



**Australian Government**  

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**Civil Aviation Safety Authority**

# **ADVISORY CIRCULAR**

## **AC 21-46**

### **Airworthiness approval of avionics equipment**

Advisory Circulars are intended to provide advice and guidance to illustrate a means, but not necessarily the only means, of complying with the Regulations, or to explain certain regulatory requirements by providing informative, interpretative and explanatory material.

**Advisory Circulars should always be read in conjunction with the relevant regulations.**

## Audience

This Advisory Circular (AC) applies to:

- Subpart 21.J – approved design organisations
- Subpart 21.M – authorised persons.

## Purpose

The purpose of this AC is to provide information and guidance concerning the standards used for the approval of required avionics equipment for use in Australian registered aircraft.

## For further information

For further information on this AC, contact CASA's Airworthiness and Engineering Standards Branch (telephone 131 757).

## Status

Version	Date	Details
3.0	Aug 2014	Removed reference to CAR 35, recognition of European Technical Standard Orders (ETSOs), reference to Airworthiness Bulletin (AWB) 00-21, reference to subpart 21.J, reference to AC 21-50 and revision of existing avionics standards in Appendix 1.
(1)	Sept 2010	Appendix 1 and 2 updated to include new equipment.
(0)	Sept 2009	A review of CAO Series 103 and 108 identified a number of orders that are obsolete, inaccurate and no longer relevant. This AC was first drafted to assist industry in identifying the appropriate standards CASA wishes to apply to particular avionics equipment.

Unless specified otherwise, all subregulations, regulations, divisions, subparts and parts referenced in this AC are references to the *Civil Aviation Safety Regulations 1998 (CASR 1998)*.

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# 1 Reference material

## 1.1 Acronyms

The acronyms and abbreviations used in this AC are listed in the table below.

Acronym	Description
AC	Advisory Circular
ADO	Approved Design Organisation
ATSO	Australian Technical Standard Order
AWB	Airworthiness Bulletin
CAR 1988	<i>Civil Aviation Regulations 1988</i>
CASA	Civil Aviation Safety Authority
CASR 1998	<i>Civil Aviation Safety Regulations 1998</i>
CS	Certification Specification
DAL	Design Assurance Level
FAA	Federal Aviation Administration
IoA	Instrument of Appointment
NAA	National Airworthiness Authority
ETSO	European Technical Standard Order
STC	Supplemental Type Certificate
TSO	Technical Standard Order

## 1.2 Definitions

Terms that have specific meaning within this AC are defined in the table below.

Term	Definition
Active Historical	Where Technical Standard Order (TSO) equipment can still be used but new applications should be manufactured to the current version.
Certification Basis	An airworthiness design standard plus any special conditions applied by CASA (or NAA) to that code.
Hazard	Failure condition as specified in FAA AC 23-1309-1E, FAA AC 25.1309-1A , EASA AMC 23.1309 or EASA AMC 25.1309.
Invalid	Where TSO equipment can still be used but new applications should be manufactured to the current version.
Latent	A failure that is not detected and/or annunciated when it occurs.

## 1.3 References

### Regulations

Regulations are available on the ComLaw website <http://www.comlaw.gov.au/Home>

Part 1 of the *Civil Aviation Regulations 1988* (CAR 1988)—Preliminary

Part 14 of CAR—Air service operations

Regulation 82 of CAR—Equipment of Australian aircraft with radio-communication systems

Part 21—Certification and airworthiness requirements for an aircraft and parts

CASR Dictionary

Schedule 1 to the *Civil Aviation (Fees) Regulations 1995*—Fees for aviation regulatory services

### Advisory material

Advisory Circulars are available at <http://www.casa.gov.au/AC>

Civil Aviation Advisory Publications are available at <http://www.casa.gov.au/CAAP>

[Airworthiness Bulletins are available at http://www.casa.gov.au/scripts/nc.dll?WCMS:STANDARD::pc=PC\\_90607](http://www.casa.gov.au/scripts/nc.dll?WCMS:STANDARD::pc=PC_90607)

