



Department of Transportation
Federal Aviation Administration
Aircraft Certification Service
Washington, D.C.

TSO-C195a

Effective
Date: 2/29/12

Technical Standard Order

Subject: *Avionics Supporting Automatic Dependent Surveillance – Broadcast (ADS-B) Aircraft Surveillance Applications (ASA)*

1. **PURPOSE.** This technical standard order (TSO) is for manufacturers applying for a TSO authorization (TSOA) or letter of design approval (LODA). In it, we (the Federal Aviation Administration, or FAA) tell you what minimum performance standards (MPS) your ADS-B ASA systems and equipment must meet for approval and identification with the applicable TSO marking.
2. **APPLICABILITY.** This TSO affects new applications submitted after its effective date.
 - a. All prior revisions to this TSO are no longer effective. Generally, we will not accept applications for the previous revision after the effective date of this TSO. We may do so, however, up to six months after the effective date, if we know that you were working against the prior MPS before the new change became effective.
 - b. ADS-B ASA approved under a previous TSOA may still be manufactured under the provisions of its original approval.
3. **REQUIREMENTS.** New models of ADS-B ASA systems and equipment identified and manufactured on or after the effective date of this TSO must meet the MPS qualification and documentation requirements in Sections 2.1 through 2.3 of RTCA Document No. (RTCA/DO-317A), *Minimum Operational Performance Standards for Aircraft Surveillance Applications System*, dated December 13, 2011 as appropriate to the functional equipment classes listed in Table 1. Functional equipment classes for this TSO are defined by the avionics equipment functionality they provide for one or more of the applications listed in Table 1. The three equipment functionalities are Cockpit Display of Traffic Information (CDTI) (Surface Only), CDTI, and Airborne Surveillance and Separation Assurance Processing (ASSAP). Applicable performance standards for these classes are identified per equipment class in Appendix L of DO-317A and are based on Section 2 of RTCA/DO-317A. The functional equipment classes are shown in the following table.

	Application	Criticality		Equipment Classes		
		Loss of Function	Hazardous Misleading Information	CDTI (Surface Only) (A)	CDTI (B)	ASSAP (C)
1	Enhanced Visual Acquisition (EVAcq)	Minor	Major	Not Permitted	B1	C1
2	Basic Surface (Runways)	Minor	Major (> 80 Knots) Minor (< 80 Knots)	A2	B2	C2
3	Basic Surface (Runways + Taxiways)	Minor	Major (> 80 Knots) Minor (< 80 Knots)	A3	B3	C3
4	Visual Separation on Approach (VSA)	Minor	Major	Not Permitted	B4	C4
5	Basic Airborne (AIRB)	Minor	Major	Not Permitted	B5	C5
6	In-Trail Procedures (ITP)	Minor	Major	Not Permitted	B6	C6

Table 1 – ASA Functional Equipment Classes

a. Functionality. This TSO's standards apply to equipment intended to be used in aircraft to display traffic using ADS-B message data from other aircraft. Applications 1 through 5 in Table 1 support a pilot's see and avoid responsibility. No existing responsibility is changed by virtue of installation of this equipment.

(1) The In-Trail Procedures (ITP) application (item 6 in Table 1) supports a new separation standard in procedural airspace. ITP application enables aircraft that desire flight level changes in procedural airspace to achieve these changes on a more frequent basis, thus improving flight efficiency and safety. The ITP achieves this objective by permitting a climb-through or descend-through maneuver between properly equipped aircraft, using a new distance-based longitudinal separation minimum during the maneuver. When performing ITP operations, regional air traffic procedures must be observed. Crew training and operational approvals are required. If the applicant cannot support ITP in polar regions, this limitation must be clearly stated. The applicant must define what the boundaries of the polar region are in the installation and flight manual. Additional operational guidance will be published by FAA flight standards organization.

(2) ASSAP equipment authorized under this TSO must contain or support an interface to an ADS-B receiver. If the receiver is embedded in the equipment, it must meet TSO-C154c or TSO-C166b. If the receiver is not embedded, the installation manual must have a requirement to interface to a TSO-C154c or TSO-C166b approved ADS-B receiver.

