



Technical Standard Order

**Subject: TSO-C113, AIRBORNE MULTIPURPOSE ELECTRONIC
DISPLAYS**

a. Applicability.

(1) Minimum Performance Standard. This technical standard order (TSO) prescribes the minimum performance standard that airborne multipurpose electronic displays must meet in order to be identified with the applicable TSO marking. Airborne multipurpose electronic displays that are to be so identified and that are manufactured on or after the date of this TSO must meet the minimum performance standard set forth in the Society of Automotive Engineers, Inc. (SAE) Aerospace Standard (AS) document No. AS 8034, "Minimum Performance Standard for Airborne Multipurpose Electronic Displays," dated December 30, 1982, except as noted below:

(2) Exceptions:

(i) Applicable Documents.

(a) Reword the last sentence of paragraph 2.1 as follows: With the exception of the Federal Aviation Regulations (FAR), in the event of conflict between these documents and this standard, the contents of this standard shall govern.

(b) In lieu of paragraph 2.1.1 substitute the following: 2.1.1 Federal Aviation Regulations (FAR): The applicable portions of the FAR Parts 21, 23, and 25 should be adhered to.

(c) Delete paragraph 2.1.2 and the note "Currently in Preparation."

(d) Renumber paragraph 2.1.3 as 2.1.2, and reword it as follows:

2.1.2 Other:

(1) Radio Technical Commission for Aeronautics (RTCA) document No. RTCA/DO-160B, "Environmental Conditions and Test Procedures for Airborne Equipment," dated July 1984.

(2) Electronic Industries Association (EIA) document No. RS-503, "Recommended Practice for the Measurement of X-Radiation from Direct View Television Picture Tubes," dated November 1983.

(e) Reword paragraph 2.2 as follows:

2.2 Related Documents. SAE document No. ARP 1068B, "Flight Deck Instrumentation, Display Criteria and Associated Controls for Transport Aircraft," dated September 30, 1985, provides information related to the equipment of this aerospace standard.

(i) Fail Safe Provision. Renumber paragraph 3.8.2 as 3.9 Fail Safe Provision. Delete paragraph 3.10 Identification, and renumber paragraph 3.9 Multiple Mode Indications as paragraph 3.10. The numbering of the remaining paragraphs will be unchanged.

(ii) Color. Add the following information to paragraph 4.3.3:
The following depicts acceptable display colors related to their functional meaning for electronic display systems:

(a) Display feature should be color coded as follows:

Warnings	Red
Flight envelope and system limits	Red
Cautions, abnormal sources	Amber/Yellow
Earth	Tan/Brown
Scales and associated figures	White
Engaged modes	Green
Sky	Cyan/Blue

(b) Precipitation and turbulence areas should be coded as follows:

Precipitation up to 4 millimeter per hour(mm/hr)	Green
4 - 12 mm/hr	Amber/Yellow
12 - 50 "	Red
Above 50 "	Magenta
Turbulence "	White or Magenta

- (c) Background color: Background color may be used to (gray or other shade) enhance display presentation.

Colors must track brightness so that chrominance and relative chrominance separation are maintained as much as possible during day-night operations.

(3) Environmental Standard. The conditions and procedures prescribed in Radio Technical Commission for Aeronautics (RTCA) document No. DO-160B, "Environmental Conditions and Test Procedures for Airborne Equipment," dated July 1984, are to be used in lieu of RTCA Document No. DO-160A, "Environmental Conditions and Test Procedures for Airborne Equipment," dated January 1980.

(4) Computer Software. If the equipment design implementation includes a digital computer, the computer software must be verified and validated in an acceptable manner. One acceptable means of compliance for the verification and validation of the computer software is outlined in RTCA document No. RTCA/DO-178A, "Software Considerations in Airborne Systems and Equipment Certification," dated March 1985. For those applicants who elect to use RTCA document No. RTCA/DO-178A to demonstrate compliance for the verification and validation of the computer software, the following requirements must be met:

(i) RTCA document No. RTCA/DO-178A defines three levels of software: Level 1, Level 2, and Level 3. The applicant must declare the level (or levels) to which the computer software has been verified and validated. This equipment may incorporate more than one software level. The software for navigation functions must be verified and validated to at least Level 2.

