European Aviation Safety Agency

Explanatory Note to Decision 2013/026/R

Amendment 10 to AMC-20

RELATED NPA/CRD 2012-11 — RMT.0462 — 12/09/2013

EXECUTIVE SUMMARY

This Decision addresses a technological development issue related to the publication of new editions of Eurocae/RTCA standards for the development of airborne software as outlined in the Terms of Reference (ToR) RMT.0462 of 06 July 2012.

The specific objective of is to ensure safety of the processes related to airborne software development assurance level (SW-DAL) taking into account the latest industry developments, as contained in ED-12C/DO-178C.

This Decision contains amendment 10 to AMC 20, and in particular:

- Update of AMC 20-115B to AMC 20-115C;
- Changes to the references in AMC 20-2, AMC 20-3, AMC 20-4 and AMC 20-27 from ED-12 and DO-178 to AMC 20-115.

In total five AMC-20s are affected.

The proposed changes are expected to increase safety by following the latest developments of the state of the art on development of airborne software.

Applicability	
Affected regulations and decisions:	AMC-20
Affected stakeholders:	applicants for Agency airworthiness approvals of airborne SW (i.e. airborne parts, systems or products hosting SW)
Driver/origin:	Technological development
Reference:	EUROCAE ED-12C: Software considerations in airborne systems and equipment certification (January 2012)

Process map	
Concept Paper:	No
Publication of the ToR	10/07/2012
Rulemaking group:	No
RIA type:	Light
Technical consultation during NPA drafting:	No
Publication date of the NPA:	22 Aug 2012
Duration of NPA consultation:	3 months
Review group:	No
Focussed consultation:	No
Publication date of CRD:	13/03/2013

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1. Procedural information

1.1. The rule development procedure

The European Aviation Safety Agency (hereinafter referred to as the 'Agency') developed ED Decision 2013/026/R in line with Regulation (EC) No 216/2008[1] (hereinafter referred to as the 'Basic Regulation') and the Rulemaking Procedure[2].

This rulemaking activity is included in the Agency's Rulemaking Programme for 2013-16 under RMT.0462[3]. The scope and timescale of the task were defined in the related Terms of Reference published on 06 July 2012.

The draft text of this Decision has been developed by the Agency. All interested parties were consulted through NPA 2012-11[4]. 122 comments were received from 19 interested parties, including industry and National Aviation Authorities.

The Agency has reviewed the comments received on the NPA. The comments received and the Agency's responses are presented in the Comment-Response Document (CRD) 2012-11[5].

The final text of this Decision with amendment 10 of AMC 20 has been developed by the Agency.

The process map on the title page summarises the major milestones of this rulemaking activity.

1.2. Structure of the related documents

Chapter 1 contains the procedural information related to this task. Chapter 2 explains the core technical content. The five updated AMC-20s are annexed to the ED Decision.

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1 Regulation (EC) No 216/2008 of the European Parliament and of the Council of 20 February 2008 on common rules in the field of civil aviation and establishing a European Aviation Safety Agency, and repealing Council Directive 91/670/EEC, Regulation (EC) No 1592/2002 and Directive 2004/36/EC. (OJ L 79, 19.03.2008, p. 1). Regulation as last amended by Commission Regulation (EU) No 6/2013 of 8 January 2013 (OJ L 4, 9.1.2013, p. 34).

2 The Agency is bound to follow a structured rulemaking process as required by Article 52(1) of the Basic Regulation. Such process has been adopted by the Agency's Management Board and is referred to as the 'Rulemaking Procedure'. See Management Board Decision concerning the procedure to be applied by the Agency for the issuing of opinions, certification specifications and guidance material (Rulemaking Procedure), EASA MB Decision No 01-2012 of 13 March 2012.

3 http://www.easa.europa.eu/rulemaking/docs/tor/RMT/ToR%20RMT.0462.pdf.

4 In accordance with Article 52 of the Basic Regulation and Articles 5(3) and 6 of the Rulemaking Procedure.

5 http://www.easa.europa.eu/rulemaking/docs/crd/2012/CRD%202012-11.pdf.

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2. Explanatory Note

2.1. Overview of the issues to be addressed

With the Decision 2003/12/RM of 5 November 2003 the Agency adopted AMC 20-115B on the recognition of EUROCAE ED-12B/RTCA DO-178B. This Acceptable Means of Compliance draws attention to the European Organisation for Civil Aviation Equipment's (EUROCAE) document ED-12B 'Software Consideration in Airborne Systems and Equipment Certification', issued in December 1992.

The EUROCAE document ED-12B was technically equivalent to RTCA Inc. document DO-178B. About 20 years of concrete experience gained by industry has demonstrated that ED-12B needed some modernisation. Therefore, EUROCAE published in January 2012 the revised ED-12C guidance document. In parallel, RTCA issued revision C of their DO-178.
The primary purposes of the revision of the ED-12B are:

- to continue to promote the safe implementation of aviation software without changing the consolidated approach and taxonomy for Software Development Assurance (SWDAL);
- to provide clearer and more consistent relationships to the systems development processes and safety assessment processes;
- to address emerging trends and technologies in software development; and
- to provide an approach that is flexible and allows for changes in technology.

