

AMC 20-115C

Software Considerations for Certification of Airborne Systems and Equipment

1 PURPOSE

This Acceptable Means of Compliance (AMC) provides a means that can be used to demonstrate that the safety aspects of software hosted on airborne systems and equipment comply with requirements for initial airworthiness in order to obtain an airworthiness approval.

Compliance with this AMC is not mandatory and hence an applicant may elect to use an alternative means of compliance. However, those alternative means of compliance must meet the relevant requirements, ensure an equivalent level of software safety and be approved by the European Aviation Safety Agency on a product basis.

In particular, the purpose of this AMC is to provide guidelines for the production of software for airborne systems and equipment that performs its intended function with a level of confidence in safety that complies with airworthiness requirements.

2 SCOPE

This AMC discusses those aspects of airworthiness certification that pertain to the production of software for airborne systems and equipment used on aircraft, engines, propellers, APU or others parts.

In discussing those aspects, the system life cycle and its relationship with the software life cycle are considered to aid in the understanding of the certification process.

Other system and software life cycle processes are out of scope of the present AMC. For instance, out of scope are:

- system safety assessment and validation processes at product level, in the context of initial airworthiness certification of aircraft and engines;
- software considerations for the verification of ground and space systems and constituents of Air Traffic Management (ATM)/Air Navigation Services (ANS);
- software considerations for services consisting of the origination and processing of data and formatting and delivering data to general air traffic for the purpose of safety-critical air navigation;

Since certification issues for initial airworthiness are discussed only in relation to the software life cycle, the operational aspects of the resulting software are not discussed. For example, the certification, approval and management aspects of user-modifiable data are beyond the scope of this AMC.

This AMC does not provide guidelines concerning the structure of the applicant's organisation, the relationships between the applicant and its suppliers, or how the responsibilities are divided.

Personnel qualification criteria are also beyond the scope of this AMC.

3 PROCEDURES, METHODS AND TOOLS FOR SOFTWARE CONSIDERATIONS

This AMC recognises that the European Organisation for Civil Aviation Equipment (EUROCAE) document ED-12C, 'Software Considerations in Airborne Systems and Equipment Certification', issued in January 2012, related guidance documents and supplements or equivalent RTCA Inc. documents, constitute an acceptable means of compliance for software (SW).

Aspects of certification that pertain to the production of software for airborne systems and equipment used on aircraft, engines, propellers and, by region, auxiliary power units. It discusses how the document may be applied to certification programmes administered by the European Aviation Safety Agency.

4 RELATED DOCUMENTS

4.1 EUROCAE document ED-12C, 'Software Considerations in Airborne Systems and Equipment Certification', describes the acceptable processes to develop and verify SW for airborne systems and equipment.

4.2 EUROCAE document ED-12C is technically equivalent to RTCA Inc. document DO-178C. A reference to one document, at the same revision level, may be interpreted to mean either document.

4.3 ED-12C/DO-178C guidance is extended with the following related documents and supplements:

- ED-94C/DO-248C 'Supporting Information for ED-12C and ED-109A' ;
- ED-215/DO-330 'Software Tool Qualification Considerations';
- ED-216/DO-333 'Formal Methods Supplement to ED-12C and ED-109A';
- ED-217/DO-332 'Object-Oriented Technology and Related Techniques Supplement to ED-12C and ED-109A'; and
- ED-218/DO-331 'Model-based Development and Verification Supplement to ED-12C and ED-109A'.

4.4 The technical content of this AMC is as far as practicable harmonised with the latest edition of FAA AC 20-115¹, equally based on ED-12/DO-178.

5 RELATED CERTIFICATION SPECIFICATIONS (CSs)

Part 21, CS-22, CS-23, CS-25, CS-27, CS-29, CS-AWO, CS-E, CS-P, CS-APU, CS-ETSO and CS-VLA. Existing references to ED-12/DO-178, ED-12A/DO-178A and ED-12B/DO-178B in the above CSs will be replaced by reference to this AMC to provide a single source of regulatory material on airborne software development for airborne systems and, equipment used on aircraft, engines, propellers and auxiliary power units.

