

TECHNICAL PAPER

AFS-360-2017-1

(Rev 0, 09/25/2017)

INSTALLATION OF ADS-B OUT EQUIPMENT

1. Purpose

The purpose of this Technical Paper is to explain the Federal Aviation Administration's (FAA) policy regarding alterations to aircraft for the installation of Automatic Dependent Surveillance-Broadcast (ADS-B) equipment. This policy applies to aircraft certificated under Title 14, Code of Federal Regulations (14 CFR) § 23, 25, 27, 29, and their predecessor regulations. This Technical Paper provides policy pursuant to compliance with 14 CFR § 91.225 and § 91.227. Reference [FAA Policy Memorandum dated March 2, 2016 \(or later revision\)](#).

FAA Policy Memorandum dated March 2, 2016 provides policy for follow-on installation approval of ADS-B OUT systems previously approved via Supplemental Type Certificate (STC) including minor deviations to the STC installation data as well as the accompanying Approved Flight Manual Supplements. STCs that are applicable to the aircraft make and model are outside the scope of FAA Policy Memorandum dated March 2, 2016 as well as this Technical Paper.

14 CFR § 91.225 and § 91.227 are effective beginning January 1st, 2020 and require installation of equipment meeting the performance requirements of TSO-C166b or TSO-C154c.

2. How can the ADS-B OUT system obtain initial approval?

Initial ADS-B OUT system pairings (ADS-B OUT transmitter/position source) must be approved for installation using the Type Certificate (TC), amended TC (ATC), or Supplemental Type Certificate (STC) process. Consult your Aircraft Certification Office (ACO) to determine the appropriate approval process for initial ADS-B pairings. Once the performance of the initial pairing has been established and approved, data from that approval can be used for follow-on installations without further FAA approval.

Organization Designation Authorization (ODA) holders can issue ATCs and STCs when authorized by their FAA Organization Management Team (OMT).

If an STC is available that provides for the installation of a specific ADS-B OUT transmitter and position source, the FAA strongly encourages installers and owners to utilize that data. Written permission is required from the STC holder to use applicable data per 14 CFR § 91.403.

Note: The Global Navigation Satellite System (GNSS), and Global Positioning System (GPS), are referred to as "position source" or "position sensor" in this document.

3. After initial equipment pairing approval, can applicable ADS-B OUT systems be installed on aircraft not covered by that approval?

Yes, per FAA Policy Memorandum, *Installation Approval for ADS-B OUT Systems*, dated March 2, 2016, equipment pairings that have previously received FAA approval and meet all of the following conditions may be installed and approved for return to service on other aircraft without further data approval when:

- a. The ADS-B OUT equipment is manufactured to meet the performance requirements of TSO-C154c or TSO-C166b;
- b. The position sensor is manufactured under TSO-C129 (or later revision), TSO-C145a/C146a (or later revision), or TSO-C196 (or later revision);
- c. The installer has a statement of compliance from the applicable manufacturer(s) or STC holder that the equipment (with self-contained position sensor), or specific equipment pairing (ADS-B OUT transmitter and position sensor) have been shown via TC, ATC, or STC to comply with all 14 CFR § 91.227 requirements. This statement of compliance may be included in the applicable installation instructions. The installation instructions must address how the equipment is to be installed and maintained to comply with not only the applicable TSOs but also 14 CFR § 91.227 requirements.

Note: The requirement for using previously approved data and ADS-B OUT system component pairings is intended to expedite installations and/or field approvals by minimizing the need for ACO support. On systems with configurable transmit and receive ports, it is acceptable to use different pin locations for this connection as long as the ports are configured identically to those associated with the previously approved system installations. If there are any differences in pin locations, those differences are to be clearly documented on FAA Form 337.

- d. The installer has documentation from the STC holder(s) (per 14 CFR § 91.403(d)) that indicates the owner/operator of the aircraft has permission to use the STC data for the alteration.
- e. The ADS-B OUT equipment, position sensor, and interconnect wiring are connected in accordance with the applicable manufacturer's STC installation instructions. In addition, when installers use this installation method, they should consider electrical/wiring installation guidance and practices from the aircraft manufacturer, the equipment manufacturer(s), and FAA AC 43.13-1B (as revised).
- f. The installation is performed in accordance with documentation from the manufacturer(s) or STC holder indicating what configuration settings, if applicable, are to be used for the ADS-B OUT system to meet 14 CFR § 91.227 requirements which include, but may not be limited to:

- (1) FAA assigned Mode S/International Civil Aviation Organization (ICAO) code address associated with current aircraft registration when returned to service;

Note: The FAA has observed numerous installations of ADS-B OUT equipment that broadcast incorrect ICAO codes. Extra care should be taken to ensure that newly installed systems are configured correctly and verified with appropriate ground test equipment.

(2) Emitter Category;

Note: A high number of ADS-B OUT installations have been completed with an improper Emitter Category code. Configuration of an ADS-B OUT system with respect to the Emitter Category should be appropriate for the aircraft and in accordance with the following table:

Emitter Category	Description
No Emitter Category	Do not use this emitter category. If no emitter category fits your installation, seek guidance from the FAA as appropriate.
Light Airplane < 15,500 lbs	Any airplane with a maximum takeoff weight less than 15,500 pounds. This includes very light aircraft (light-sport aircraft) that do not meet the requirements of 14 CFR 103.1.
Small Airplane ≥ 15,500 to < 75,000 lbs	Any airplane with a maximum takeoff weight greater than or equal to 15,500 pounds but less than 75,000 pounds.
Large Airplane ≥ 75,000 to < 300,000 lbs	Any airplane with a maximum takeoff weight greater than or equal to 75,000 pounds but less than 300,000 pounds that does not qualify for the high vortex category.
Large Airplane With High Vortex	Any airplane with a maximum takeoff weight greater than or equal to 75,000 pounds but less than 300,000 pounds that has been determined to generate a high wake vortex. Currently, the Boeing 757 is the only example.
Heavy ≥ 300,000 lbs	Any airplane with a maximum takeoff weight equal to or above 300,000 pounds.
High Performance > 5 G and > 400 TAS	Any airplane, regardless of weight, that can maneuver in excess of 5 G's and maintain true airspeed above 400 knots.
Rotorcraft	Any rotorcraft, regardless of weight.