(ii) The applicant must submit a software verification and validation plan for review and approval.

NOTE: The Federal Aviation Administration (FAA) strongly recommends early discussion and agreement between the applicant and the FAA on the applicant's proposed software verification and validation plan, and the applicant's proposed software level or levels.

b. Marking. In addition to the marking specified in Federal Aviation Regulations (FAR) Section 21.607(d), the following information shall be legibly and permanently marked on the major equipment components.

(1) Each separate component of equipment that is manufactured under this TSO (antenna, receiver, transmitter, etc.) must be permanently and legibly marked with at least the name of the manufacturer and the TSO number.

(2) With regard to FAR § 21.607(d)(2), the part number is to 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 modification status.

(3) The level(s) to which the computer software has been verified and validated.

c. Data Requirements.

(1) In addition to FAR § 21.605, the manufacturer must furnish the Manager, Aircraft Certification Office (ACO), Federal Aviation Administration (FAA), having purview of the manufacturer's facilities, one copy each of the following technical data:

- (i) Operating instructions.
- (ii) Equipment limitations.
- (iii) Installation procedures and limitations.
- (iv) Schematic drawings as applicable to the installation procedures.
- (v) Wiring diagrams as applicable to the installation procedures.
- (vi) Specifications.
- (vii) List of the major components (by part number) that make up the equipment system complying with the standards prescribed in this TSO.
- (viii) An environmental qualification form as described in RTCA document DO-160B.
- (ix) Manufacturer's TSO qualification test report.
- (x) Nameplate drawing.
- (xi) The appropriate documentation as defined in RTCA/DO-178A, or equivalent, necessary to support the verification and validation of the computer software to Level 1, Level 2, or Level 3. If the software is verified and validated to more than one level, the appropriate documentation for all levels must be submitted.

(2) In addition to those data requirements that are to be furnished directly to the FAA, each manufacturer must have available for review by the Manager, ACO having purview of the manufacturer's facilities, the following technical data:

- (i) A drawing list, enumerating all the drawings and processes that are necessary to define the article design.
- (ii) The functional test specification to be used to test each production article to ensure compliance with this TSO.

- (iii) Equipment calibration procedures.
- (iv) Corrective maintenance procedures (within 12 months after TSO authorization).
- (v) Schematic drawings.
- (vi) Wiring diagrams.
- (vii) Documentation to support the computer software verification and validation plan for Level 1, Level 2, or Level 3 software.
- (viii) The appropriate documentation as defined in RTCA/DO-178A, or equivalent, necessary to support the verification and validation of the computer software to Level 1, Level 2 or Level 3. If the software is verified and validated to more than one level, the appropriate documentation for all levels must be available for review.
- (ix) The results of the environmental qualification tests conducted in accordance with RTCA DO-160B.

d. Data to be furnished with manufactured units. One copy of the data and information specified in paragraphs (c)(1)(i) through (viii) of this TSO, and instructions for periodic maintenance and calibration which are necessary for continued airworthiness must go to each person receiving for use one or more articles manufactured under this TSO.

e. Availability of Reference Documents.

(1) Copies of SAE document Nos. AS 8034 and ARP 1068B may be purchased from the Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale, PA 15096.

(2) Copies of RTCA document Nos. RTCA/DO-178A and DO-160B may be purchased from the Radio Technical Commission for Aeronautics Secretariat, One McPherson Square, 1425 K Street, NW., Suite 500, Washington, DC 20005.

(3) Copies of EIA document No. RS-503 may be purchased from the Electronics Industries Association, 2001 I Street, NW., Washington, DC 20006.

(4) Federal Aviation Regulations, Part 21, Subpart O, and Advisory Circular 20-110C, "Index of Aviation Technical Standard Orders," may be reviewed at FAA Headquarters in the Office of Airworthiness, Aircraft Engineering Division (AWS-120), and at all regional ACO's.

/S/ M. C. Beard
Director of Airworthiness