Department of Transportation
Federal Aviation Administration
Aircraft Certification Service
Washington, DC

TSO-C157

Effective Date:
9/20/04

Technical Standard Order

Subject: **AIRCRAFT FLIGHT INFORMATION SERVICES-BROADCAST (FIS-B) DATA LINK SYSTEMS AND EQUIPMENT**

1. PURPOSE. This Technical Standard Order (TSO) is written for manufacturers and designers of Aircraft Flight Information services-Broadcast (FIS-B) Data Link Systems and Equipment applying for a TSO authorization or letter of design approval. In it, we tell you what minimum performance standard (MPS) your FIS-B system and equipment must first meet for approval and identification with the applicable TSO markings. Title 14 of the Code of Federal Regulations (14 CFR), part 21, Subpart O, prescribes the requirements and rules governing TSO Authorizations.

2. APPLICABILITY. This TSO affects new applications submitted after this TSO's effective date.

> **NOTE:** This TSO does not supersede system specific requirements in other FAA publications, such as:
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> **(1)** TSO-C151b, Terrain Awareness And Warning System, Appendix 3 Supplemental Information, dated December 17, 2002;
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> **(2)** TSO-C119b, Traffic Alert and Collision Avoidance System (TCAS) Airborne Equipment, TCAS II; dated December 18, 1998;
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> **(3)** Advisory Circular (AC) 20-131A, Airworthiness Approval of Traffic Alert and Collision Avoidance Systems (TCAS II) and Mode S Transponders, dated March 29, 1993; and
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> **(4)** TSO-C165, Electronic Map Display Equipment for Graphical Depiction of Aircraft Position, dated September 30, 2003.

3. REQUIREMENTS. New models of FIS-B data link systems identified and manufactured on or after the effective date of this TSO must meet the MPS in RTCA, Inc., Document No. (RTCA/DO)-267A, Minimum Aviation System Performance Standards (MASPS) for Flight Information Services-Broadcast (FIS-B) Data Link, Sections 2 and 3, dated April 04, 2004.

> **Note:** The FIS-B display performance standards in this TSO are referred to in RTCA/DO-267A, Section 3.8. While not a

requirement of this TSO, we encourage equipment manufacturers to develop FIS-B display equipment to meet the requirements of TSO-C113, Airborne Multipurpose Electronic Displays, dated October 27, 1986, or the latest FAA approved revision.

a. Exception/Clarification to Minimum Performance Standards Reference. The following clarifies the performance standards in RTCA/DO-267A:

(1) Clarification: RTCA/DO-267A, Section 3.8.1.9 refers to Society of Automotive Engineering (SAE) Aerospace Recommended Practice ARP4102/7, Electronic Displays.

(2**)** Exception: RTCA/DO-267A, Section 3.8.2 and Table 3-2; the appropriate use of color for FIS-B equipment is highly dependent upon aircraft integration, operational context and aircraft capability. For Part 25 airplanes, the use of the colors red, yellow/amber, and green is more closely controlled and installation limitations may apply. For Part 25 airplanes, use of red for low IFR, convective SIGMETs, and certain special use airspace is not acceptable.

b. Functionality. This TSO's standards apply to equipment intended to display weather and NAS status information by promoting pilot awareness of reported weather and NAS status. The operational goal of FIS-B equipment is to enhance pilot decision-making during strategic flight planning. We consider FIS-B products to be advisory information only. As such, FIS-B is non-binding advice and information provided to help pilots fly safely. The standards of this TSO do not cover integration with other avionics and airborne applications, such as integration of FIS-B displays with displays of terrain, aircraft traffic information, moving maps, and flight plan overlays. Manufacturers, installers, and applicants must assess the potential impact of display integration issues on the referenced FIS-B hazard classification (See paragraph **5.b.(3)** below) during equipment installation.

c. Failure Condition Classification. Failure of the function defined in paragraphs **3**. and **3.b.** of this TSO is a minor failure condition. Develop FIS-B data link systems and equipment to at least the design assurance level commensurate with this failure condition classification.

d. Functional Qualification. Demonstrate the required performance under the test conditions in RTCA/DO-267A, Minimum Aviation System Performance Standards (MASPS) for Flight Information Services-Broadcast (FIS-B) Data Link, Section 4, dated April 04, 2004.

e. Environmental Qualification. Test the equipment to the conditions in RTCA/DO-160D, Environmental Conditions and Test Procedures for Airborne Equipment, including Change 1, dated, December 14, 2000, Change 2, dated, June 12, 2001, and Change 3, dated December 5, 2002. Standards for these test procedures are located in RTCA/DO-160D, Appendix A.

f. Software Qualification. If the article includes a digital computer, develop the software according to RTCA/DO-178B, Software Considerations in Airborne Systems and Equipment Certification, Sections 2 and 5, dated December 1, 1992.

g. Deviations. We have provisions for using alternative or equivalent means of compliance to the criteria in this TSO. If you invoke these provisions, you must show that your equipment maintains an equivalent level of safety. Apply for a deviation per 14 CFR § 21.609.

