



Technical Standard Order

Subject: TSO-C165, Electronic Map Display Equipment for Graphical Depiction of Aircraft Position

1. PURPOSE. This Technical Standard Order (TSO) tells persons seeking a TSO authorization or letter of design approval what minimum performance standards (MPS) their Electronic Map Displays (EMDs) must first meet in order to obtain approval and be identified with the applicable TSO marking.

2. APPLICABILITY. This TSO is effective for new applications submitted after the effective date of this TSO.

3. REQUIREMENTS. New models of EMDs that are to be so identified and that are manufactured on or after the effective date of this TSO must meet the MPS for moving map equipment in Section 2 of RTCA Document No. (RTCA/DO)-257A, “Minimum Operational Performance Standards for the Depiction of Navigational Information on Electronic Maps,” dated June, 25, 2003. EMDs for use in flight must meet the MPS in Sections 2.1 and 2.2 of RTCA/DO-257A, EMDs for use on the airport surface must meet the MPS in Sections 2.1, 2.2, and 2.3 of RTCA/DO-257A, and EMDs including Vertical Situation Displays (VSD) for use in facilitating pilot’s awareness of the aircraft’s vertical flight path must meet the MPS in Sections 2.1, 2.2, and 2.4 of RTCA/DO-257A.

a. Functionality. The standards of this TSO apply to equipment intended to provide graphical depiction of navigation information on the EMD used to improve the flight crew awareness of the aircraft ownership position relative to other items depicted on the EMD.

b. Failure Condition Classification. Failure of the functions defined in paragraph 3 and 3a of this TSO for EMDs used in flight and VSD equipment (airborne applications) have been determined to be a major failure condition for malfunctions causing the display of misleading information. Failure of the function defined in paragraph 3 and 3a of this TSO for EMDs used on the airport surface (ground applications) have been determined to be a minor failure condition for malfunctions causing the display of misleading information. Loss of function for EMDs used in flight and VSD equipment (airborne applications) have been determined to be a minor failure condition. Loss of function for EMDs used on the airport surface (ground applications) is

determined to be a no safety effect failure condition. The applicant must develop the system to at least the design assurance level commensurate with the applicable hazard classification(s).

c. Functional Qualification. The required performance shall be demonstrated under the test conditions and procedures specified in RTCA/DO-257A, Section 2.

d. Environmental Qualifications. The equipment shall be subject to the test conditions in RTCA/DO-160D, "Environmental Conditions and Test Procedures for Airborne Equipment," through Change 3, dated December 5, 2002.

e. Software Qualifications. If the article includes software, develop the software in accordance with RTCA/DO-178B, "Software Considerations in Airborne Systems and Equipment Certification," dated December 1, 1992.

f. Deviations. The FAA has provisions for using alternative or equivalent means of compliance to the criteria set forth in the MPS of this TSO. Applicants invoking these provisions shall demonstrate that an equivalent level of safety is maintained and shall apply for a deviation per 14 CFR § 21.609.

4. MARKING. Under 14 CFR § 21.607(d), articles manufactured under this TSO must be marked as follows:

a. At least one major component must be permanently and legibly marked with all of the information listed in 14 CFR § 21.607(d), except for the following: the option in 14 CFR § 21.607(d)(2), where the name, type and part number must be used in lieu of the optional model number; and the option in 14 CFR § 21.607(d)(3), where the date of manufacture must be used in lieu of the optional serial number.

b. In addition to the requirements of 14 CFR § 21.607(d), each separate component that is easily removable (without hand tools), each interchangeable element, and each separate sub-assembly of the article that the manufacturer determines may be interchangeable must be permanently and legibly marked with at least the name of the manufacturer, manufacturer's subassembly part number, and the TSO number.

c. If the component includes a digital computer, the part number must include hardware and software identification, or a separate part number may be utilized for hardware and software. Either approach must include a means for showing the modification status. Note that similar software versions, which have been approved to different software levels, must be differentiated by part number.

d. When applicable, identify the article as an incomplete system or that the article accomplishes additional functions beyond that described in paragraph 3 and 3a of this TSO.

5. DATA REQUIREMENTS.

a. Application Data. Under 14 CFR § 21.605(a)(2), the manufacturer must furnish the Manager, Aircraft Certification Office (ACO), Federal Aviation Administration (FAA),

responsible for the manufacturer's facilities, one copy each of the following technical data to support the FAA design and production approval. For EMDs that are for use on the airport surface and will be used as a portable device, paragraphs **5a(3)** and **5a(4)** do not apply.

(1) Operating instructions and equipment limitations. The limitations shall be sufficient to describe the operational capability of the equipment, including the EMD functions that are provided (e.g., use in flight, use on airport surface, VSD). In particular, operational or installation limitations resulting from specific deviations granted must be described in detail.