- (3) Source Integrity Level (SIL);
- (4) System Design Assurance (SDA);
- (5) Flight Identification (e.g., N-number); and
- (6) Position sensor settings required to correctly communicate with the ADS-B OUT equipment.

Note: Reference AC 20-165 (as revised), Chapter 3, for definitions of the above broadcast elements.

g. The system installation complies with the regulatory requirements of 14 CFR § 43. Installers may consult FAA Advisory Circulars 43.13-2B (as revised) for acceptable methods, techniques, and practices for aircraft alterations in addition to the equipment manufacturer's installation instructions.

4. Can ADS-B OUT system installations be accomplished if they do not meet the requirements for installation without further data approval?

Yes, an ADS-B OUT system that fails to meet the requirements for installation without further data approval (as discussed earlier in this document) may still be pursued. FAA Policy Memorandum dated March 2, 2016 provides information to obtain installation data approvals as well as airplane or rotorcraft flight manual supplement (AFMS/RFMS) information.

Minor deviations that are deemed approved through the FAA Policy Memorandum dated March 2, 2016 are aircraft make and model changes, equipment installation locations, wire routing and attachments, and other deviations included in the STC holder's installation manuals. Major deviations are those deviations that are not included in the installation manual, or might affect structural strength, equipment performance, or other qualities affecting airworthiness such as electrical load exceedances. Installers should consult Attachment 1 to this document, ADS-B OUT Alteration Flow Chart for guidance in determining the appropriate approval requirements.

Major deviations to the elements of the system installation that require separate approval(s) must be completed using data approved through an appropriate means (see FAA Order 8300.16 (as revised) Major Repair and Alteration Data Approval). If an installation is being accomplished through the use of STC data, but major deviations to the STC installation data are required, then a field approval may be requested to obtain data approval.

Note: ADS-B OUT installations involving airframe structural alterations may require evaluation with respect to fatigue and damage tolerance criteria. Installers of ADS-B OUT systems must take into account the effects of damage tolerance for airframes type certificated under 14 CFR § 23, 25, 27, and 29.

When the installer chooses to not follow an existing STC installation, an additional method for ADS-B OUT system installations may also be completed through the field approval process in accordance with FAA Order 8300.16 (as revised), and AC 43-210 (as revised).

Document the entire ADS-B OUT system installation along with the additional major alteration elements per 14 CFR § 43.9. Complete FAA Form 337 including block 8 to record the alteration. Reference Attachment 5 of this Technical Paper for an example of Form 337 block 8 with recommended content for an ADS-B OUT system installation.

In cases where an ADS-B OUT system is installed without need for further data approval, Form 337 may be executed without FAA signature in Block 3. Forward the completed FAA Form 337 to the Aircraft Registration Branch, AFS-750, P.O. box 25504, Oklahoma City, Oklahoma 73125. The installer should also include the information contained in

block 3 of the example Form 337, attachment 4 of this document.

Note: Installations completed without Block 3 signature on Form 337 may delay or prevent the future sale and export of the aircraft to certain foreign states.

In addition to, or in lieu of the field approval process, an installer may also consider utilizing the services of a Designated Engineering Representative (DER) with the appropriate authorization(s), an Organizational Designation Authorization (ODA) with major repair alteration (MRA) function, or a Designated Airworthiness Representative (DAR) with function code 51 (authorization to perform field approvals). These designees can support elements of an ADS-B OUT system installation that require separate approval. Reference FAA Order 8300.16 (as revised) for further information.

5. Is it acceptable to use previously installed equipment to complete an ADS-B OUT system installation without requiring further data approval?

Yes, if the existing equipment meets requirements specified in AC 20-165 (as revised) and was installed in a manner acceptable to the Administrator. It should be noted that both Universal Access Transceivers (UAT) and 1090ES Transponders are considered ADS-B OUT transmitters. In cases where existing equipment has been installed appropriately, it may be used as part of an ADS-B OUT system. For example, if a TSO-compliant GPS was previously installed in an aircraft it may be used as the position source to support ADS-B OUT functionality if it meets the criteria defined in AC 20-165 (as revised). The installer must ensure that the position source and ADS-B OUT transmitter were previously approved as a pair under a TC/ATC/STC or other acceptable method.

6. Is it acceptable to substitute parts in an ADS-B OUT system installation?

The primary requirement for ADS-B OUT final installations (when not directly using an STC applicable to the make/model of aircraft with no deviations), is that the position source and the ADS-B transmitter pairing have FAA approval under a TC/ATC/STC or other accepted approval method. Equipment that is desired for use that is not specifically identified as approved under a TC/ATC/STC, such as a remote/blind encoder, may be used when FAA approval is sought using alternate approval methods such as the field approval process, DER, or ODA.

7. Is it possible to upgrade components in an existing ADS-B OUT system installation?

Yes, it is possible to upgrade components in an existing ADS-B OUT system installation under the following conditions:

- a. ADS-B OUT equipment installed in an aircraft under the TC or ATC process may be upgraded in accordance with the instructions provided in a manufacturer's service bulletin or comparable method that retains an appropriate approval under the aircraft

TC.

- b. In cases where an ADS-B OUT installation was completed under an STC that directly applies to the make/model aircraft (this includes AML STCs), the part number of the upgraded component must be identified in the applicable STC data. Any applicable instructions provided by the STC must be followed (i.e., ground testing or flight evaluation, etc.) to verify regulatory compliance to §91.227 for the upgraded system.
- c. In cases where the ADS-B OUT installation was completed under an approved pairing basis from a non-applicable STC, the component that is proposed for upgrade (specifically a position source and/or an ADS-B OUT transmitter) must have a pairing approval (by part number) through the TC/ATC/STC or other acceptable process. The person installing the upgraded component must seek FAA approval of evidence of the approved pairing of the equipment. The installer should document the FAA approval source on Form 337 or obtain FAA approval if needed
- d. ADS-B OUT system upgrades should be documented on Form 337 when appropriate.

