed traffic in radio communications, as this could create confusion for both ATC and flightcrews monitoring the frequency.

NOTE: Flightcrews are not relieved of their duty to see and avoid.

NOTE: CAVS is currently restricted to maintaining visual separation from aircraft approaching the same landing runway.

a. CAVS Alerting. Installations compliant with Technical Standard Order (TSO)-C195b, Avionics Supporting Automatic Dependent Surveillance-Broadcast (ADS-B) Aircraft Surveillance Applications (ASA), incorporate two alerting features: a caution level minimum range alert and an advisory level selectable range indication.

(1) The selectable range indication alert is used to advise the flightcrew at the range when they are no longer authorized to use the CAVS equipment as a substitute for OTW visual observation of the TTF. The range indication is set in accordance with individual established company procedures and is intended to assist the flightcrew in maintaining a safe distance from the TTF.

(2) The caution level minimum range alert is activated when the range to the TTF is less than 1.4 NM or, in some installations, when the CAVS system detects a predetermined excessive closure to the TTF. This alert cannot be modified by the flightcrew and indicates that, due to uncertainty in the ADS-B positions at such close ranges, the CDTI cannot safely be used to determine the position of the TTF.

b. Normal Procedures. CAVS normal procedures are as follows:

(1) ATC points out TTF to flightcrew of CAVS-equipped aircraft.

(2) The CAVS flightcrew visually locates the traffic OTW and reports this to ATC.

(3) ATC issues a clearance to “maintain visual separation” from the TTF.

(4) If the TTF is broadcasting usable ADS-B Out information, the CAVS flightcrew correlates the TTF as seen OTW, with the traffic symbol of the TTF aircraft displayed on their aircraft’s CDTI and any information provided via ADS-B.

(5) Once the flightcrew has correctly correlated the TTF on the CDTI, they designate the TTF target on the CDTI and the avionics displays the distance and groundspeed (GS) differential between TTF and own-ship. If CAVS is equipped with a selectable range indication alert, the flightcrew may set it in accordance with company procedures if it has not already been set.

(6) Aided by this information, the CAVS flightcrew can more easily maintain visual contact with the TTF and more precisely manage their spacing and closure.

(7) The CAVS aircraft must maintain VMC at all times. However, if the flightcrew should lose OTW contact with the TTF, the approach may continue using the CDTI (and ADS-B Guidance Display (AGD), if one is required) to maintain visual separation using the CAVS information alone.

(8) If the distance between the two aircraft becomes less than the operator's authorized selectable range indication value, the flightcrew may no longer use the CAVS information as a substitute for OTW visual observation of TTF. If closer than the operator's authorized selectable range indication value, the flightcrew must have visual contact OTW or notify ATC that they have lost visual contact and proceed accordingly.

c. Maneuver Termination. CAVS is intended to assist the flightcrew in maintaining visual separation. The loss of CAVS information does not itself require discontinuing visual separation, provided OTW visual contact with the TTF and safe separation can be maintained. Discontinue using CAVS as a substitute for OTW visual contact under any of the following conditions:

(1) The flightcrew is unable to maintain VMC.

(2) AGD (if installed) fails and OTW visual contact cannot be maintained.

(3) AGD (if installed) information conflicts with the CDTI information to the extent that it becomes a distraction, is confusing to the pilots, or it raises a concern about the safety of the procedure.

(4) Sustained loss of ADS-B data quality and/or integrity as indicated to the pilot via the displays.

(5) The caution level minimum range alert is activated.

(6) If the flightcrew is unable to maintain a safe interval for any reason, they must immediately advise ATC and request further clearance.