4. MARKING.

a. Mark at least one major component permanently and legibly with all the information in 14 CFR § 21.607(d), except for:

(1) 14 CFR § 21.607(d)(2): where you must use the name, type, and part number. Do not use the optional model number; and

(2) 14 CFR § 21.607(d)(3): where you must use the date of manufacture instead of the optional serial number, when that information is critical for maintenance and/or inspections.

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);

(2) Each interchangeable element; and

(3) Each sub-assembly of the article that you determine may be interchangeable.

c. If the component includes a digital computer, the part number must include hardware and software identification. Or, you can use a separate part number for hardware and software. Either approach must include a means of showing the modification status.

> **NOTE:** Similar software versions, approved to different software levels, must be differentiated by part number.

d. When it applies, identify the equipment as an incomplete system or that the appliance accomplishes additional functions beyond that described in paragraphs **3**, **3.a.**, and **3.b.** of this TSO.

5. APPLICATION DATA REQUIREMENTS. Under 14 CFR Part 21.605(a)(2), you as a manufacturer or designer, must furnish the FAA's Aircraft Certification Office (ACO) responsible for your facilities, one copy each of the following technical data to support our design and production approval:

a. Operating instructions and equipment limitations, sufficient to describe the operational capability of the equipment. Operational or installation limitations resulting from specific deviation granted must be described in detail. The Airplane/Rotorcraft Flight Manual, Section 3, Normal Operating Procedures, should state the following:

> "FIS-B information is to be used as a strategic planning tool for pilot decisions on avoiding areas of inclement weather that are beyond visual range or where poor visibility precludes visual acquisition of inclement weather. FIS-B weather and NAS status information may be used as follows:

(1) To promote pilot awareness of ownership location with respect to reported weather, including hazardous meteorological conditions, NAS status indicators, and enhance decision-making during strategic flight planning activities.

(2) To cue the pilot to communicate with the Air Traffic Control controller, Aircraft Flight Service station specialist, operator dispatch, or airline operations control center for general and mission critical meteorological information, NAS status conditions, or both.

FIS-B information, including, weather information, NOTAMs, and TFR areas, are intended for the purpose of assisting in strategic flight planning only. The system lacks sufficient resolution and updating necessary for tactical maneuvering."

b. Installation procedures and limitations, sufficient to ensure that the FIS-B data link system, when installed according to the installation procedures, continue to meet the requirements of this TSO. Limitations must identify any unique aspects of the installation. Finally, the limitations must include a note with the following statement:

"The conditions and tests for TSO approval of this article are minimum performance standards. Those installing this article, on or in a specific type or class of aircraft, must determine that the aircraft installation conditions are within the TSO standards. TSO articles must have separate approval for installation in an aircraft. The article may be installed only according to 14 CFR, Part 43, or the applicable airworthiness requirements."

c. When applicable, identify the equipment as an incomplete system or that the equipment accomplishes additional functions beyond that described in paragraphs **3** and **3.a.** of this TSO. Describe the intended functions provided by the equipment.

d. Hardware and software design assurance requirements may vary, depending on equipment installation guidelines. If you are a manufacturer, identify in the Installation Manual (IM), the Component Maintenance Manual (CMM), or both, the hardware and software design assurance to which the equipment is qualified. The IM or CMM entry should include the following statement, or equivalent.

"The FIS-B equipment installer needs to assess FIS-B equipment integration with other avionics and airborne applications, such as integration of FIS-B display products with display of terrain, proximate aircraft traffic information, flight plan overlays, moving map displays, and so forth. Manufacturers, installers, and applicants must assess identification of display integration issues, and their potential impact upon FIS-B equipment design and developmental assurance, during equipment installation. For example, FIS-B equipment may share common avionics display resources hosting

multiple applications. Evaluate the installation for hazards contributed by FIS-B equipment malfunction that may cause loss or malfunction of other aircraft applications. Limited display resource computing capability will require the installer to review display resource priority schemes to ensure FIS-B equipment does not preclude, corrupt, or delay display of applications necessary for the continued safe flight of the aircraft. Installers must assess the incompatible use of common color coding philosophies and symbology."

e. Schematic drawings as applicable to the installation procedures.

f. Wiring diagrams as applicable to the installation procedures.

g. Equipment Specifications.

h. List of the components, by part number, that make up the FIS-B data link system complying with the standards prescribed in this TSO. Manufacturers should include vendor part number cross-references when applicable.

i. A CMM or IM covering periodic maintenance, calibration and repair, for the continued airworthiness of installed equipment, including recommended inspection intervals and service life. Details of deviations and limitations, as noted in paragraph 5.a and 5.b of this TSO, may also be described in the CMM, IM or both.

j. Material and process specifications list.

k. The quality control system description required by 14 CFR §§ 21.605(a)(3) and 21.143(a) including functional test specifications used to test each production article.

l. Manufacturer's TSO qualification test report.