The ability to replace and/or upgrade components may be made available by equipment manufacturers such as “plug and play” upgrades. Aircraft owners and installing persons must ensure that appropriate evaluation and approval is sought in these situations. These types of component upgrades are not preventive maintenance actions, and must be completed by appropriately certificated personnel.

8. Can components within an existing approved ADS-B OUT system be replaced by new part number components?

Yes. When new part number components (self-contained units or standalone transmitter/position source systems) are considered for installation on aircraft with an existing ADS-B OUT system, it's the responsibility of the installer to verify that FAA approval has been provided per Section 2 of this document. Once FAA approval has been verified, the installation can be accomplished with data approval if applicable (e.g., STC, AML) or otherwise by using guidance contained in Section 3 of this document. Any alteration to a previously approved ADS-B OUT system will be documented on FAA Form 337 and submitted for retention in the aircraft's permanent airworthiness records. In addition, it's the responsibility of the installer to evaluate other considerations in the component replacement such as instructions for continued airworthiness and flight manual supplement requirements as well as the recommended approval for return to service process as described in this document.

9. Can STC data approved for a specific category of aircraft (e.g., part 23, 25, 27, 29, etc) be used to support installations on other category aircraft?

STC data developed for an ADS-B OUT system installation is designed to a specific airworthiness standard (i.e. 14 CFR § 23/25/27/29). The STC development process substantiates many different design requirements regarding the specific airworthiness

standard applicable to the respective category of aircraft. FAA Order 8300.16, par. 4-2 (e) 3 states that data approved for alteration purposes for a particular airworthiness standard (i.e., part 25 transport category aircraft) may be used to provide substantiation for a similar alteration on a different product type (i.e. part 23 aircraft). Typically, data that meets a more stringent airworthiness standard is normally acceptable. The same does not hold true when applying data derived from a less stringent airworthiness standard to an alteration on an aircraft which possesses a more stringent airworthiness standard. While this practice is not specifically prohibited, installers should be aware that choosing this path will be more challenging and time consuming due to the additional requirements involved. The installer of an ADS-B OUT system is responsible for ensuring that all of the design requirements for the type/category of the aircraft being altered are evaluated when using approved data derived from a different category of aircraft (e.g., part 23 data applied to a part 25 aircraft installation).

10. Does installation of ADS-B OUT systems require revision of the flight manual?

Initial approval of ADS-B OUT systems requires that any operating limitation, normal operating procedures and system description (as required) be provided as supplemental information in the applicable flight manual. The supplemental information or flight manual supplement associated with initial approvals are submitted and approved by the appropriate ACO (or designee) as part of the certification data package.

ADS-B OUT system installations in aircraft that are applying an STC (or an STC with an approved model list (AML)) that are directly applicable to the make and model of aircraft, are outside of the scope of FAA Policy Memorandum dated March 2, 2016 and should be installed as normal STC policy and guidance support. No further guidance is necessary when using an STC that is directly applicable.

Note: The term airplane flight manual supplement (AFMS) hereon applies to both fixed wing aircraft and rotorcraft.

In cases where an ADS-B OUT system installation occurs that is based on an equipment pairing approved under an STC that is not directly applicable to the make and model of an aircraft being altered, a revised AFMS must be developed to provide supplemental information regarding the system and aircraft make and model. A revised AFMS based on an STC AFMS with minor deviations are considered approved per FAA Policy Memorandum dated March 2, 2016; deviations to the AFMS that exceed minor deviations require approval per FAA Order 8300.16 (as revised).

Minor deviations to the base STC AFMS are changes to the equipment/switch locations or operating procedures. Major deviations to the base STC AFMS are changes that affect the aircraft operating limitations.

Note: Installing persons are encouraged to reference FAA Order 8300.16, Chapter 6 (as revised) and FAA AC 20-165 Chapter 2 (as revised) for additional guidance regarding

flight manual supplement development requirements and considerations. In addition, installers may consult FAA AC 23-8 (as revised), AC 25.1581-1 (as revised), AC 27-1 (as revised), and AC 29-2 (as revised) respectively for the particular category of aircraft being altered.

a. For installations not based on STC data the installer must provide an AFMS appropriate for the aircraft being altered that is based on the approved AFMS using the following guidance:

Note: Attachments 2 and 3 of this document provide templates for AFMS development. Attachment 2 provides a recommended AFMS cover page for situations where FAA approval is not required. Attachment 3 provides a recommended AFMS cover page for situations where major deviations occur and FAA approval of the AFMS is required.

(1) Develop the AFMS using available references and templates to ease document creation. The AFMS should adhere to the same basic format of the applicable aircraft flight manual. The supplement should state the following information on each page in the header and footer areas; The aircraft manufacturer's name, aircraft model name, serial number of the aircraft, ADS-B OUT System (position source and ADS-B OUT transmitter), author (e.g. the installing person), and page number of total pages information (e.g., Page X of X). The title page of the AFMS should present a signature line denoting FAA approval (when required), and applicable date;

(2) The General Section, System Description Section, or comparable section (depending upon the aircraft manufacturer's basic AFM format), must reflect any specific ADS-B OUT system information that requires communication to the flight crew. The following compliance statement must also be included in the General Section or equivalent section, "The installed ADS-B OUT system has been shown to meet the equipment requirements of 14 CFR § 91.227."; and

(3) The Operating Limitations Section must contain any operating limitations identified in the original TC, ATC, or STC AFMS, if applicable.