6. CAVS SYSTEM REQUIREMENTS. CAVS aircraft must have an installed ADS-B In system that meets the standards of TSO-C195b, Avionics Supporting Automatic Dependent Surveillance-Broadcast (ADS-B) Aircraft Surveillance Applications (ASA), or a system approved by the Administrator intended for use in CAVS. For guidance on the installation of CAVS equipment, refer to the current editions of Advisory Circular (AC) 20-165, Airworthiness Approval of Automatic Dependent Surveillance-Broadcast (ADS-B) Out Systems, and AC 20-172, Airworthiness Approval for ADS-B In Systems and Applications.

7. AUTHORIZATION TO CONDUCT CAVS. FAA authorization is required for all U.S. aircraft operators to conduct CAVS operations using ADS-B In. This appendix provides guidance to operators on the process and documentation required when requesting issuance of this authorization.

NOTE: For FAA authorization, refer to FAA Order 8900.1, Flight Standards Information Management System (FSIMS), Volume 3,

Chapter 18, Section 3, Operations Specification (OpSpec)/Management Specification (MSpec)/Letter of Authorization (LOA) A355, Automatic Dependent Surveillance-Broadcast (ADS-B) In Operations.

NOTE: Operators may already hold other ADS-B In authorizations. There is no need to submit documentation for CAVS requirements that duplicate specific requirements for previous ADS-B In authorizations. The CAVS application may include references to those duplicate requirements instead.

a. Initial Request for Authorization. U.S. aircraft operators seeking to conduct CAVS must first contact their assigned FAA office to indicate their intent. At the time of the operator's initial request, the FAA will provide the operator with a CAVS Application Checklist, which must be completed with attached supporting documents.

b. Required Documentation for Submission of Formal Request.

(1) Documentation Guidance. This section describes the documentation required for submission of a formal CAVS proposal. The operator's assigned principal inspector (PI) may require additional information based on any unique aspects of their specific operation. The operator must submit a letter of request for issuance of authorization to the assigned PI. The letter of request should include the following information:

(a) Type of aircraft (make, model, and series (M/M/S)).

(b) List of aircraft registration numbers (N-number) associated with the request for authorization.

(c) ADS-B equipment complies with TSO-C195b, or as approved for CAVS by the Administrator.

(d) Installation complies with guidance contained in AC 20-165 and AC 20-172.

(e) Name of the ADS-B In (CAVS) software manufacturer and applicable software version(s).

(2) Airplane Flight Manual (AFM) Compliance Documentation. Operators must submit documentation that demonstrates applicable aircraft have an ADS-B In system that meets the performance standards of TSO-C195b, or as otherwise approved by the Administrator, for CAVS operations.

(3) Operation Manuals and Checklists. The certificate holder/operator/program manager (as applicable) must submit information (e.g., Airplane Operations Manual (AOM) bulletin or equivalent) to the flightcrews describing ADS-B to include:

- CAVS system description;
- Normal procedures; and
- Non-normal or contingency procedures.

(4) Maintenance Requirements. See Appendix 4, ADS-B In Operations—Aircraft Qualification and Maintenance Requirements, for applicable maintenance requirements.

(5) Revision of Minimum Equipment List (MEL). See Appendix 4 for applicable MEL requirements.

(6) Pilot Training. Submit applicable portions of proposed CAVS-specific pilot training material and include a description of the methods used to conduct, evaluate, and manage the training. The CAVS pilot training should include:

(a) ADS-B Out/In system overview (if not previously addressed with another ADS-B application).

(b) ADS-B CAVS system operations.

(c) CAVS normal procedures:

1. Visual separation procedures.

2. Speed management.

3. Assessing closure rates.

4. Wake turbulence avoidance.

5. Weather minimums.

6. Use of and response to the selectable CAVS range alert.

7. Crew coordination during CAVS.

(d) CAVS MEL procedures (as applicable).

(e) CAVS equipment limitations.

(f) CDTI interface.

(g) Contingency procedures.

APPENDIX 4. ADS-B IN OPERATIONS—AIRCRAFT QUALIFICATION AND MAINTENANCE REQUIREMENTS

1. PURPOSE. This appendix provides guidance on aircraft qualification, maintenance, and maintenance personnel training requirements associated with authorization of Automatic Dependent Surveillance-Broadcast (ADS-B) In operations.