AC 21-14—Production certificates

AC 21-27—Manufacturing Approval – Overview

AC 21-50—Approval of software and electronic hardware parts

AC 21-601—Australian Technical Standard Order Authorisation

Civil Aviation Advisory Publication (CAAP) 42W-2—Authorised Release Certificate

AWB 00-21—CASR Part 21 Approval of Aircraft Equipment used in Modifications or Repairs

### Other documents

FAA Advisory Circulars are available at:

[http://rgl.faa.gov/Regulatory\\_and\\_Guidance\\_Library/rgAdvisoryCircular.nsf/](http://rgl.faa.gov/Regulatory_and_Guidance_Library/rgAdvisoryCircular.nsf/)

FAA AC 21-16G—RTCA Document DO-160 versions D, E, F, and G, “Environmental Conditions and Test Procedures for Airborne Equipment

[http://rgl.faa.gov/Regulatory\\_and\\_Guidance\\_Library/rgAdvisoryCircular.nsf/0/880bd753c9d79c35862578b80062049d/\\$FILE/AC\\_21-16G.pdf](http://rgl.faa.gov/Regulatory_and_Guidance_Library/rgAdvisoryCircular.nsf/0/880bd753c9d79c35862578b80062049d/$FILE/AC_21-16G.pdf)

EASA CS-ETSO - Certification Specification ETSO

<http://easa.europa.eu/certification-specifications/cs-etso-european-technical-standard-orders>

RTCA/DO-160G—Environmental Conditions and Test Procedures for Airborne Equipment

RTCA/DO-178C—Software Considerations in Airborne Systems and Equipment Certification

RTCA/DO-254—Design Assurance Guidance for Airborne Electronic Hardware

## 1.4 Forms

CASA's forms are available at <http://www.casa.gov.au/forms>

Form 849—Production Approval - Application

## 2 Background

This AC provides details of the data needed to support a request for approval of avionics equipment that is to be fitted to a certified aircraft in accordance with Subparts 21.E and Subpart 21.M.

### 2.1 Regulations

2.1.1 Any required equipment fitted in compliance with the regulations must be approved by CASA prior to use. Subregulation 207(2) of CAR 1988 states:

“A person must not use an Australian aircraft in a class of operation if the aircraft is not;

- a. fitted with instruments; and
- b. fitted with, or carrying, equipment, including emergency equipment, that CASA has approved and directed.”

2.1.2 Any equipment fitted to, or on, an aircraft from time to time can be divided into two basic categories:

- a. Required equipment – items required for compliance with the regulations governing specific types of operation
- b. Non-required equipment – any other equipment that is fitted in addition to that required by regulation.

2.1.3 All equipment, both required and non-required equipment, may only be installed on an aircraft in accordance with an approved design (i.e. Subpart 21.E Supplemental type certificate (STC), Subpart 21.M modification approval). For required equipment to be approved, sufficient evidence needs to be presented to certify that the design standard and manufacturing processes provide an appropriate level of safety.

2.1.4 Regulation 2 of CAR 1988 states that:

“any part or equipment for an aircraft that, when fitted to, or provided in an aircraft may, if it is not sound or functioning correctly, affect the safety of the aircraft, its occupants or its cargo or cause the aircraft to become a danger to person or property.”

As an example, the Aeronautical Information Package (AIP) states that radio navigation equipment fitted to an aircraft must be of a type approved by CASA.

#### 2.1.5 Approval of materials, parts, processes and appliances

2.1.5.1 Regulation 21.305 lists the methods of approval of required equipment:

- a. under an APMA
- b. under an ATSO authorisation or letter of ATSO design approval
- c. in conjunction with type certification procedures for an aircraft, aircraft engine or propeller
- d. under Subpart 21.N – imported items
- e. in any other manner approved by CASA.

### 2.1.6 Recognised countries

- 2.1.6.1 Regulation 21.012 provides a list of recognised countries from where material, parts, processes, appliances and technical standards, approved by the National Aviation Authority (NAA), are automatically accepted.