b. When installations utilize STC data that does not directly apply to the make and model of aircraft being altered, and those installations create deviations in the information and instructions provided in the original AFMS, the installer must obtain FAA approval for those deviations. Installing persons will need to pursue approval of the AFMS through one of several methods. Aviation Safety Inspectors authorized to conduct field approvals are typically eligible to approve an AFMS. If the conditions are met in FAA Order 8300.16, Chapter 6 (as revised), then a qualified ASI may provide FAA approval of the AFMS. An ASI may also coordinate approval with the appropriate ACO if necessary. Designated Engineering Representatives (DER) and Organizational Designation Authorization (ODA) with the proper authorizations may also be used in seeking approval of an AFMS.

c. For ADS-B OUT system installations that occur in aircraft that do not possess an

AFM, a supplemental airplane (aircraft) flight manual (SAFM) may be developed and approved in the same manner as an AFMS. Reference FAA Order 8300.16 Chapter 6 (as revised).

d. For implementation of the AFMS into the AFM, see section 11 of this document.

11. System Performance Verification and Methods

It is the responsibility of the person installing the ADS-B OUT system to verify compliance with both the system configuration and equipment performance requirements of 14 CFR §91.227. The system configuration aspects of §91.227 requirements include the aircraft's assigned ICAO 24-bit address, emitter category, SIL, SDA, flight identification, etc. Installers must verify the system configuration data is correct for the aircraft during testing. Performance aspects of the § 91.227 requirements include the NIC, Navigation Accuracy Category for Position and Velocity (NACp and NACv), and must be verified by Operational Flight Evaluation (OFE) or ground test as described below.

- a. Operational Flight Evaluation (OFE): Conduct an OFE per 14 CFR § 91.407(b) and verify proper avionics performance per the following steps:
 - (i) Verify the planned OFE flight area is supported by ADS-B ground station coverage at <http://www.faa.gov/nextgen/equipadsb/airspace/>
 - (ii) Verify there are no active NOTAMs for ADS-B service disruption for the planned OFE area.
 - (iii) Conduct the OFE operation. It is recommended that the OFE reach a minimum altitude of 5000 ft. AGL for a minimum duration of 10 minutes.
 - (iv) Obtain an ADS-B OUT Performance Report (APR) from the FAA Public ADS-B Performance Monitor (PAPM) at <https://adsbperformance.faa.gov/PAPRRequest.aspx>. APM reports are typically available for retrieval within one hour of OFE termination.

Note: When the PAPM service is unavailable, an APR can be obtained by emailing a request to the following address: 9-AWA-AFS-300-ADSB-AvionicsCheck@faa.gov. Include the applicable aircraft registration number (N-number) and "OFE" acronym in the email subject line. In the body of the email include the OFE date/time, assigned Mode S address (ICAO 24-bit address), and the ADS-B transmitter and GPS equipment make/model information. APR requests that lack any of this information cannot be processed.

- (v) Following receipt of the applicable OFE APR, the installer must verify that the installed ADS-B OUT system complies with all section 14 CFR § 91.227 performance requirements and the system configuration is correct for the aircraft. Corrective action should be taken to address issues identified within an APR prior to return to service. Questions related to data contained in an APR should be

submitted via email to 9-AWA-AFS-300-ADSB-AvionicsCheck@faa.gov.

(vi) Upon the completed installation and complete verification is established through an OFE (or in cases of multiple OFEs), the ADS-B OUT AFMS should not be inserted into the AFM until the determination of compliance with 14 CFR § 91.227 is established. Once established, the AFMS may be inserted into the AFM.

Note: Ground testing or OFE(s) should be repeated as necessary to validate system performance when resolving issues identified within an APR. A user's guide is available for download from the PAPM website to aid in the interpretation of system performance information provided in the APR. This user's guide may also be obtained via email request at 9-AWA-AFS-300-ADSB-AvionicsCheck@faa.gov or through contact information provided in this document.

b. Ground Testing. Using appropriate ramp test equipment (reference section 91.407(c)) verify proper system operation, configuration and compliance with section 14 CFR § 91.227 equipment performance requirements. When the installation is complete and compliance verification is established through the use of ground/ramp test equipment, the AFMS may be inserted into the AFM during the approval for return to service process.

Note: The FAA strongly encourages those involved with testing of ADS-B OUT systems to connect test equipment directly to the system under test or use appropriate antenna coupling/shielding equipment to preclude signal propagation into local airspace. If these methods are not possible, coordination with the respective air traffic control (ATC) facility should be made. If applicable, TCAS II equipment must be disabled on the aircraft when conducting ADS-B Out equipment testing. Failure to follow this guidance may lead to unexpected display of the aircraft under test within local ATC controlled airspace and generate false TCAS II Traffic and Resolution Advisories on nearby aircraft. Reference FAA Safety Alert for Operators (SAFO) 17002, Improper Transponder and Automatic Dependent Surveillance-Broadcast (ADS-B) OUT Equipment Testing, dated 2/6/2017. In addition, reference AC 20-151 (as revised), AC 43-6C (as revised), and AC 20-165 (as revised) for additional guidance on proper testing procedures.

12. Documenting ADS-B OUT System Performance Verification.

Following system performance verification of the ADS-B OUT installation by OFE and/or ground testing, document the results of the system performance in the aircraft maintenance record per 14 CFR § 43. When system performance is found acceptable, include the statement, "The installed ADS-B OUT system was shown to meet the equipment requirements of 14 CFR § 91.227" in the aircraft maintenance records.

(a) Execute FAA Form 337

Note: Upon completion of the alteration for the ADS-B OUT system, if the ground testing method is not used and only the OFE method is employed, the aircraft may be approved for return to service with ADS-B OUT system use limited to use for OFE purposes only.