(3) If intended for installation on aircraft with TAS or TCAS equipment, ASSAP equipment authorized under this TSO must contain or support an interface to equipment complying with TSO-C147, TSO-C118, or TSO-C119c. If the ASSAP equipment does not support this functionality, the installation manual must prohibit installation on an aircraft equipped with TAS or TCAS.

(4) Class A and B equipment authorized under this TSO must comply with TSO-C165 when implementing Surface Applications. This TSO shall take precedence where it differs from TSO-C165. Databases used to support moving maps integrated with the SURF application must meet at least 5 meter accuracy and 1 meter resolution. Databases used to support moving maps integrated with the SURF application must meet DO-200A Data Process Assurance Level 2 for state-provided data with Essential Integrity as defined in DO-272B.

(5) Equipment authorized under this TSO may include or interface with airborne multipurpose electronic display equipment complying with TSO-C113.

(6) Equipment authorized under this TSO must contain or support an interface to position sources that meet one of the following TSOs: TSO-C129, TSO-C145, TSO-C146, TSO-C196 or equivalent.

b. Failure Condition Classifications.

(1) Failure of the function defined in paragraph 3.a of this TSO has been determined to be a major failure condition for malfunctions causing the display of hazardously misleading information in airborne aircraft and aircraft on the ground greater than 80 knots. Failure of the function defined in paragraph 3.a of this TSO has been determined to be a minor failure condition for malfunctions causing the display of hazardously misleading information in aircraft on the ground with groundspeed of less than 80 knots.

(2) Loss of function defined in paragraph 3.a has been determined to be a minor failure condition.

(3) Develop the system to, at least, the design assurance level applicable to these failure condition classifications. Design assurance levels should be based upon the guidance of AC 23.1309-1E for Part 23 aircraft, AC 25.1309-1A for Part 25 aircraft, AC 27-1B for normal category rotorcraft, and AC 29-2C for transport category rotorcraft. To clarify this requirement for aircraft types, Table 2 indicates the minimum Design Assurance Level required for Small Aircraft, Transport Aircraft, and Rotorcraft.

ASA Equipment Classes for installation in 14 CFR § 23 Class 1,2,and 3 (per AC 23-1309-1E)	ASA Equipment Classes for installation in 14 CFR § 23 Class 4, 14 CFR § 25, 14 CFR § 27, 14 CFR § 29	Minimum Required Hardware Failure Probability (HMI)	Minimum Required DO-178B Software Design Assurance Level	Minimum Required DO-254 Complex Hardware Design Assurance Level
A2, A3, B1, B2, B3, B4, B5, C1, C2, C3, C4, C5	A2, A3	10E-3	Level D	Level D
B6, C6	B1, B2, B3, B4, B5, B6, C1, C2, C3, C4, C5, C6	10E-5	Level C	Level C

Table 2 – Design Assurance Levels per Aircraft Class

c. Functional Qualification. Demonstrate the required functional performance under the test conditions specified in RTCA/DO-317A, Sections 2.5 and 2.6. All equipment authorized under this TSO must demonstrate interoperability with an FAA Automatic Dependent Surveillance- Rebroadcast (ADS-R) service broadcast. In addition, equipment authorized under this TSO that includes a Traffic Information Service – Broadcast (TIS-B) function must demonstrate interoperability with an FAA TIS-B service broadcast. Applicants must propose a method to demonstrate interoperability with FAA ADS-R and TIS-B services. This method must include operation with live data within an ADS-R and/or TIS-B service volume.

Note: Equipment designed for installations that include a TCAS or TAS processor are not required to implement TIS-B for airborne applications. Equipment designed to support Class C2 and C3 must implement TIS-B for surface applications.

d. Environmental Qualification. Demonstrate the required performance under the test conditions specified in RTCA/DO-317A, Section 2.4 using standard environmental conditions and test procedures appropriate for airborne equipment.