2. APPLICABILITY. ADS-B In aircraft qualification and maintenance requirements apply to operations conducted under Title 14 of the Code of Federal Regulations (14 CFR) parts 91, 91K, 121, 125 (including Letter of Deviation Authority (LODA) (125M)), 129, and 135. Part 91 operators (excluding part 91K operators) should comply with the guidance contained in this appendix, as required by applicable regulations. Operators conducting operations under parts 91K, 121, 125 (including LODA (125M)), 129, and 135 should address all aspects of the guidance contained in this appendix when submitting requests for authorization of ADS-B In operations.

3. AIRCRAFT QUALIFICATION REQUIREMENTS.

a. ADS-B In systems must meet the standards of the appropriate Technical Standard Order (TSO)-C195, Avionics Supporting Automatic Dependent Surveillance-Broadcast (ADS-B) Aircraft Surveillance Applications (ASA), for authorization. Guidance on the installation of ADS-B Out equipment can be found in the current edition of Advisory Circular (AC) 20-165, Airworthiness Approval of Automatic Dependent Surveillance-Broadcast (ADS-B) Out Systems. Guidance on the installation of ADS-B In systems can be found in the current edition of AC 20-172, Airworthiness Approval for ADS-B In Systems and Applications.

b. Applications submitted to the Federal Aviation Administration (FAA) for authorization to conduct ADS-B In operations should contain the following documentation to demonstrate aircraft qualification:

(1) Applicable ADS-B In airworthiness documentation in the form of an aircraft type certificate (TC), amended TC, or Supplemental Type Certificate (STC).

(2) ADS-B In avionics manufacturer’s instructions for continued airworthiness (ICA), as accepted by the FAA.

(3) Proposed minimum equipment list (MEL) revisions, if applicable, listing all limitations and procedures associated with the dispatch of aircraft with the ADS-B In system inoperative.

4. MAINTENANCE REQUIREMENTS.

a. Maintenance of ADS-B In systems should comply with the guidance contained in this section and applicable airworthiness regulations. Maintenance personnel should be familiar with the operator’s ADS-B In system maintenance procedures, their individual responsibilities with respect to those procedures, and the availability of any resources within or outside of the maintenance organization necessary to ensure the continued airworthiness of the ADS-B In system.

b. Applications submitted for authorization to conduct ADS-B In operations under parts 91, 91K, 121, 125 (including LODA (125M)), 129, and 135 should include documentation that demonstrates compliance with the following, as applicable:

(1) The General Maintenance Manual (GMM) must incorporate the ADS-B In manufacturer's ICA, as accepted by the FAA, and identify any special techniques, maintenance/inspection frequencies, and test equipment required to support the continued airworthiness of the system.

(2) Indicate whether ADS-B In system maintenance is integrated into an existing approved maintenance program or is a separate program.

(3) Identify the GMM revision and update procedures, if not previously approved.

(4) Identify how maintenance personnel will be trained on the ADS-B In system and the method to record and maintain any associated qualifications.

(5) Procedures for ADS-B In software installation, updates, evaluations, tests, and configuration control.

(6) Procedures used to make modifications, additions, and changes to the ADS-B In system.

(7) Procedures for ADS-B In discrepancy reporting and recording.

(8) MEL and logbook procedures for deferral of the ADS-B In system or components of the system.

(9) Notification procedures between maintenance control, engineering, flight operations, and dispatch (or equivalent) when the ADS-B In system is deferred.

(10) Procedures to monitor and identify ADS-B In-equipped aircraft with chronic discrepancies and restrict the aircraft from ADS-B In operations until appropriate corrective action and verification tests have been performed.