- (i) When using an OFE to determine compliance, complete Form 337 per the example provided in Attachment 5 of this document to record the ADS-B OUT alteration. This Form 337 must be completed prior to returning the aircraft to service. Once the OFE has been accomplished and it has been established that the system is compliant with 14 CFR § 91.227, an additional Form 337 should be completed to record compliance (see Attachment 6). Block 8 of the second Form 337 should include the following statement: “The installed ADS-B OUT system has been shown to meet the equipment requirements of 14 CFR § 91.227.” This Form 337 serves as a permanent record of ADS-B OUT system compliance at installation.
- (ii) When using ground/ramp test equipment to establish compliance with 14 CFR § 91.227, complete Form 337 and reference Attachment 5 as an example. Upon determining that the system complies with the 14 CFR § 91.227, include the following statement in block 8 of Form 337: “The installed ADS-B OUT system has been shown to meet the equipment requirements of 14 CFR § 91.227.”
- (iii) Include the ADS-B OUT transmitter and position source make/model information in block 8 of Form 337 as shown in Attachment 5.
- (iv) In situations where no further FAA approval is sought, the installer should include the following information in Block 3 of Form 337. “This ADS-B OUT system installation was completed using approved data from STC SX-XXXXX as per FAA Policy Memorandum Installation Approval for ADS-B OUT Systems, (current revision).” Reference Attachment 4 for an example of Form 337, Block 3 entry.
- (v) Submit completed hardcopy Form 337s to the Aircraft Registration Branch, AFS-750, P.O. box 25504, Oklahoma City, Oklahoma 73125. Submittal of electronic Form 337 is also acceptable.

13. Instructions for Continued Airworthiness (ICA) Requirements

When an installing person utilizes an STC that is directly applicable to the aircraft being altered, the ICA for the ADS-B OUT system provided with that STC must be used. However, if an ADS-B OUT system is being installed based on an STC that is not directly applicable to the aircraft being altered; the installer must develop an applicable ICA that addresses the continued airworthiness requirements for the specific system installation. ICAs are created in compliance with 14 CFR Part 21 § 21.50, Part 23 §

23.1529, Part 25 § 25.1529, Part 27 § 27.1529, and Part 29 § 29.1529. Guidance for the development and content of ICAs is provided in FAA Order 8300.16 (as revised) and FAA AC 43-210 (as revised). The applicant should include a reference in FAA Form 337, block 8 to the ICA that is provided for the installation.

14. Does the installation of an ADS-B OUT system affect RVSM or TCAS II systems?

Note: Reference AIR-100 Policy Memo (AIR-100-14-130-GM27) for guidance on RVSM and TCAS II considerations during installation of ADS-B OUT systems on applicable aircraft.

15. What are the installation and approval requirements for ADS-B IN equipment?

The requirements for installation and approval of ADS-B IN equipment are dependent on the intended function and use of the data provided. In most cases, alterations to aircraft that enable ADS-B IN functionality will be accomplished concurrent with ADS-B OUT system installations. Typically, these installations are completed using data from a single approval (TC, STC, etc) and enable the display of advisory-only traffic and aviation relevant information. Installations on other aircraft, such as part 25 aircraft, may enable more advanced ADS-B IN functionality such as In-Trail Procedures (ITP), Interval Management (IM), and Cockpit Display of Traffic Information Assisted Visual Separation (CAVS). In most cases, equipage and operational use of advanced ADS-B IN functionality require FAA airworthiness approval and operational authorization due to the higher level of criticality and safety associated with them.

The following guidance is applicable to permanently installed ADS-B IN equipment that meet the requirements of TSO-C195b, Avionics Supporting Automatic Dependent Surveillance - Broadcast (ADS-B) Aircraft Surveillance Applications (ASA). Refer to FAA Advisory Circular (AC) 120-76 (as revised) Guidelines for the Certification, Airworthiness, and Operational Use of Electronic Flight Bags when applicable.

The FAA does not provide approval for portable electronic devices such as those used to display ADS-B traffic and weather information and such devices are outside the scope of this guidance.

Equipment Installation Guidance for ADS-B IN Advisory-Only Functionality:

ADS-B IN Advisory-Only functionality includes manufacturer provided functionality enabled by ADS-B (e.g., traffic and altitude alerting) and display of data provided through the FAA ADS-B broadcast services (TIS-B and FIS-B). In most cases, alterations to aircraft that enable ADS-B IN functionality will be accomplished concurrent with an ADS-B OUT system installation. Typically, these installations are completed using data from a single approval (TC, STC, etc).

When an ADS-B IN system is installed separate from an ADS-B OUT system the

installer must determine the appropriate means of approval for the alteration. Installers should reference 14 CFR § 43, FAA Order 8300.16 (as revised), Major Repair and Alteration Data Approval, Major Repair and Alteration Data Approval-Online Job Aid (as revised), and guidance contained in AC 43-210 (as revised) when making this determination.

Changes to the AFM resulting from installation of an ADS-B IN system should be approved using the guidance contained in Section 10 of this document.

Note: The FAA advises that ADS-B IN installations be integrated with a compliant ADS-B OUT installation to realize the full benefits of the ADS-B system.

Equipment Installation Guidance for Advanced ADS-B IN Functionality:

For guidance on the airworthiness requirements for advanced ADS-B IN functionality refer to AC 90-114(current version). In addition, consult AC 20-172 (as revised) Airworthiness Approval for ADS-B IN Systems and Applications, and AC 20-149 (as revised), Installation Guidance for Domestic Flight Information Service – Broadcast for detailed information concerning installation of ADS-B IN systems and their associated approval requirements.

