Number：CTSO-C113b
Date of approval：
Approved by：

China Civil Aviation Technical Standard Order

This China Civil Aviation Technical Standard Order (CTSO) is issued according to Part 37 of the China Civil Aviation Regulations (CCAR-37). Each CTSO is a criterion which the concerned aeronautical materials, parts or appliances used on civil aircraft must comply with when it is presented for airworthiness certification.

Airborne Multipurpose Electronic Displays

1. Purpose.

This China Civil Aviation Technical Standard Order (CTSO) is applicable to the manufacturer of the Project Approval for application of CTSO authorization (CTSOA) for airborne multipurpose electronic displays. This CTSO specifies the minimum performance standards that airborne multipurpose electronic displays must meet in order to be approved and identified using the applicable CTSO markings.

2. Applicability.

This CTSO affects new application submitted after its effective date.

a. From the effective date of this CTSO, applicants who wish to obtain the CTSOA of airborne multipurpose electronic displays should submit applications in accordance with this CTSO. CTSO-C113a will also remain effective until 24 months from this CTSO release. After this date, we will no longer accept new applications for CTSO-C113a.

b. From of the effective date of this CTSO, equipment that approved under CTSO-C113a may still be manufactured under the provisions of its original approval.

c. Major design changes to article approved under this CTSO will require a new authorization in accordance with section 21.353 of CCAR-21R4.

3. Requirements.

New models of airborne multipurpose electronic displays identified and manufactured on or after the effective date of this CTSO must meet the requirements in sections 3 and 4 of the Society of Automotive Engineers (SAE) Aerospace Standard (AS) 8034C, Minimum Performance Standards for Airborne Multipurpose Electronic Displays, dated July 30, 2018. Additional requirements on color can be found in Appendix 1 of this document.

Note: The Failure Modes and Effects Analysis (FMEA) in SAE AS 8034C Section 3.8.3 is only required when applicable.

a. Functionality.

This CTSO apply to equipment intended for use as an electronic display in the flight deck by flight crew operating aircraft certificated pursuant to CCAR-23, CCAR-25, CCAR-27 or CCAR-29. This CTSO covers basic display standards, but does not include specific application requirements. Specific applications can include flight instrumentation,

navigation, engine and system status, alerting, surveillance, communication, terrain awareness, weather, and other displays. Additionally, this CTSO does not provide standards for head up displays or head worn displays. TSO-C210 or Later revisions provide requirements on head up displays.

b. Failure Condition Classifications.

There is no standard minimum failure condition classification for this CTSO. The failure condition classification appropriate for the equipment will depend on the intended use of the equipment in a specific aircraft. Document the loss of function and malfunction failure condition classification for which the equipment is designed.

c. Functional Qualification.

This CTSO does not define the test procedures to verify functional performance. The manufacturer must define the appropriate tests to verify compliance with the SAE (AS) 8034C Section 4 requirements for the airborne multipurpose electronic display.

d. Environmental Qualification.

Demonstrate the required performance, including touchscreen performance if applicable, under the test conditions specified in SAE AS 8034C, section 5 using standard environmental conditions and test procedures appropriate for airborne equipment. You may use a different standard environmental condition and test procedure than

RTCA/DO-160G, Environmental Conditions and Test Procedures for Airborne Equipment, as directed in AS 8034C, provided the standard is appropriate for the airborne multipurpose electronic display.

Note: The use of RTCA/DO-160D (with Changes 1 and 2 only) or earlier versions is generally not considered appropriate and will require substantiation via the deviation process as discussed in paragraph 3.g of this CTSO.

e. Software Qualification.

If the article includes software, develop the software according to RTCA/DO-178C, Software Considerations in Airborne Systems and Equipment Certification, dated December 13, 2011, including referenced supplements as applicable, to at least the software level consistent with the failure condition classification defined in paragraph 3.b of this CTSO. If RTCA/DO-178B, dated December 1, 1992 is used as a method of software development compliance, CAAC reserves the right to require applicants to meet additional requirements in addition to RTCA/DO-178B.

f. Electronic Hardware Qualification.

If the article includes complex custom airborne electronic hardware, develop the component according to RTCA/DO-254, Design Assurance Guidance for Airborne Electronic Hardware, dated April 19, 2000, to at least the design assurance level consistent with the failure condition

classification defined in paragraph 3.b of this CTSO. For custom airborne electronic hardware determined to be simple, RTCA/DO-254, paragraph 1.6 applies.

g. Deviations.

For using alternative or equivalent means of compliance to the criteria in the MPS of this CTSO, the applicant must show that the equipment maintains an equivalent level of safety. Apply for a deviation pursuant to 21.368(a) in CCAR-21R4.

4. Marking.

a. Mark at least one major component permanently and legibly with all of the information in 21.423(b) of CCAR-21R4. The marking must include the serial number.

b. 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.

c. The applicant 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.

5. Application Data Requirements.

You must give CAAC a statement of conformance, pursuant to section 21.353(a)(1) in CCAR-21R4 and one copy each of the following technical data to support your design and production approval.

a. Manuals containing the following:

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

(2) Detailed description of all deviations.