(11) Procedures for return to service of the ADS-B In system following routine/nonroutine maintenance or completion of corrective action on an aircraft flagged for chronic discrepancies, including:

- Required tests for return to service;
- Functional flight test requirements; and
- Component mount or rack removal/installation.

(12) Integration of ADS-B In maintenance into existing quality control (QC) and quality assurance (QA) programs, as applicable.

5. MAINTENANCE PERSONNEL TRAINING.

a. General. This paragraph contains guidance on maintenance personnel training requirements associated with ADS-B In operations. Operators should address these requirements, as applicable, in proposals submitted to the FAA for authorization to conduct ADS-B In operations.

b. Maintenance Training Requirements. Maintenance personnel should be knowledgeable of the guidance contained in this AC and applicable regulations. Operator and contract maintenance personnel, including mechanics, maintenance controllers, avionics technicians, and inspection/QA personnel should receive initial and recurrent training (as necessary) to establish and maintain an effective ADS-B In maintenance program.

c. Application Submissions. Applications submitted for authorization to conduct ADS-B In operations should address the following:

(1) Identify the person(s) responsible for ensuring ADS-B In maintenance and inspection personnel are properly trained, knowledgeable, and current in accordance with the GMM.

(2) Identify how the ADS-B In training will be conducted (i.e., in-house or outside training provider).

(3) Include policy and procedures that address any qualification requirements for ADS-B In maintenance and inspection personnel.

(4) Identify the methods and techniques used to conduct initial and recurrent training (e.g., instructor-led training (ILT), computer-based training (CBT), and on-the-job training (OJT)).

(5) Identify the procedures used to record and maintain initial and recurrent ADS-B In training and qualifications.

(6) Include maintenance and inspection training curriculum that addresses the following ADS-B In topics:

- Operational overview;
- Aircraft system overview;
- Maintenance and inspection procedures;
- Personnel training qualification requirements (as applicable);
- MEL procedures;
- Test equipment and use (as applicable); and
- Return to service test procedures.

APPENDIX 5. DEFINITIONS

The terms have the following meaning when used in this advisory circular (AC):

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

b. Automatic Dependent Surveillance-Broadcast (ADS-B) Airspace. The airspace specified in Title 14 of the Code of Federal Regulations (14 CFR) part 91, § 91.225.

c. Automatic Dependent Surveillance-Broadcast (ADS-B) Guidance Display (AGD). The AGD provides digital readouts and alerts of time-sensitive information located on the Cockpit Display of Traffic Information (CDTI). This is used primarily for installations where the CDTI is not installed in the forward field of view (FOV).

d. Automatic Dependent Surveillance-Broadcast (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 Services-Broadcast (TIS-B)).

e. Automatic Dependent Surveillance-Broadcast (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. 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.

g. Cockpit Display of Traffic Information (CDTI). This is a generic display that provides the flightcrew with surveillance information about other aircraft, including position. Traffic information may be obtained from one or multiple sources, including ADS-B, Traffic Alert and Collision Avoidance System (TCAS), and TIS-B. The display of information may be hosted on an Electronic Flight Bag (EFB) or the aircraft's integrated avionics suite.

h. Cockpit Display of Traffic Information (CDTI) Assisted Visual Separation (CAVS). CAVS is an ADS-B In application that assists the flightcrew in maintaining visual separation from ADS-B Out-equipped aircraft.

i. 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.

j. Flight Information Service-Broadcast (FIS-B). FIS-B is a ground broadcast service provided over the 978 MHz frequency Universal Access Transceiver (UAT) data link. The Federal Aviation Administration (FAA) FIS-B system provides pilots and flightcrews of

properly equipped aircraft (ADS-B In) with a cockpit display of certain aviation weather and aeronautical information for advisory-only use.