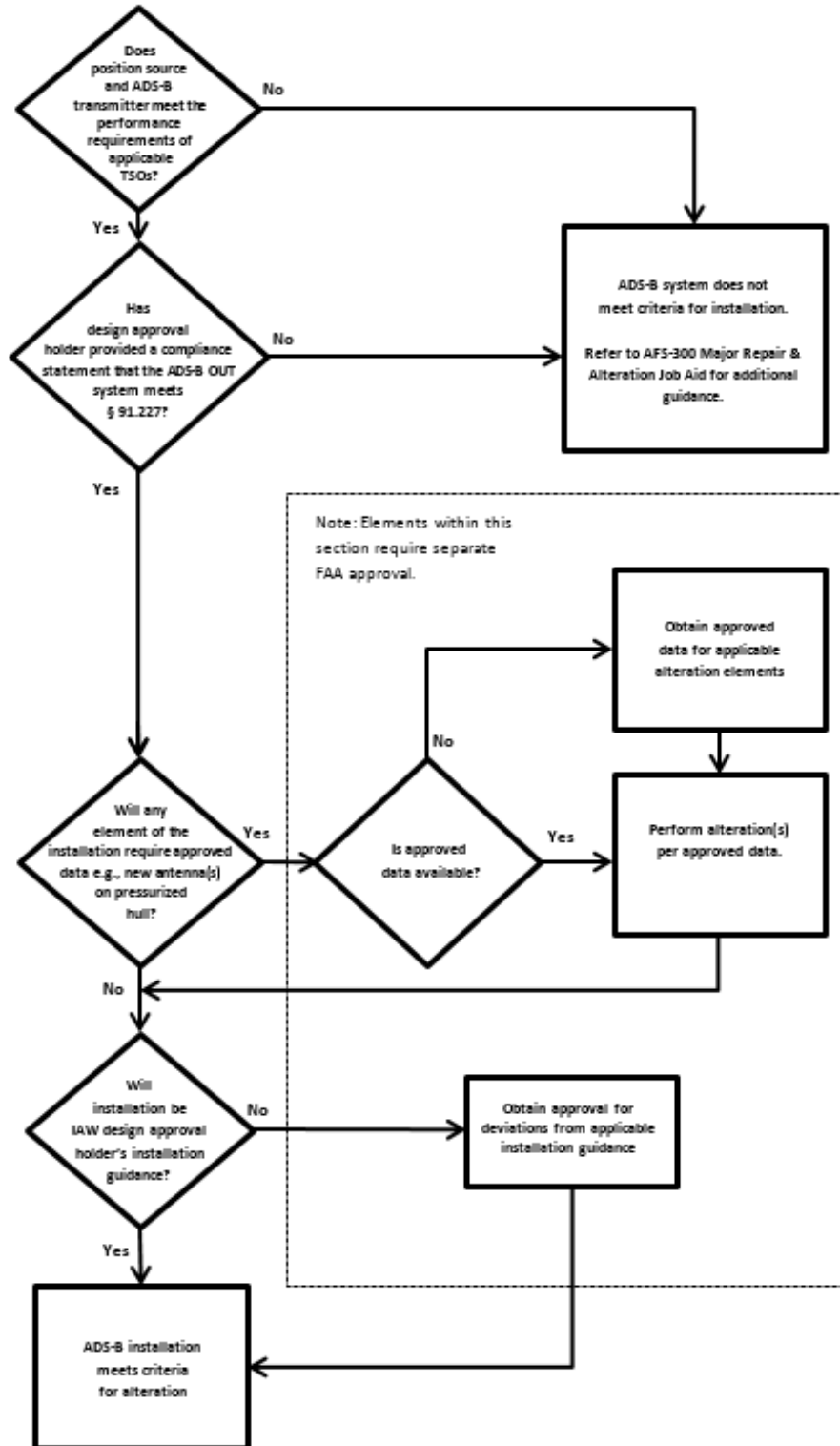
16. References

- a. FAA Order 8300.16, Major Repair and Alteration Data Approval - provides the policy for data approvals for major repairs and alterations.
- b. Job Aid - Major Repair and Alteration Data Approval - provides guidance applicable to ADS-B OUT installation approvals.
- c. FAA Advisory Circular 20-151 (as revised), Airworthiness Approval of Traffic Alert and Collision Avoidance Systems (TCAS II), Versions 7.0 & 7.1 and Associated Mode S Transponders.
- d. FAA Advisory Circular 20-165 (as revised), Airworthiness Approval of Automatic Dependent Surveillance – Broadcast (ADS-B) OUT systems in aircraft - provides guidance on ADS-B system design and installation.
- e. FAA Advisory Circular 43-6 (as revised), Altitude Reporting Equipment and Transponder System Maintenance and Inspection Practices.
- f. FAA AC 43-210 (as revised), Standardized Procedures for Requesting Field Approval of Data, Major Alterations, and Repairs - provides guidance related to the field approval process.
- g. FAA AC 43.13-2B Acceptable Methods, Techniques, and Practices – Aircraft Alterations
- h. AVS Policy Memorandum, March 2, 2016 or later, Installation Approval for ADS-B OUT Systems – provides guidance on FAA policy regarding required approvals and non-interference installations of ADS-B systems.

17. Who should I contact for questions about this Technical Paper?

Questions regarding ADS-B equipment installation and this Technical Paper should be directed to the ADS-B Focus Team (AFT) at adsbfocusteam@faa.gov .

Attachment 1 ADS-B OUT Alteration Flow Chart



Attachment 2
AFMS Cover Page Example – FAA Approval Not Required

Installer Name/Company (*AFMS author*)
XXX Aviation Road
Your City, ST. Zip

AFM/RFM Supplement
Document No. (*optional*)
ADS-B OUT System
Aircraft Mfr Name, Model Name, S/N XXX

AIRPLANE FLIGHT MANUAL SUPPLEMENT

Equipment Manufacturer Name(s)
Automatic Dependent Surveillance Broadcast (ADS-B) OUT System

In
(customize to aircraft being altered)
Aircraft Manufacturer Name,
Model Name,
S/N XXX

This supplement must be attached to the Approved Airplane/Rotorcraft (*as applicable*) Flight Manual when a (*insert applicable manufacturer name(s)*) ADS-B OUT System is installed to provide ADS-B OUT functionality.

The information contained herein supplements or supersedes the basic manual only in those areas listed herein. For Limitations, Procedures, and Performance information not contained in this supplement, consult the basic Airplane/Rotorcraft Flight Manual.