Furthermore, ED-12C is now supplemented by additional documents which extend the guidance to cover specific techniques. These supplements are:

- the ED-94C 'Supporting Information for ED-12C and ED-109A' document;
- the ED-215 'Software Tool Qualification Considerations' document;
- the ED-218 'Model-based Development and Verification Supplement to ED-12C and
- ED-109A' document;
- the ED-217 'Object-Oriented Technology and Related Techniques Supplement to
- ED-12C and ED-109A' document; and
- the ED-216 'Formal Methods Supplement to ED-12C and ED-109A' document.

Hence the Agency hereby issues a revised 'C' version of AMC 20-115 to align its material with the latest industry developments.

2.2. Objectives

The overall objectives of the EASA system are defined in Article 2 of the Basic Regulation. This proposal will contribute to the achievement of the overall objectives by addressing the issues outlined in Chapter 2.

The specific objective of this proposal is, therefore, to ensure safety of the processes related to airborne software development assurance level (SW-DAL) taking into account the latest industry developments, as contained in ED-12C/DO-178C.

2.3. Outcome of the consultation

Based on the 122 comments received from 19 commentators and the individual responses to each of them, in the CRD 2012-11, the Agency concluded that:

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- in principle stakeholders agreed to recognise latest edition of EUROCAE Document ED-12C and associated material for software development, through issuing new edition C of AMC 20-115, however, asking for proper transition, including applicability of previous industry standards to changes to existing approved software;
- stakeholders also agreed that AMC 20-2, 20-3, 20-24 and 20-27 should be modified to refer to AMC 20-115C for software matters;
- on the contrary, as advised by stakeholders, the Agency acknowledged that it was not necessary to amend AMC 20-1.

2.4. Summary of the Regulatory Impact Assessment (RIA)

The following five options were considered in the RIA:

No.	Option
0	**'Do nothing'** in which case the Agency's rules would continue to refer to editions 'B' of ED-12 and DO-178 and the possibility of using more modern AMCs could be negotiated with applicants on a case-by-case basis.
1	**Simple 'recognition'** of edition 'C' of ED-12/DO-178, without mentioning additional guidance material and without providing even minimal explanations.
2	Publish a revised **AMC 20-115C of no more than five pages, containing also some explanation** and reference not only to ED-12C/DO-178C, but also to the associated documents; in parallel, introduce in other Agency's 'soft rules' only reference to AMC 20-115 (i.e. not directly to industry standards).
3	**As 2 for AMC 20-115 but directly refer to ED-12C/DO-178C** and associated industry documents **in all other affected Agency 'soft rules'**.
4	Reproduce the total content of ED-12C and its associated documents in AMC 20-115C, whose size would then become **more than one hundred pages**.

The RIA concluded that Options 3 (ED-12C/DO-178C referred directly in multiple Agency's documents) and 4 ('copy and paste' of all EUROCAE material in AMC 20-115C) had a negative safety score (this means that they would make today's safe situation worse). But, even more important, Option 4 would potentially infringe the laws on copyright, while option 3 would be (as today) cumbersome for the Agency to maintain, having referred ED-12 in multiple regulatory documents. Neither option 3 nor 4 was therefore recommended.

Options 0, 1 and 2 were all neutral from the safety perspective (i.e. risk index remains at 'safe' level of 5 as today).

However, Option 0 ('do nothing') showed an overall negative score, since no longer aligned with state of the art.

The remaining two Options 1 and 2 exhibited a positive total (weighted) score and were equivalent and neutral in terms of safety. Among them, however, Option 2 had the highest total score and, in particular, it was the best one in terms of proportionality, since, before

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purchasing ED or DO documents, small and medium-sized enterprises (SMEs) would have minimum information to orient their choice towards the documents really required for them.

Therefore, Option 2 (i.e. group in AMC 20-115C all guidance necessary for development of airborne software and refer to it from any other Agency Certification Specification, like e.g. CS-ETSO or AMC-20s) was the preferred one.

No stakeholder objected that option 2 had to be preferred.

2.5. Reactions to the CRD

None of the reactions addressed the amendments proposed to AMC 20-2, -3, -4 or -27.

The Agency received 23 reactions to CRD 2012-11, all concerning AMC 20-115C. Four of these reactions expressed full support with the resulting text of the proposed rule. The other reactions can be grouped into three categories:

1. One software developer requested to further delay the date of applicability which had been already postponed in the CRD to January 2014, for one additional year;
2. There were proposals to improve the clarity of the wording concerning the legacy software and modifications thereof;
3. Some stakeholders expressed the wish for a better harmonisation with the FAA proposed[6] AC 20-115C.