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

l. 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.

m. 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 current edition of the GPS Standard Positioning System (SPS) Performance Standard.

n. 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.

o. International Civil Aviation Organization (ICAO) 24-Bit Address (Mode S Code). Address (octal format) assigned to each aircraft transponder or ADS-B transmitter during registration or change of registration. The correct address is required to be transmitted by both the installed transponder(s) and the ADS-B Out system (1090ES/UAT). For aircraft equipped with Mode S transponders, their replies to TCAS to enable proper operation of TCAS avionics and ATC ground systems interrogations and their ADS-B transmissions should use the same 24-bit address, allowing correlations by Airborne Surveillance and Separation Assurance Processing (ASSAP).

p. In-Trail Procedures (ITP). ITP are designed primarily for use in nonradar oceanic airspace to enable appropriately equipped ADS-B In aircraft to perform flight level (FL) changes previously unavailable with procedural separation minima applied.

q. 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 (FP) with surveillance data.

r. 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.

s. 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.

t. 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.

u. 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 sensors, require the aircraft under surveillance to carry a transponder.

v. Statement of Compliance. The statement of compliance is a manufacturer-generated document that states the ADS-B equipment, when installed in accordance with the installation instructions, complies with all requirements of § 91.227, and with the performance requirements of the appropriate TSO.

w. 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.

x. Traffic Information Services-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.

y. 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.

z. 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.

aa. Visual Meteorological Conditions (VMC). Weather conditions in which pilots have sufficient visibility to fly the aircraft while maintaining visual separation from terrain and other aircraft. The exact requirements vary by class of airspace (e.g., Class B airspace – 3 statute miles (sm) visibility, clear of clouds).

APPENDIX 6. RELATED REGULATIONS AND READING MATERIAL

1. RELATED TITLE 14 OF THE CODE OF FEDERAL REGULATIONS (14 CFR) PARTS. You can find the Code of Federal Regulations (CFR) online at http://www.ecfr.gov.

a. Part 1, § 1.1, General Definitions.

b. Part 21, § 21.50, Instructions for Continued Airworthiness and Manufacturer's Maintenance Manuals Having Airworthiness Limitations Sections.

c. Part 61, Certification: Pilots, Flight Instructors, and Ground Instructors.

d. 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 (refer to Registry Identification Number (RIN) 2120-AI92);
- Section 91.227, Automatic Dependent Surveillance-Broadcast (ADS-B) Out Equipment Performance Requirements (refer to RIN 2120-AI92); and
- Subpart K (Part 91K), Fractional Ownership Operations.

e. Part 121, Operating Requirements: Domestic, Flag, and Supplemental Operations.

f. 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.

g. Part 133, Rotorcraft External-Load Operations.

h. Part 135, Operating Requirements: Commuter and On Demand Operations and Rules Governing Persons On Board Such Aircraft.

i. Part 137, Agricultural Aircraft Operations.

2. RELATED READING MATERIAL (current editions).

- You can find this and other advisory circulars (AC) on the Federal Aviation Administration (FAA) Web site at 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.

(1) AC 20-165, Airworthiness Approval of Automatic Dependent Surveillance-Broadcast (ADS-B) Out Systems.

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

(3) Order 8900.1, Volume 3, Chapter 18, Section 3, Operations Specification (OpSpec)/Management Specification (MSpec)/Letter of Authorization (LOA) A153, Automatic Dependent Surveillance-Broadcast (ADS-B) Out Operations Outside of U.S.-Designated Airspace.

(4) Order 8900.1, Volume 3, Chapter 18, Section 3, OpSpec/MSpec/LOA A354, Automatic Dependent Surveillance-Broadcast (ADS-B) In-Trail Procedure (ITP).

(5) Aeronautical Information Manual (AIM), paragraphs 4-5-7 through 4-5-10.

b. FAA TSOs (edition listed below or later).

(1) TSO-C112d, Air Traffic Control Radar Beacon System/Mode Select (ATCRBS/Mode S) Airborne Equipment.

(2) TSO-C129a, Airborne Supplemental Navigation Equipment Using the Global Positioning System (GPS).