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

n. A list of all drawings and processes, including revision level, to define the article's design. If the change is minor, make the revisions available only upon request.

o. An environmental qualifications form, described in RTCA/DO-160D, for each component of the system.

p. If the article includes a digital computer: a Plan for Software Aspects of Certification (PSAC); Software Configuration Index; and Software Accomplishment Summary. We recommend that you submit the PSAC early in the software development process. Early submittal allows us to quickly resolve issues, such as partitioning and determining software levels.

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

a. The functional qualification specifications used to qualify each production article.

b. Equipment calibration procedures.

c. Corrective maintenance procedures within 12 months after TSO authorization.

d. Schematic drawings.

e. Wiring diagrams.

f. Material and process specifications.

g. The results of the environmental qualification tests conducted per RTCA/DO-160D.

h. If the article includes a digital computer, include the appropriate documentation defined in RTCA/DO-178B, including all data supporting the applicable objectives in Annex A of RTCA/DO-178B, Process Objectives and Outputs by Software Level.

7. FURNISHED DATA REQUIREMENTS. With each article manufactured under this TSO, provide the following:

a. One copy of the data in paragraphs **5.a**. through **5.i.** of this TSO. Add any other data necessary for proper installation, certification and use, or for continued airworthiness or both, of the equipment you manufactured under this TSO.

b. One copy of the data in paragraphs **5.n.** through **5.p.,** if the appliance performs functions beyond those described in paragraph **3.** and **3.a.** of this TSO. You must send these data to each person receiving one or more FIS-B data link system for use.

8. AVAILABILITY OF REFERENCED DOCUMENTS.

a. You can buy copies of RTCA/DO-267A, RTCA/DO-160D (including Changes 1, 2 and 3), RTCA/DO-178B, and RTCA/DO-186A (including Changes 1 and 2) from RTCA Inc., 1828 L Street NW, Suite 805, Washington, D.C. 20036-4001. Copies also can be obtained from the RTCA Internet website at: www.rtca.org.

b. You can buy copies 14 CFR part 21, Subpart O from the Superintendent of Documents, Government Printing Office, Washington, DC 20402-9325. You can also obtain copies from the Government Printing Office (GPO), electronic CFR Internet website at: www.access.gpo.gov/ecfr.

c. You can order AC 20-110L (or current revision), Index of Aviation Technical Standard Orders, AC 20-115B (or current revision) and the related ACs listed below from the U.S. Department of Transportation, Subsequent Distribution Office, M-30, Ardmore East Business Center, 3341 Q 75th Avenue, Landover, MD 80785, telephone (301) 322-4477 or FAX (301)

386-5394. You can also obtain copies from the Federal Aviation Administration Internet website at: www.faa.gov/.

(1) AC 23.1311-1, Installation of Electronic Displays in Part 23 Airplanes, March 13, 1999.

(2) AC 25-11, Transport Category Airplane Electronic Display Systems, July 16, 1987.

d. You can get Advisory Circular (AC) 20-110L (or current revision), "Index of Aviation Technical Standard Orders", and AC 20-115B (or current revision), "RTCA, Inc., Document RTCA/DO-178B", from the U.S. Department of Transportation, Subsequent Distribution Office, M-30, Ardmore East Business Center, 3341 Q 75th Avenue, Landover, MD 80785, telephone (301) 322-4477 or FAX (301) 386-5394. You can also get copies from our Regulatory and Guidance library at: www.airweb.faa.gov/rgl. On the RGL WebPages, select "Advisory Circulars."

e. You can get copies of the following Technical Standard Orders from our Regulatory and Guidance library at: www.airweb.faa.gov/rgl. On the RGL WebPages, select "Technical Standard Orders."

(1) TSO-C151b, Terrain Awareness And Warning System, Appendix 3 Supplemental Information, December 17, 2002.

(2) TSO-C119b, Traffic Alert and Collision Avoidance System (TCAS) Airborne Equipment, TCAS II; December 18, 1998.

(3) TSO-C165, Electronic Map Display Equipment for Graphical Depiction of Aircraft Position, September 30, 2003.

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