### 2.1.7 Approval of imported items

- 2.1.7.1 Subpart 21.N provides the mechanism for the approval of imported items and is only concerned with the approval of imported items that comply with design and manufacture airworthiness standards automatically accepted by CASA or as otherwise negotiated with CASA.

### 2.1.8 Equipment approved in conjunction with Type Certification

- 2.1.8.1 Aircraft manufacturers, when certifying an aircraft model, explicitly state that the aircraft complies with a design standard at that time. This includes the equipment fitted during production of the aircraft and that certification is only applicable to that aircraft make and model.

## 2.2 Approval of required equipment

- 2.2.1 In order to comply with the regulations and obtain CASA approval under one of the methods specified in regulation 21.305 or 21.305A, all required equipment fitted to an aircraft must conform to an approved design standard and manufactured using processes that ensure continuing conformance to that standard.
- 2.2.2 Regulation 82 of CAR 1988 is the regulation to be used for approval of radio communication equipment.

## 2.3 Approval of non-required equipment

- 2.3.1 Non-required equipment does not require approval under regulation 21.305 or 21.305A. However, all non-required equipment must be designed such that it is sound and functions correctly to ensure that it does not constitute a hazard to the aircraft or occupants. In order for any equipment to be approved as part of the approved design of the aircraft, it must be demonstrated that the aircraft type certification basis has not been compromised.

## 2.4 Approval to fit equipment

- 2.4.1 Equipment can only be installed on an aircraft in accordance with an approved design. All installation data for equipment to be fitted to a certified aircraft is approved by one the following methods:

- Subpart 21.D—Changes to the type certificates
- Subpart 21.E—Supplemental type certificates
- Subpart 21.K—Approval of materials, parts, processes and appliances
- Subpart 21.M—Designs of modifications of, and repairs to, aircraft, aircraft engines, propellers and appliances.



## 2.5 Commercial/off-the-shelf products

2.5.1 An increasing number of manufacturers are offering products that are not designed or meant for aviation use, such as multifunction displays and radios. These products generally lack any formalised configuration control from the manufacturers, which may imply that:

- equipment initially fitted during a modification may differ significantly to an item purchased at a later date as a replacement part
- embedded software may not have been verified against a known standard or tested to ensure that all software functions operate correctly without producing unexpected outcomes. Manufacturers may also change and improve the software at any time. This software may appear to function correctly but may contain latent errors<sup>1</sup>
- manufacturers may not intend to support the existing equipment configuration in the longer term.

2.5.2 To facilitate the approval process, and as per subregulation 207(2) of CAR, required equipment must:

- comply with an accepted design standard
- be manufactured in a manner that ensures continuing conformance to that standard
- supply approved data, including continuing airworthiness requirements, to enable correct installation and operation.

**Note:** Continuing airworthiness requirements includes processes that monitor in-service performance and continuing compliance of the product against the specified design standard.

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<sup>1</sup> See AC 21-50 for further details.

## 3 Current recognised standards

### 3.1 Technical Standard Orders

3.1.1 Subregulation 21.601(2) recognises foreign Technical Standard Orders (TSOs) for approved equipment. These are available online at:

- [TSO - FAA](#)
- [ETSO - EASA](#)

3.1.2 Equipment designed to (E)TSO standards listed as either active historical or invalid are still eligible for fitment to aircraft unless they are prohibited by a specific regulation requirement. The (E)TSO standards for any new equipment approvals are listed in Appendix 1.

3.1.3 This is not an exhaustive list as new technology or novel applications of existing technologies may be beyond the scope of the existing standards. In this case, it is recommended that the applicant approach CASA at the earliest instance to enable the development of an agreed standard.

**Note:** The RTCA, Inc and SAE International documents may not contain the complete requirements for a device to meet the necessary specifications and it is advisable to contact CASA early during the design or approval process.

### 3.2 Approval of equipment for which there is no standard

3.2.1 For all other equipment, consultation with CASA would enable approval of a suitable standard.

## 4 Approvals

### 4.1 Existing equipment approvals

- 4.1.1 Appendix 2 of this AC provides a listing of equipment that has been previously approved by CASA.

**Note:** This appendix is derived from Airborne Radio Classification Publication (Publication 50) which is no longer in print.