(3) TSO-C145c, Airborne Navigation Sensors Using the Global Positioning System Augmented by the Satellite Based Augmentation System.

(4) TSO-C146c, 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-C157a, Aircraft Flight Information Services-Broadcast (FIS-B) Data Link Systems and Equipment.

(7) 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).

(8) TSO-C195, Avionics Supporting Automatic Dependent Surveillance-Broadcast (ADS-B) Aircraft Surveillance Applications (ASA).

(9) TSO-C196a, Airborne Supplemental Navigation Sensors for Global Positioning System Equipment Using Aircraft Based Augmentation.

c. RTCA, Inc. Documents.

(1) RTCA DO-260B, Minimum Operational Performance Standards for 1090 MHz Extended Squitter Automatic Dependent Surveillance-Broadcast (ADS-B) and Traffic Information Services-Broadcast (TIS-B).

(2) Supplement to RTCA DO-312, Safety, Performance and Interoperability Requirements Document for the In-Trail Procedure in Oceanic Airspace (ATSA-ITP) Application.

(3) RTCA DO-317B, Minimum Operational Performance Standards (MOPS) for Aircraft Surveillance Applications (ASA) System.

3. INTERNATIONAL PUBLICATIONS (current editions).

a. Asia-Pacific.

(1) Civil Aviation Authority of Singapore (CAAS) Aeronautical Information Publication (AIP).

(2) Hong Kong AIP.

(3) Republic of China Civil Aeronautics Administration AIP Supplement (AIP SUP) 08/14, Revision to Automatic Dependent Surveillance Broadcast (ADS-B) Out Operation Within Taipei FIR.

(4) Civil Aviation Authority (CAA) of Vietnam AIC 03/13, Implementation of Automatic Dependent Surveillance Broadcast (ADS-B) within Ho Chi Minh FIR.

(5) India Aeronautical Information Regulation and Control (AIRAC) AIP SUP 18/2014 Automatic Dependent Surveillance-Broadcast (ADS-B) Out Based ATS Surveillance Services.

(6) Republic of Indonesia AIRAC AIP SUP 08/15, Automatic Dependent Surveillance-Broadcast (ADS-B) Implementation in Indonesia for ATS Surveillance Separation (Tier – 1).

(7) Republic of Seychelles AIC 02/2014, Mandatory Carriage of GNSS Navigation Equipment, ADS-B and Mode S Transponders in SEYCHELLES Airspace.

b. Australia.

(1) Civil Aviation Safety Authority (CASA) AC 21-45, Airworthiness Approval of Airborne Automatic Dependent Surveillance-Broadcast Equipment.

(2) CASA Civil Aviation Order (CAO) 20.18, Aircraft Equipment—Basic Operational Requirements.

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

c. Canada: NavCanada, AIP Canada, Part 2—En Route (ENR), Section 1.6.3, Automatic Dependent Surveillance-Broadcast.

d. Europe.

(1) 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.

(2) EASA Certification Specifications and Acceptable Means of Compliance for Airborne Communications, Navigation and Surveillance (CS-ACNS).

Advisory Circular Feedback Form

If you find an error in this AC, have recommendations for improving it, or have suggestions for new items/subjects to be added, you may let us know by contacting the Flight Technologies and Procedures Division (AFS-400) or the Flight Standards Directives Management Officer.

Subject: AC 90-114A CHG 1, Automatic Dependent Surveillance Broadcast Operations

Date: _____

Please check all appropriate line items:

☐ An error (procedural or typographical) has been noted in paragraph _____ on page _____.

☐ Recommend paragraph _____ on page _____ be changed as follows:

_____

_____

☐ In a future change to this AC, please cover the following subject:
(Briefly describe what you want added.)

_____

_____

☐ Other comments:

_____

_____

☐ I would like to discuss the above. Please contact me.

Submitted by:_____ Date:_____