This AFMS/RFMS has been created using the applicable AFMS/RFMS associated with Supplement Type Certificate (STC) SX-XXXXXX (*insert applicable STC no*). STC SX-XXXXXX is used as the basis for the ADS-B OUT system installation.

This AFMS/RFMS contains the same information as the AFMS associated with the STC for the ADS-B OUT system installation identified above. The information contained herein requires no further FAA approval as the AFMS/RFMS has previously received FAA approval. It has been created to provide applicability to the ADS-B OUT system installation with respect to the particular make/model and serial number of the aircraft being altered. Reference Federal Aviation Administration Policy Memorandum, dated March 2, 2016 (or later), Installation Approval for ADS-B OUT Systems.

Reference FAA Form 337 dated [insert date] for the applicable system installation information. Block 3 of FAA Form 337 dated [insert date] contains information to identify this AFMS/RFMS and its applicability to the ADS-B OUT system installation.

Attachment 3

AFMS Cover Page Example – FAA Approval of AFMS Required

Installer Name/Company (*AFMS author*)
XXX Aviation Road
Your City, ST. Zip

AFM/RFM Supplement
Document No. (*optional*)
ADS-B OUT System
Aircraft Mfr Name, Model Name, S/N XXX

FAA APPROVED

AIRPLANE FLIGHT MANUAL SUPPLEMENT

Equipment Manufacturer's Name(s)
Automatic Dependent Surveillance Broadcast (ADS-B) OUT System

In

(customize to aircraft being altered)

Aircraft Manufacturer Name,
Model Name,
S/N XXX

This supplement must be attached to the Approved Airplane/Rotorcraft (*as applicable*) Flight Manual when a (*insert applicable manufacturer name(s)*) ADS-B OUT System is installed to provide ADS-B OUT functionality.

The information contained herein supplements or supersedes the basic manual only in those areas listed herein. For Limitations, Procedures, and Performance information not contained in this supplement, consult the basic Airplane/Rotorcraft Flight Manual.

This AFMS/RFMS has been created through the use of Supplement Type Certificate (STC) SX-XXXXX (*insert applicable STC no*).

This AFMS/RFMS contains the same information as the AFMS associated with the STC for ADS-B OUT equipment identified above except where major deviations are present. This AFMS/RFMS has been created to provide information with respect to those deviations and the resultant effects upon the ADS-B OUT system installation. Reference Federal Aviation Administration Policy Memorandum, dated March 2, 2016 (or later), Installation Approval for ADS-B OUT Systems.

Reference FAA Form 337 dated [insert date] or the applicable system installation information.

FAA APPROVED [insert signature]

Date[insert date]

(insert Aviation Safety Inspector name here or other approving authority)

Aviation Safety Inspector
Flight Standards District Office (*FSDO-XXXX*)
Federal Aviation Administration

Attachment 4

Completion of FAA Form 337 Block 3

The following is for use by the installer in completing block 3 of FAA Form 337 when an ADS-B OUT installation is completed and further FAA approval is not required.

MAJOR REPAIR AND ALTERATION (Airframe, Powerplant, Propeller, or Appliance)		Form Approved OMB No. 2120-0020 11/30/2007	Electronic Tracking Number _____
		For FAA Use Only	
INSTRUCTIONS: Print or type all entries. See FAR 43.9, FAR 43 Appendix B, and AC 43.9-1 (or subsequent revision thereof) for instructions and disposition of this form. This report is required by law (49 U.S.C. 1421). Failure to report can result in a civil penalty not to exceed \$1,000 for each such violation (Section 901 Federal Aviation Act 1958)			
1. Aircraft	Nationality and Registration Mark _____		Serial No. _____
	Make _____	Model _____	Series _____
2. Owner	Name (As shown on registration certificate) _____ _____		Address (As shown on registration certificate) Address: _____ City: _____ State: _____ Zip: _____ Country: _____
	3. For FAA Use Only		
	[This ADS-B OUT system installation was completed using approved data from STC SX-XXXXX as per FAA Policy Memorandum Installation Approval for ADS-B OUT Systems, dated March 2, 2016 (or later).]		
4. Type		5. Unit Identification	
Repair	Alteration	Unit	Make
<input type="checkbox"/>	<input type="checkbox"/>	AIRFRAME	_____ (As described in item 1 above)
<input type="checkbox"/>	<input type="checkbox"/>	POWERPLANT	_____
<input type="checkbox"/>	<input type="checkbox"/>	PROPELLER	_____
<input type="checkbox"/>	<input type="checkbox"/>	APPLIANCE	Type: _____ Manufacturer: _____
6. Conformity Statement			
A. Agency's Name and Address		B. Kind of Agency	
Name: _____		<input type="checkbox"/> U.S. Certificated Mechanic	
Address: _____		<input type="checkbox"/> Foreign Certificated Mechanic	
City: _____ State: _____		<input type="checkbox"/> Manufacturer	
Zip: _____ Country: _____		C. Certificate No. _____	
		<input type="checkbox"/> Certificated Repair Station	
		<input type="checkbox"/> Certificated Maintenance Organization	
D. I certify that the repair and/or alteration made to the unit(s) identified in item 5 above and described on the reverse or attachments hereto have been made in accordance with the requirements of Part 43 of the U.S. Federal Aviation Regulations and that the information furnished herein is true and correct to the best of my knowledge.			
Extended range fuel per 14 CFR Part 43 App. B <input type="checkbox"/>		Signature/Date of Authorized Individual _____	
7. Approval for Return to Service			
Pursuant to the authority given persons specified below, the unit identified in item 5 was inspected in the manner prescribed by the Administrator of the Federal Aviation Administration and is <input type="checkbox"/> APPROVED <input type="checkbox"/> REJECTED			
BY	<input type="checkbox"/> FAA Fit Standards Inspector	<input type="checkbox"/> Manufacturer	<input type="checkbox"/> Maintenance Organization
	<input type="checkbox"/> FAA Designee	<input type="checkbox"/> Repair Station	<input type="checkbox"/> Inspection Authorization
Certificate or Designation No. _____		Signature/Date of Authorized Individual _____	
		Person Approved by Canadian Department of Transport Other (Specify) _____	

Attachment 5

Completion of FAA Form 337 to record ADS-B OUT system installation.

