English Translation Version for Reference Only

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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.

Detect and Avoid (DAA) Systems

1. Purpose.

This China Civil Aviation Technical Standard Order (CTSO) is for manufacturers applying for a Detect and Avoid (DAA) Systems CTSO authorization (CTSOA). This CTSO prescribes the minimum performance standards (MPS) that Detect and Avoid (DAA) Systems must first meet for approval and identification with the applicable CTSO marking.

2. Applicability.

This CTSO affects new application submitted after its effective date. Major design changes to article approved under this CTSO will require a new authorization in accordance with section 21.353 of CCAR-21-R4.

3. Requirements

New models of DAA equipment identified and manufactured on or

after the effective date of this CTSO must meet the MPS qualification and documentation requirements in Section 2 of RTCA Document No. RTCA DO-365, Minimum Operational Performance Standards for Detect and Avoid Systems, dated May 31, 2017, as appropriate to the functional equipment classes listed in Table 1, and paragraph 3.h. The different classes for this CTSO are defined by the different functionalities the system provides. Class 1 is the basic DAA system and Class 2 is the basic DAA system with Traffic Alert and Collision Avoidance System (TCAS) II (Version 7.1) functions except for traffic advisories. Each class is further subdivided into several individual articles with corresponding functionalities. Table 1 provides details of the functional equipment classes and articles.

Table 1 – DAA Classes and Articles

class	Equipment[1]	criticality		DAA Article Designation [2&3]	DAA Equipment Article Name	Function
		Loss of Function	Misleading Information			
1	DAA-Basic	major	major	A	Active Surveillance	Air Traffic Control Radar Beacon System (ATCRBS)/ModeS Intruder Detection, TCAS II Mode data, Collision Avoidance coordination data
				B	Unmanned Aircraft (UA) DAA Processor	Track Processing, DAA Alerting[2] and Guidance[2]

class	Equipment[1]	criticality		DAA Article Designation 2&3	DAA Equipment Article Name	Function
		Loss of Function	Misleading Information			
				C	Control Station (CS) DAA Processor	DAA Alerting[2] and Guidance[2]
				D	CS DAA Control Panel	DAA Mode Control
				E	CS DAA Traffic Display	Display of Traffic, Alerting, and Guidance Information
2	DAA with TCAS II	Major	Hazardous/ Severe Major (See 3.b.(2)(b))	A	TCAS II, Version 7.1	ATCRBS/Mode S Intruder Detection, TCAS II Resolution Advisories (RA)Status and coordination data, Collision Avoidance System Logic, Hybrid Surveillance
				B	UA DAA Processor	Track Processing, DAA Alerting[2] and Guidance[2]
				C	CS DAA Processor	DAA Alerting[2] and Guidance[2] with TCAS II Integration
				D	CS DAA Control Panel	DAA Mode Control with TCAS II Integration
				E	CS DAA Traffic Display	Display of Traffic, Alerting, Guidance, and RA Information

Notes:

1. In addition to the articles listed in Table 1, in order for the DAA system to function according to this CTSO, both Class 1 and Class 2 Equipment will require the integration of an Air-to-Air Radar for Traffic Surveillance (ATAR) to detect non-cooperative aircraft and an Automatic Dependent Surveillance-Broadcast (ADS-B) In system to receive ADS-B messages. CTSO-C212 provides the MPS for ATAR equipment. CTSO-C166b provides MPS for ADS-B In equipment for DAA systems. CTSO-C166b equipment used with DAA systems must be Class A, 1090 MHz with receive capability. CTSO-C154c equipment may also be used in addition to CTSO-C166b Class A equipment. However, CTSO-C154c equipment may not be used in place of CTSO-C166b Class A equipment because CTSO-C154c equipment by itself does not meet the ADS-B detection performance requirements for a DAA system.

2. Articles can be designated both Class 1 and 2 equipment. Articles A and B are installed on aircraft. Articles C, D, and E contain functions that operate remotely on the ground or in a CS, or, for manned aircraft, may be located in the aircraft. Articles B and C contain DAA alerting and guidance functions that are interchangeable on an unmanned aircraft system platform. They may reside either in the UA or in the CS. See Section 5.a.(3) for installation limitations associated with interchangeability and class designations.