Note: The use of RTCA/DO-160D, *Environmental Conditions and Test Conditions for Airborne Equipment*, dated July 29, 1997, (with Changes 1 and 2 only, incorporated) or earlier versions is generally not considered appropriate and will require substantiation via the deviation process as discussed in paragraph **3.g** of the TSO.

e. Software Qualification. If the article includes software, develop the software according to RTCA Inc. document RTCA/DO-178B, *Software Considerations in Airborne Systems and Equipment Certification*, dated December 1, 1992 to at least the software design assurance level consistent with the failure condition classification defined in paragraph **3.b** of this TSO.

Note: The certification liaison process objectives will be considered satisfied after FAA review of the applicable life cycle data.

f. Electronic Hardware Qualification. If the article includes complex custom airborne electronic hardware, develop the component according to RTCA, Inc. document RTCA/DO-254, *Design Assurance Guidance for Airborne Electronic Hardware*, to at least the design assurance level consistent with the failure condition classification defined in paragraph **3.b** of this TSO.

Note: The certification liaison process objectives will be considered satisfied after FAA review of the applicable life cycle data.

g. Deviations. We have provisions for using alternate or equivalent means of compliance to the criteria in the MPS of this TSO. If you invoke these provisions, you must show that your equipment maintains an equivalent level of safety. Apply for a deviation under the provision of 14 CFR § 21.618.

4. MARKING.

a. Mark at least one major component permanently and legibly with all the information in 14 CFR § 45.15(b). The marking must include the serial number. The markings may include functional equipment class(es) in accordance with Table 1 of Section 3, or they may be included in the manual referenced in Section 5.a. An acceptable way to mark the supported equipment class is as follows: TSO-C195a Class C3, C4, C5.

b. Also, mark the following permanently and legibly, with at least the manufacturer's name, subassembly part number, and the TSO number:

- (1) Each component that is easily removable (without hand tools), and
- (2) Each subassembly of the article that you determined may be interchangeable.

c. If the article includes software and/or airborne electronic hardware, then the article part numbering scheme must identify the software and airborne electronic hardware configuration. The part numbering scheme can use separate, unique part numbers for software, hardware, and airborne electronic hardware.

d. You may use electronic part marking to identify software or airborne electronic hardware components by embedding the identification within the hardware component itself (using software) rather than marking it on the equipment nameplate. If electronic marking is used, it must be readily accessible without the use of special tools or equipment.

Note: Similar software versions, developed and tested to different software levels, must be differentiated by part number.

5. APPLICATION DATA REQUIREMENTS. You must give the FAA aircraft certification office (ACO) manager responsible for your facility a statement of conformance, as specified in 14 CFR § 21.603(a)(1) and one copy each of the following technical data to support your design and production approval. LODA applicants must submit the same data (excluding paragraph **5.g**) through their civil aviation authority.

a. A manual(s) containing the following:

(1) Operating instructions and equipment limitations sufficient to describe the equipment's operational capability.

(2) Describe in detail any deviations.

(3) Installation procedures and limitations sufficient to ensure that the ADS-B ASA equipment, when installed according to the installation or operational procedures, still meets this TSO's requirements. Limitations must identify any unique aspects of the installation. The limitations must include a note with the following statement:

“This article meets the minimum performance and quality control standards required by a technical standard order (TSO).
Installation of this article requires separate approval”

(4) For each unique configuration of software and airborne electronic hardware, reference the following:

(a) Software part number including revision and design assurance level;

(b) Airborne electronic hardware part number including revision and design assurance level; and,

(c) Functional description.

(5) A summary of the test conditions used for environmental qualifications for each component of the article. For example, a form as described in RTCA/DO-160G, *Environmental Conditions and Test Procedures for Airborne Equipment*, Appendix A.

(6) Schematic drawings, wiring diagrams, and any other documentation necessary for installation of the ADS-B ASA equipment.

