



Number: CTSO-C151d

Date of approval: June 12, 2023

Approved by: Yang Zhenmei

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.

Terrain Awareness and Warning Systems (TAWS)

1. Purpose.

This China Civil Aviation Technical Standard Order (CTSO) is for manufacturers applying for Terrain Awareness and Warning System (TAWS) CTSO authorization (CTSOA). This CTSO specifies the minimum performance standards that TAWS must meet for approval and identification with the applicable CTSO marking.

2. Applicability.

This CTSO affects new applications submitted after its effective date.

a. Since the effective date of this CTSO, applicants who wish to obtain the CTSOA of Terrain Awareness and Warning System (TAWS) should submit applications in accordance with this CTSO. CTSO-C151b will also remain effective until 24 months from this CTSO release. After

this date, we will no longer accept new applications for CTSO-C151b.

b. Since the effective date of this CTSO, TAWS approved under a previous CTSO may still be manufactured under the provisions of its original approval.

3. Requirements.

New models of TAWS identified and manufactured on or after the effective date of this CTSO must meet the requirements in RTCA/DO-367, Minimum Operational Performance Standard (MOPS) for Terrain Awareness and Warning Systems (TAWS) Airborne Equipment, Section 2. Requirements for Class A, Class B, and Class C equipment are discussed in sections 2.2.1, 2.2.2 and 2.2.3, respectively. This equipment is intended for fixed-wing aircraft only.

a. Functionality.

This CTSO standard applies to equipment intended to provide flight crews with aural and visual alerts aimed at reducing the risk of CFIT accidents through increased terrain awareness. Class A systems include Terrain Displays intended to provide awareness to the flight crew of the aircraft's proximity to terrain.

b. Failure Condition Classifications.

(1) For Class A and B systems, failure of the function defined in paragraph 3.a due to a TAWS computer malfunction resulting in false terrain warnings, un-annunciated loss of function, or presentation of

misleading information is a major failure condition.

(2) For Class C systems, failure of the function defined in paragraph 3.a due to a TAWS computer malfunction resulting in false terrain warnings, un-announced loss of function, or presentation of misleading information is a minor failure condition.

(3) Loss of the function defined in paragraph 3.a is a minor failure condition.

(4) Design the system to at least these failure condition classifications.

c. Functional Qualification

Demonstrate the required functional performance under the test conditions specified in RTCA/DO-367, section 2.4. Test procedures for Class A, Class B, and Class C equipment are in sections 2.4.10, 2.4.11, and 2.4.12, respectively.

d. Environmental Qualification.

Demonstrate the required performance, under the test conditions specified in RTCA/DO-367, section 2.3 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, provided the standard is appropriate for the TAWS.

Note: The use of RTCA/DO-160D (with Changes 1 and 2 only,

without Change 3 incorporated) 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, or can assign separate areas for them.

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. The operating instructions must include information on the effects of loss of the Global Navigation Satellite System (GNSS) on the TAWS function if the TAWS relies on GNSS. Additionally, the instructions must contain processes for updating the terrain database.

(2) Detailed description of all deviations.

(3) Installation procedures and limitations sufficient to ensure that the TAWS, 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 requirements of CTSO-C151d. 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 the TAWS.

(7) By-part-number list of replaceable components that makes up the TAWS. 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 TAWS 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(or HCI, as applicable), 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-CTSO functions to be accepted, you must declare these functions and include the following information with your CTSO application:

(1) Description of the non-CTSO function(s), such as performance specifications, failure condition classifications, software, hardware, and environmental qualification levels. Include a statement confirming that the non-CTSO 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 CTSOAs).

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

i. Material and process specifications list.

j. A 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-178B or RTCA/DO-178C specified in paragraph 3.e of this CTSO, including all data supporting the applicable objectives in Annex A, Process Objectives and Outputs by Software Level of RTCA/DO-178B or RTCA/DO-178C.

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 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 TAWS.

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. You can also order copies online at www.rtca.org .

(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.)