3. The requirements for the individual articles are identified in

RTCA DO-365, Appendix O.

a. Functionality.

This CTSO's standard applies to DAA Class 1 and 2 equipment intended to be used in aircraft operating under Instrument Flight Rules (IFR) to provide alerting and guidance against traffic to remain DAA Well-Clear. In addition, the Class 2 DAA system includes RA capability by integrating a TCAS II System (Version 7.1) without traffic advisories.

Note: DAA Well-Clear is a temporal and/or spatial boundary around the aircraft intended to be an electronic means of avoiding conflicting traffic (see Appendix C in RTCA DO-365 for the quantitative definition).

b. Failure Condition Classifications.

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

(2) Failure of the function that causes misleading information is as follows:

(a) For Class 1 and Class 2 - Major failure condition for malfunctions causing misleading DAA alerting and/or guidance.

(b) For Class 2 Only - Hazardous/severe-major for un-annunciated failures condition that could generate an incorrect or false TCAS II RA, or result in a missing TCAS II RA.

(c) Develop the system to, at least, the design assurance level applicable to these failure condition classifications.

c. Functional Qualification.

Demonstrate the required functional performance under the test conditions specified in RTCA DO-365, Section 2.4.

d. Environmental Qualification.

Demonstrate the required performance under the test conditions specified in RTCA DO-365, Section 2.3 using standard environmental conditions and test procedures appropriate for airborne and ground equipment. Applicant may use a different standard environmental condition and test procedure than those specified in RTCA DO-365, section 2.3, which includes use of RTCA/DO-160G (for both airborne and ground equipment) and MIL-STD-810G, MIL-STD-704, and RTCA/DO-365, Appendix J (for ground equipment), provided the standard selected is appropriate for the airborne or ground equipment.

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, Inc. document RTCA/DO-178B, Software Considerations in Airborne Systems and Equipment Certification, dated December 1, 1992, or RTCA, Inc. document 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.

f. Electronic Hardware Qualification.

If the article includes complex custom airborne electronic hardware, then develop the component according to RTCA, Inc. Document 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 under the provision of 21.368(a) in CCAR-21-R4.

4. Marking.

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

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.

The applicant must furnish the responsible certification personnel with the related data to support design and production approval. The application data include a statement of conformance as specified in section 21.353(a)(1) in CCAR-21-R4 and one copy each of the following technical data:

a. A Manual(s) containing the following:

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

(2) Describe in detail all deviations.

(3) Installation procedures and limitations sufficient to ensure that

the HUD, when installed according to the installation or operational procedures, still meets this CTSO's requirements. Installation procedures must address the installation specific functional performance requirements of paragraph 3.c of this CTSO. Limitations must identify any unique aspects of the installation. The limitations must 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:

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

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

(c) 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 HUD.

(7) List of replaceable components, by part number, that makes up the Class 1 DAA or Class 2 DAA equipment. Include vendor part number cross-references, when applicable.

b. Instructions covering periodic maintenance, calibration, and repair, to ensure that the DAA continues to meet the CTSO approved design. Include recommended inspection intervals and service life, as appropriate.

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 (that is, non-CTSO functions). Non-CTSO functions are accepted in parallel with the CTSO authorization. For those non-CTSO functions to be accepted, the applicant must declare these functions and include the following information with the 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 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 manual required by section 21.358 of CCAR-21-R4 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.

h. A description of your organization as required by section 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 the authorities, have the following technical data available for review by the authorities:

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-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 available items 6.a through 6.h as they pertain to the non-CTSO function(s).

7. Furnished Data Requirements.

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

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).

c. If the article contains software, include one copy of the Open Problem Report (OPR) summary to type certification or supplemental type certification.

8. Availability of Referenced Documents.

a. Order SAE documents from:

Society of Automotive Engineers, Inc.

400 Commonwealth Drive, WARRENDALE, PA 15096-001, USA

You can also order copies online at: www.sae.org.

b. Order RTCA documents from:

Radio Technical Commission for Aeronautics, Inc.

1150 18th Street NW, Suite 910, Washington D.C. 20036

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