(7) List of replaceable components, by part number, that makes up the ADS-B ASA equipment article. Include vendor part number cross-references, when applicable.

b. Instructions covering periodic maintenance, calibration, and repair, for the continued airworthiness of ADS-B ASA equipment. Include recommended inspection intervals and service life, as appropriate.

c. If the article includes software: a plan for software aspects of certification (PSAC), software configuration index, and software accomplishment summary (SAS).

d. If the article includes simple or complex custom airborne electronic hardware, a plan for hardware aspects of certification (PHAC), hardware verification plan, top-level drawing, and hardware accomplishment summary (or similar document, as applicable).

e. Nameplate drawing with the information required by paragraph **4** of this TSO.

f. Identify functionality or performance contained in the article not evaluated under paragraph **3** of this TSO (that is, non-TSO functions). Non-TSO functions are accepted in parallel with the TSO authorization. For those non-TSO functions to be accepted, you must declare these functions and include the following information with your TSO application:

(1) Description of the non-TSO function(s), such as performance specifications, failure condition classifications, software, hardware, and environmental qualification levels. Include a statement confirming that the non-TSO function(s) don't interfere with the article's compliance with the requirements of paragraph **3**.

(2) Installation procedures and limitations sufficient to ensure that the non-TSO function(s) meets the declared functions and performance specification(s) described in paragraph **5.f.(1)**.

(3) Instructions for continued performance applicable to the non-TSO function(s) described in paragraph **5.f.(1)**.

(4) Interface requirements and applicable installation test procedures to ensure compliance with the performance data defined in paragraph **5.f.(1)**.

(5) Test plans, analysis and results, as appropriate, to verify that performance of the hosting TSO article is not affected by the non-TSO function(s).

(6) Test plans, analysis and results, as appropriate, to verify the function and performance of the non-TSO function(s) as described in paragraph **5.f.(1)**.

g. The quality system description required by 14 CFR 21.608, including functional test specifications. The quality system should ensure that you will detect any change to the approved design that could adversely affect compliance with the TSO MPS, and reject the article accordingly. (Not required for LODA applicants.)

h. Material and process specifications list.

i. List of all drawings and processes (including revision level) that define the article's design.

j. Manufacturer's TSO qualification report showing results of testing accomplished according to paragraph 3.c of this TSO.

6. MANUFACTURER DATA REQUIREMENTS. Besides the data given directly to the responsible ACO, have the following technical data available for review by the responsible ACO:

a. Functional qualification specifications for qualifying each production article to ensure compliance with this TSO.

b. Article calibration procedures.

c. Schematic drawings.

d. Wiring diagrams.

e. Material and process specifications.

f. The results of the environmental qualification tests conducted according to paragraph 3.d of this TSO.

g. If the article includes software, the appropriate documentation defined in RTCA/DO-178B including all data supporting the applicable objectives in RTCA/DO-178B *Annex A, Process Objectives and Outputs by Software Level.*

h. If the article includes complex custom airborne electronic hardware, the appropriate hardware life cycle data in combination with design assurance level, as defined in RTCA/DO-254, Appendix A, Table A-1. For simple custom airborne electronic hardware, the following data: test cases or procedures, test results, test coverage analysis, tool assessment and qualification data, and configuration management records, including problem reports.

i. If the article contains non-TSO function(s), you must also make available items 6.a through 6.h as they pertain to the non-TSO function(s).

7. FURNISHED DATA REQUIREMENTS.

a. If furnishing one or more articles manufactured under this TSO to one entity (such as an operator or repair station), provide one copy or on-line access to the data in paragraphs 5.a and 5.b of this TSO. Add any other data needed for the proper installation, certification, use, or for continued compliance with the TSO, of the ADS-B ASA equipment.

b. If the article contains declared non-TSO function(s), include one copy of the data in paragraphs 5.f.(1) through 5.f.(4).

8. HOW TO GET REFERENCED DOCUMENTS.

a. Order RTCA documents from RTCA Inc., 1150 18th St, NW, Suite 910, Washington, D.C. 20036. Telephone (202) 833-9339, fax (202) 833-9434. You can also order copies online at www.rtca.org.

b. Order copies of 14 CFR parts from the Superintendent of Documents, Government Printing Office, P.O. Box 979050, St. Louis, MO 63197. Telephone (202) 512-1800, fax (202) 512-2250. You can also order copies online at www.access.gpo.gov. Select “Access,” then “Online Bookstore.” Select “Aviation,” then “Code of Federal Regulations.”

c. You can find a current list of technical standard orders and advisory circulars on the FAA Internet website Regulatory and Guidance Library at <http://rgl.faa.gov/>. You will also find the TSO Index of Articles at the same site.



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