(2) Installation/Interface procedures and limitations. The limitations shall be sufficient to ensure that the EMDs, when installed in accordance with the installation procedures, continues to meet the requirements of this TSO. The limitations shall identify any unique aspects of the installation. Finally, the limitations shall include a note with the following statement:

The conditions and tests required for TSO approval of this article are minimum performance standards. It is the responsibility of those installing this article either on or within a specific type or class of aircraft to 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 if performed under 14 CFR part 43 or the applicable airworthiness requirements.

(i) If the software qualification limits the equipment to be eligible on certain aircraft types, identification must be in place to show qualification level and the equipment should be determined to be eligible for all aircraft types (e.g., AC 23-1309-1C, "Equipment, Systems, and Installations in Part 23 Airplanes," states that the DO-178B Level D software may be associated with a major failure condition for certain aircraft types).

(ii) When applicable, identify the article as an incomplete system or a multi-use system and describe the functions that are intended to be provided by the article.

(3) Schematic drawings, as applicable to the installation procedures.

(4) Wiring drawings, as applicable to the installation procedures.

(5) List of the components, by part number, that make up the Electronic Map Display system complying with the standards prescribed in this TSO. Manufacturers should include vendor part number cross-references when applicable.

(6) Instructions, in the form of a Component Maintenance Manual (CMM). These should contain information on the periodic maintenance, calibration and repair, for the continued airworthiness of the EMDs, including recommended inspection intervals and service life. Details of deviations granted, as noted in paragraph **5a(1)** of this TSO, may also be described in the CMM.

(7) An environmental qualifications form as described in RTCA/DO-160D for each component of the system.

(8) Materials and process specifications list.

(9) The quality control system description required by 14 CFR §§ 21.605(a)(3) and 21.143(a) including functional test specifications to be used to test each production article to ensure compliance with this TSO.

(10) Manufacturer's TSO qualification test report.

(11) Nameplate drawing providing the information required by paragraph 4 of this TSO.

(12) A list of all drawings and processes, including revision level, necessary to define the article's design. In the case of a minor change, any revisions to the drawing list need only be made available upon request.

(13) If the article includes a digital computer: Plan for Software Aspects of Certification (PSAC); Software Configuration Index; and Software Accomplishment Summary, as defined in RTCA/DO-178B. The FAA recommends that the PSAC be submitted early in the software development process. Early submittal will allow timely resolution of issues such as partitioning and determining software levels.

b. Manufacturer Data. In addition to the data to be furnished directly to the FAA, each manufacturer must have available for review by the manager of the ACO responsible for the manufacturer's facilities the following technical data:

(1) The functional qualification specifications to be used to qualify each production article to ensure compliance with this TSO.

(2) Equipment calibration procedures.

(3) Corrective maintenance procedures within 12 months after TSO authorization.

(4) Schematic drawings.

(5) Wiring diagrams.

(6) Material and process specifications.

(7) The results of the environmental qualification tests conducted in accordance with RTCA/DO-160D.

(8) If the article includes a digital computer, the appropriate documentation as defined in RTCA/DO-178B, including all data supporting the applicable objectives found in Annex A of RTCA/DO-178B.

c. Furnished Data.

(1) One copy of the data and information specified in paragraphs 5(a)(1) through (7) of this TSO and any other data or information necessary for the proper installation, certification and use and/or for continued airworthiness of the EMDs, must accompany each article manufactured under this TSO.

(2) If the appliance accomplishes any additional functions beyond that described in paragraph 3 and 3a of this TSO, then a copy of the data and information specified in paragraphs 5(a)(11) through (13) that pertains to those functions must also go to each person receiving for use one or more articles manufactured under this TSO.

6. AVAILABILITY OF REFERENCED DOCUMENTS

a. You may buy copies of RTCA/DO-160D, RTCA/DO-178B, and RTCA/DO-257A from RTCA Inc., 1828 L Street, NW, Suite 805, Washington, D.C. 20036 or their website at www.rtca.org.

b. You may buy copies of Federal Aviation Regulations 14 CFR part 21, Subpart O from the Superintendent of Documents, Government Printing Office, Washington, D.C. 20402-9325. Copies also can be obtained from the Government Printing Office (GPO), electronic CFR Internet website at www.access.gpo.gov/ecfr/.

c. Advisory Circular (AC) 20-110, "Index of Aviation Technical Standard Orders", and AC 20-36, "Index of Articles Certified under the Technical Standard Order System" may be obtained from the U.S. Department of Transportation, Subsequent Distribution Office, Ardmore East Business Center, 3341 Q 75th Avenue, Landover, MD 20785, telephone (301) 322-4477 or FAX (301) 386-5394. Copies also may be obtained from the FAA Internet website at www.faa.gov/certification/aircraft/TSOA.htm.

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