The following example is recommended for use in completing block 8 of FAA Form 337 to record the ADS-B OUT system installation. "Notes to Installer" are intended to provide additional information to the installer.

NOTICE	
<i>Weight and balance or operating limitation changes shall be entered in the appropriate aircraft record. An alteration must be compatible with all previous alterations to assure continued conformity with the applicable airworthiness requirements.</i>	
8. Description of Work Accomplished <i>(If more space is required, attach additional sheets. Identify with aircraft nationality and registration mark and date work completed.)</i>	
N123XX	XX/XX/XXXX
Nationality and Registration Mark	Date
This FAA Form 337 records the installation of an Automatic Dependent Surveillance-Broadcast OUT (ADS-B OUT) system.	
The system was installed in accordance with STC S _____ (if directly applicable). OR, The system was installed using STC S _____ as the basis STC for ADS-B OUT transmitter and position source pairing.	
Note to installer: If an STC is used that is directly applicable, reference that STC. If not, reference the STC that identifies pairing approval of the ADS-B OUT transmitter and the position source.	
A. Removed the following equipment: (if applicable)	
Manufacturer/Component/Part Number _____	
B. Installed the following equipment:	
Manufacturer/Component/Part Number _____	
C. The ADS-B Out transmitter is compliant with FAA TSO C-154c or later, or TSO C166b or later (as applicable).	
D. The position sensor is compliant with FAA TSO-C129 or later, TSO-C145a/C146a or later, or TSO-C196 or later (as applicable).	
E. The system electrical interface was completed in accordance with (insert data title).	
Note to installer: If all or some of the electrical interface was deemed a major alteration, document the FAA approval basis of the data used in this location.	
F. Structural aspects of the installation were completed in accordance with (insert data title).	
Note to installer: If all or some of the structural installation elements were deemed a major alteration, document the FAA approval basis of the data used in this location.	
G. Ground Test /Operation Flight Evaluation/Approval for Return to Service	
Note to installer: If a satisfactory ground test was conducted using ground/ramp test equipment, the following statement may be used:	
"A satisfactory ground test of the ADS-B OUT system was completed using a (insert ground test equipment make and model). The ground test checked for proper configuration and the equipment performance requirements. The installed ADS-B OUT system has been shown to meet the equipment requirements of 14 CFR § 91.227."	
Note to installer: Document in the aircraft maintenance records that the ADS-B OUT system installation has been installed and include the statement, "The installed ADS-B OUT system has been shown to meet the equipment requirements of 14 CFR § 91.227."	
Note to installer: If the system has been installed, yet requires an operational flight evaluation (OFE) to make a determination of proper configuration and performance, then the following statement may be used: (Also see attachment 6 to this document).	
"The ADS-B OUT system has been installed and is limited to use for OFE purposes only. The system has not yet been determined to meet the requirements of 14 CFR § 91.227. A determination of proper configuration and performance has yet to be established via an operational flight evaluation in accordance with 14 CFR § 91.407(b)."	
Note to installer: For certificated repair stations performing the alteration, please include the work order (or equivalent tracking number) for which the work was accomplished under and recorded on the Form 337.	
H. Flight Manual revision: The appropriate airplane/rotorcraft flight manual supplement has been inserted into the flight manual/pilot's manual.	
Note to installer: See Section 10 and 11 of this document for additional information regarding flight manual revisions.	
I. The instructions for continued airworthiness (ICA) for the ADS-B OUT system are identified (insert document/location here). The ICA has been provided to the aircraft owner/operator for incorporation into the aircraft maintenance program.	
Note to installer: The complete ICA may be contained within block 8 of the FAA Form 337 or may be developed as a stand-alone document. Reference FAA Order 8300.16 (as revised) and FAA AC 43-210 (as revised).	
J. An electrical load analysis (ELA) has been calculated to evaluate the change in electrical load. The change in electrical load is (insert determination here).	
K. The new weight and balance for the aircraft has been calculated as result of this alteration. A copy of the weight and balance document has been provided to the owner/operator.	
-----END-----	
<input type="checkbox"/> Additional Sheets Are Attached	

Attachment 6

Completion of FAA Form 337 to record ADS-B OUT system installation.

The following example is recommended for use in completing block 8 of FAA Form 337 to record the verification of compliance with 14 CFR § 91.227 for the ADS-B OUT system installation after the Operational Flight Evaluation. “Notes to Installer” are intended to provide additional information to the installer.

8. Description of Work Accomplished <i>(If more space is required, attach additional sheets. Identify with aircraft nationality and registration mark and date work completed.)</i>	
<input type="text" value="N123XX"/>	<input type="text" value="XX/XX/XXXX"/>
Nationality and Registration Mark	Date
Note to Installer: This 337 is intended to be used when an operational flight evaluation is utilized to determine compliance 14 CFR § 91.227.	
This FAA Form 337 serves as a permanent record for the determination of FAA regulatory compliance for the Automatic Dependent Surveillance-Broadcast OUT (ADS-B OUT) system installation. The installed ADS-B OUT system has been shown to meet the equipment requirements of 14 CFR § 91.227.	
A. The ADS-B OUT system has been determined to be compliant via an operational flight evaluation authorized under 14 CFR § 91.407(b).	
B. The airplane/rotorcraft flight manual supplement for the ADS-B OUT system has been inserted into the flight manual/pilot's manual of the aircraft.	
C. Reference FAA Form 337 dated _____ for the ADS-B OUT system installation.	
----- END -----	
<input type="checkbox"/> Additional Sheets Are Attached	