- 4.1.2 Appendix 3 of this AC provides a listing of equipment approved since the last amendment of Publication 50. This listing will be updated as required.

### 4.2 New equipment approvals

- 4.2.1 If approval has not been given by a recognised NAA for fitting required equipment to a certificated aircraft, then the device will need to be certificated by an appropriate delegate. [AWB 00-021](#) contains general information for IoA holders on approval to designs of modifications or repairs to Australian registered aircraft. The following categories cover the different requirements and provide guidance as to the requirements of each category.

- 4.2.2 For information on manufacturing/production approvals for aeronautical products see [AC 21-14](#). Applications for a production certificate is to be made using CASA Form 849.

#### 4.2.3 ATSO design approval

- 4.2.3.1 Approval of equipment as a standalone item, conforming to an ATSO, TSO, ETSO or other agreed standard. This authorisation then allows the follow on fitment to aircraft registered in Australia in accordance with approved modification instructions.

- 4.2.3.2 In accordance with paragraph 21.603(1)(c), equipment complying with a TSO are required, as part of the approval, to have their data plate marked with the relevant TSO.

Note: An ATSO authorisation may only be granted by CASA.

#### 4.2.4 'One-off' approvals

- 4.2.4.1 The approval of an individual item of previously non-approved, or non-aviation equipment, will allow the installation of that equipment into certificated aircraft. Approval may be granted either:

- by CASA
- or
- in accordance with an engineering order approved by CASA, a Subpart 21.M IoA or a Subpart 21.J ADO.

Note: Required equipment must be approved by CASA under one of the methods specified in regulation 21.305 or 21.305A.

## 4.2.5 Supplemental type certificate

- 4.2.5.1 STC approval of a particular model of previously non-approved or non-aviation instrument or electronic equipment will allow the installation of that equipment into certificated aircraft types.

## 4.2.6 Type design

- 4.2.6.1 The approval of a particular model of previously non-approved or non-aviation instrument or electronic equipment as part of the type design of the aircraft will allow the installation of that equipment into certificated aircraft types. AC 21-27 provides guidance on various types of production approvals.

## 4.3 Data requirements

- 4.3.1 The applicant, either an individual or a company, takes design responsibility for that item of equipment for which they are seeking approval. The responsibility rests with the applicant to ensure that:

- a. an appropriate design standard has been identified and agreed to by CASA
- b. a data package for the candidate equipment (confirming the design, materials, processes, performance parameters and test plans to be used for the production model) is collated and submitted. This needs to address, as a minimum:
  - i. testing and verification of embedded software (if any) in accordance with an acceptable standard (e.g. RTCA/DO-178C Design Assurance Level (DAL) A, B, C or D) to confirm operability and functionality. Software should be treated as any other component and will need to have configuration control<sup>2</sup>
  - ii. testing and verification of complex electronic devices (if any) in accordance with an acceptable standard (e.g. RTCA/DO-254 DAL A, B, C or D) to confirm operability and functionality<sup>2</sup>
  - iii. environmental testing is conducted (if necessary) to ensure the equipment will continue to operate in all expected operational environmental conditions.
    - A. This may include recovery of operational modes from direct and indirect lightning strikes, extreme temperature conditions, altitude tests and other tests defined by RTCA/DO-160G for the selected operating conditions of the equipment.
    - B. [FAA AC 21-16G](#) provides a summary of changes between different versions of RTCA/DO-160 and which version is acceptable depending on usage. Subpart A of EASA [CS-ETSO](#) allows the use of RTCA/DO-160D unless otherwise stated.
    - C. Consultation with CASA may be necessary to identify the individual testing programs appropriate for the intended use of the equipment.
  - iv. the build status for both hardware and software against the data package
  - v. testing results which confirm the functionality and performance parameters as detailed in the design specifications

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<sup>2</sup> For further information see AC 21-50.

vi. the requirement for the component to be marked with a unique part number.

4.3.2 This data package will be frozen and identified as the model intended for fitting to the aircraft and will be subject to configuration control in a manner similar to other aircraft components.

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