(3) Installation procedures and limitations sufficient to ensure that the airborne multipurpose electronic display, when installed according to installation or operational procedures, still meets this CTSO's requirements. Limitations must identify any unique aspects of the installation. The limitations must also include a note with the following statement:

"This article meets the minimum performance and quality control standards required by a CTSO. Installation of this article requires separate approval."

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

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

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

(iii) 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 airborne multipurpose electronic display.

(7) By-part-number list of replaceable components that makes up the airborne multipurpose electronic display. Include vendor part number cross-references, when applicable.

b. Instruction of continued airworthiness, including the requirements for periodic maintenance, calibration and repair of equipment, to ensure that the airborne multipurpose electronic display continues to meet the CTSO approved design. If applicable, the recommended inspection interval and service life should be included.

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

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. A drawing depicting how the article will be marked with the information required by paragraph 4 of this CTSO.

f. Identify functionality contained in the article not evaluated under paragraph 3 of this CTSO (defined as non-CTSO functions). Non-CTSO functions are accepted in parallel with the CTSOA. 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) do not interfere with the article's compliance with the requirements of paragraph 3.

(2) Installation procedures and limitations sufficient to ensure that the non-CTSO 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-CTSO function(s) described in paragraph 5.f.(1).

(4) Interface requirements and applicable installation test procedures to ensure compliance with the non-CTSO function(s)

performance data defined in paragraph 5.f.(1).

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

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

g. The quality system description required by section 21.358 of CCAR-21R4, including functional test specifications. The quality system must ensure that you will detect any change to the approved design that could adversely affect compliance with the CTSO MPS, and reject the article accordingly. Applicants who currently hold CTSOAs must submit revisions to the existing quality manual as necessary (not required for applicants that don’t hold CTSOA).

h. Provide a description of the organization as required by 21.355 of CCAR-21-R4.

i. Material and process specifications list.

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

k. Manufacturer’s CTSO qualification report showing results of testing accomplished according to paragraph 3.c of this CTSO.

6. Manufacturer Data Requirements.

Besides the data given directly to CAAC, have the following technical data available for review by CAAC:

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

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 CTSO.

g. If the article includes software, the appropriate documentation defined in RTCA/DO-178C or RTCA/DO-178B specified in paragraph 3.e of this CTSO, including all data supporting the applicable objectives called for RTCA/DO-178C or 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-l. For simple custom airborne electronic hardware, the following data are required: 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-CTSO function(s), you must also make items 6.a through 6.h available as they pertain to the non-CTSO function(s).

7. Furnished Data Requirements.

a. When furnishing one or more articles manufactured under this CTSO to one entity (such as an operator or repair station), provide one copy access to the data in paragraphs 5.a and 5.b of this CTSO. Add any other data needed for the proper installation, certification, use, or continued compliance with this CTSO, of the airborne multipurpose electronic display.

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

8. Availability of Referenced Documents.

a. Order RTCA documents from RTCA Inc., 1150 18th Street 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 SAE documents from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001. Telephone: (724) 776-4970, fax: (724) 776-0790. You can also order copies online at www.sae.org.

Appendix 1. Color

SAE AS 8034C section 4.3.4 requires color coding to meet airworthiness standards for the appropriate category for CCAR 2x.1322 (i.e.23.1322, 25.1322, 27.1322, or 29.1322). This appendix provides additional guidance on color.

1. Display features, precipitation, and turbulence areas should be color coded as depicted in Table A1 and Table A2, respectively, unless otherwise specified by the CTSO application being displayed.

Table A1

Display Feature	**Color**
Warnings	Red
Flight envelope and system limits	Red[Note 1]
Cautions, non-normal sources	Amber[Note 1]
Scales and associated figures	White[Note 2]
Earth	Tan/Brown
Sky	Cyan/Blue
Engaged Modes/normal conditions/safe operation	Green

Note 1: The use of the colors red (warning) and amber (caution), for functions other than flightcrew alerting, should be limited and should not adversely affect flightcrew alerting. If the colors red and amber are

proposed for non-alerting functions, coordinate with the certification authority on appropriate means to demonstrate this use does not adversely affect flightcrew response to alerts.

Note 2: Use of the color green for tape elements (for example, airspeed and altitude) has also been found acceptable if the color green does not adversely affect flight crew alerting.

Table A2

Precipitation and Turbulence	**Color**
Precipitation up to 4 millimeters per hour (mm/hr)	Green
Precipitation 4-12mm/h	Amber
Precipitation 12-50mm/h	Red
Precipitation Above 50mm/h	Magenta
Turbulence	White or Magenta

2. Background color (gray or other shade) may be used to enhance display presentation, however, the color selected should not impair the use of the overlaid information elements. Labels, display-based controls, menus, symbols, and graphics should all remain identifiable and distinguishable.

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

4. A red ‘X’ can be used to denote a failure of the display or parameters.

(The English version is for reference only. In case of any discrepancy or ambiguity of meaning between this English translation and the Chinese version, the latter shall prevail.)