6 BACKGROUND

EUROCAE document ED-12C was developed to establish software considerations for aircraft system or equipment developers when the aircraft system and equipment design is developed using software based techniques. Current and future avionics designs make extensive use of this technology. The EUROCAE document provides guidance for establishing software life cycle planning, development, verification, configuration management, quality assurance and certification liaison processes to be used in software based systems.

¹ AC 20-115C of 19 July 2013:

http://www.faa.gov/regulations_policies/advisory_circulars/index.cfm/go/document.information/documentID/1021710

The guidance provided in ED-12C is in the form of:

- objectives for software life-cycle processes;
- descriptions of activities and design considerations for achieving those objectives; and
- descriptions of the evidence that indicates that the objectives have been satisfied.

ED-94C document was developed to provide supporting information and clarification of ED-12C.

ED-215 is a document that was developed to provide tool qualification guidance. ED-215 is invoked in ED-12C (section 12.2.3 Tool Qualification Process) and provides the objectives, activities, guidance, and life cycle data required for each Tool Qualification Level.

ED-216 is a supplement to ED-12C that was developed to provide specific guidance regarding Formal Methods.

ED-217 is a supplement to ED-12C that was developed to provide specific guidance regarding Object-Oriented Technology and Related Techniques.

ED-218 is a supplement to ED-12C that was developed to provide specific guidance regarding the techniques of Model-based Development and Verification.

Whenever one or more of the techniques addressed by these last three supplements is used in software based systems, the corresponding supplement or supplements to ED-12C should be applied in addition to ED-12C itself.

ED-12C and its related supplements specify the information to be made available and/or delivered to the Agency. Guidance is also provided for dealing with software developed to earlier standards, tool qualification and alternative methods that may be used.

7 USE OF EUROCAE ED-12C AND RELATED DOCUMENTS AND SUPPLEMENTS

An applicant to EASA for product certification or ETSO authorisation for any software-based equipment or system may use the considerations outlined in EUROCAE document ED-12C and its related documents and applicable supplements, as a means, but not the only means, to secure approval. The Agency may publish acceptable means of compliance for specific CSs, stating the required relationship between the criticality of the software based systems and the software levels as defined in EUROCAE document ED-12C. Such acceptable means of compliance will take precedence over the application of EUROCAE document ED-12C.

8 USE OF PREVIOUS VERSIONS

8.1 Previous ED-12 versions may continue to be accepted for modifications to the software of already approved systems and equipment or for reuse of already approved software components in new application for certification of products or part and appliances.

8.2 Paragraph 8.1 applies, provided that:

- The software level is not higher;
- The techniques described in the ED-12C supplements (MBD, OOTRT, Formal Methods) are not introduced into the new project; otherwise, ED-216 and/or ED-217 and/or ED-218 should be applied;
- the change to the ETSO authorized article is minor (see 21A.611);
- No new software criteria 1 or 2 tool qualification is needed; otherwise ED-215 should be applied only on the new software criteria 1 or 2 tools if the existing tools are not significantly changed;

- No new Parameter Data Item files are introduced, otherwise ED-12C should only be applied on the new Parameter Data Item files if the existing PDIs are not significantly changed and it should be demonstrated that software using the new Parameter Data Item files is compliant with the ED-12C sections related to Parameter Data Item;
- Software plans, processes, and life cycle environment, including process improvements have been maintained;

8.3 Where a modification is made to an existing software-based equipment or system, and the criteria in this section indicate the use of ED-12C and related supplements, they may apply, under justification, only to the software components affected by the modification.

For major changes to ETSO authorised articles, a previous version of ED-12 may continue to be accepted under justification.

Early coordination with EASA is strongly recommended to validate the above assumptions.

9 AVAILABILITY OF EUROCAE DOCUMENTS

Copies may be purchased from EUROCAE, 102 rue Étienne Dolet, 92240 Malakoff, France, (Fax : 33 1 46 55 62 65).