The proposal to further delay the date of applicability by one year, was partially accepted by the Agency. Further delay would indeed create a disadvantage to the companies which already made an investment to update their processes to the new industry standards. Some major manufacturers even proposed to use ED-12C for their significant changes to software approved under previous ED-12B. Therefore, AMC 20-115C will become applicable on 1 January 2014 (the FAA corresponding AC 20-115C is applicable since July 2013). The possibility would, however, remains for applicants to request a further 'period of grace' until end of June 2014 for software of which development was initiated not later than 2013 and if so wished by the applicant.

Five of the reactions to the CRD concerned the use of previous version ED-12B, when introducing modifications to already approved software. None of them challenged the approach taken after the consultation and published in the CRD. However, they proposed more precision and clarity in the text to avoid ambiguity. These reactions were mostly accepted and lead to changes in the final text of paragraph 8 (transition) of AMC 20-115C, of which the content is harmonised with the FAA approach.

Some reactions requested the Agency to wait for publication of the FAA AC 20-115C and subsequently 'copy and paste' the content into Agency's rules. The Agency observes that, for harmonisation purposes, it is not necessary that the regulatory material is identically worded between FAA and EASA. Furthermore, each rule has to fit into different legal orders. So differences in the structure of the material and in the semantics are unavoidable. The harmonisation effort was on the contrary focused on the technical content. In this case, the content of the FAA AC 20-115C and of the adopted AMC 20-115C are technically equivalent.

The only difference is that paragraph 8 of AMC 20-115C gives more precise guidelines on the cases in which previous ED-12 versions can be used, in relation to the corresponding FAA material, which leaves more discretion to applicants and inspectors. Agency and FAA

[6] FAA AC 20-115C was in fact in the draft status on 13 March 2013, when CRD 2012-11 was published. Later it has been published on 19 July 2013:
http://www.faa.gov/regulations_policies/advisory_circulars/index.cfm/go/document.information/documentID/1021710

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agreed to work on lower level documents (e.g. FAA orders) to achieve a deeper harmonisation.

One single stakeholder proposed to delay publication of AMC 20-115C until after publication of corresponding FAA AC 20-115C. This proposal is not accepted, since it would contravene Article 19 of the Basic Regulation, which requires the Agency to develop acceptable means of compliance reflecting the state of the art and the best practices in the fields concerned. In any case the Agency and FAA 20-115C have been published in the same semester.

2.6. Overview of the amendments

AMC 20-115B is replaced by AMC 20-115C, with substantial changes in the technical content. New versions of five other AMC 20s have also been adopted, but only to no longer reference ED12()/DO-178() but instead only the latest edition of AMC 20-115().

Further amendments to AMC 20-4 and 20-27 are planned in the context of RMT.0257 (operational approval of Performance Based Navigation – PBN), mainly to remove the OPS related paragraphs into AMC/GM to Regulation 965/2011 on air operations.

Later, the airworthiness parts of the navigation related AMCs, may migrate into CS-ACNS.

Here is the list of affected AMC 20s:

Adopted AMC 20-XX		**Replacing**	
No.	**Title**	**No.**	**Title**
AMC 20-2A	Certification of Essential APUs Equipped with Electronic Controls	AMC 20-2	Certification of Essential APUs Equipped with Electronic Controls
AMC 20-3A	Certification of Engines Equipped with Electronic Engine Control Systems	AMC 20-3	Certification of Engines Equipped with Electronic Engine Control Systems
AMC 20-4A	Airworthiness Approval and Operational Criteria For the Use of Navigation Systems in European Airspace Designated For Basic RNAV Operations	AMC 20-4	Airworthiness Approval and Operational Criteria For the Use of Navigation Systems in European Airspace Designated For Basic RNAV Operations
AMC 20-27A	Airworthiness Approval and Operational Criteria for RNP APPROACH (RNP APCH) Operations Including APV BAROVNAV Operations	AMC 20-27	Airworthiness Approval and Operational Criteria for RNP APPROACH (RNP APCH) Operations Including APV BAROVNAV Operations
AMC 20-115C	Software consideration for certification of airborne systems and equipment	AMC 20-115B	Recognition of EUROCAE ED-12B/RTCA DO-178B

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3. References

3.1. Related regulations

Regulation (EC) No 216/2008Regulation (EC) No 216/2008.of 20/02/2008 on common rules in the field of civil aviation and establishing a European Aviation Safety Agency, and repealing Council Directive 91/670/EEC, Regulation (EC) No 1592/2002 and Directive 2004/36/E. *(OJ L 79, 19/03/2008, p. 1)*

3.2. Affected decisions

ED Decision 2003/12/RM of 05 November 2003.

3.3. Reference documents

EUROCAE ED-12C: Software considerations in airborne systems and equipment certification (January 2012);

RTCA Inc. DO-178C: Software considerations in airborne systems and equipment certification (December 2011);

FAA AC 20-115C of 19 July 2013: Airborne Software Assurance.

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