



European Aviation Safety Agency
Comment-Response Document 2017-02

Appendix
to ED Decision 2017/020/R

RELATED NPA 2017-02 — RMT.0643 — 19.10.2017

Table of contents

1. Summary of the outcome of the consultation	2
2. Individual comments (and responses)	3



1. Summary of the outcome of the consultation

124 comments were received by 24 stakeholders, including national aviation authorities (NAAs) and organisations (Eurocontrol, as well as the civil aviation authorities of Brazil, Canada, France, Germany, the Netherlands, and the United Kingdom), industry and associations (Aerospace and Defence Industries Association of Europe (ASD), Airbus Helicopters, Astronautics Corporation of America, Bell Helicopter, Bombardier Aerospace, Dassault Aviation, European Council of General Aviation Support (ECOGAS), Embraer S.A., GE Aviation, General Aircraft Manufacturers Association (GAMA), Leonardo Helicopters, Rolls-Royce Corporation, THALES Avionics, The Boeing Company, Zodiac Aerospace), as well as certification service providers (ACG-Solutions, Worldwide Certification Services).

The commentators were in general supportive of the proposed amendment to the existing European Aviation Safety Agency (EASA) AMC 20-115C and Federal Aviation Administration (FAA) AC 20-115C, as well as of the harmonisation effort.

None of the comments were against the proposal or gave rise to any controversy.

Further to the comments received, some parts of the NPA 2017-02 proposed text were modified for improvement or clarification purposes.

The individual comments and the responses thereto are contained in Chapter 2 of this Comment-Response Document (CRD).



2. Individual comments (and responses)

In responding to comments, a standard terminology has been applied to attest EASA's position. This terminology is as follows:

- (a) **Accepted** — EASA agrees with the comment and any proposed amendment is wholly transferred to the revised text.
- (b) **Partially accepted** — EASA either agrees partially with the comment, or agrees with it but the proposed amendment is only partially transferred to the revised text.
- (c) **Noted** — EASA acknowledges the comment but no change to the existing text is considered necessary.
- (d) **Not accepted** — The comment or proposed amendment is not shared by EASA.

(General Comments)

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comment	7	comment by: <i>CAA-NL</i>
	The Netherlands does support this NPA and is specifically positive on the enhanced clarity for an applicant using this document as well as on the harmonization with the FAA.	
response	Noted. Thank you for your positive feedback.	
comment	14	comment by: <i>THALES Avionics</i>
	Thales Avionics is fully supporting ASD comments focused on the major ones, and thanks both EASA and FAA for their efforts in ensuring harmonization of software regulatory text of AMC 20-115D and AC20-115D, based on both Authorities and industry experience.	
response	Noted. Thank you for your positive feedback.	
comment	15	comment by: <i>Luftfahrt-Bundesamt</i>
	The LBA has no comments on NPA 2017-02.	
response	Noted. Thank you for your feedback.	
comment	16	comment by: <i>UK CAA</i>
	Thank you for the opportunity to comment on NPA 2016-02, Regular update of AMC-20:	



	<p>update of EASA AMC 20-115C and FAA AC 20-115C.</p> <p>Please be advised that there are no comments from the UK Civil Aviation Authority.</p>
response	<p>Noted.</p> <p>Thank you for your feedback.</p>
comment	<p>32 comment by: <i>ASD</i></p> <p>ASD is very satisfied that EASA/FAA has taken into consideration the SW harmonization regarding AMC/AC 20-115 as a priority and that, for the first time, a unique consultation process for both Authorities was set up to ensure the official publication of fully harmonized AMC 20-115D and AC20-115D, thus ensuring a level playing field in the SW compliance domain. Moreover, the creation of a task force has allowed to initiate a constructive dialogue between Authorities and Industry, at international level, that also benefits the other harmonization tasks, such as AEH and OPR.</p> <p>Nevertheless, ASD would like to re-iterate some major comments hereafter, already expressed end of 2016, which were not accepted by Authorities at the time. Taking account these comments in this final phase will achieve the best material possible based on both Authorities and Industry experience. It will also demonstrate that the Safety based approach Transformation is on-going.</p>
response	<p>Noted.</p> <p>Thank you for your positive feedback.</p>
comment	<p>67 comment by: <i>EUROCONTROL</i></p> <p>The EUROCONTROL Agency welcomes the effort of harmonisation with FAA and does not make other comments.</p>
response	<p>Noted.</p> <p>Thank you for your positive feedback.</p>
comment	<p>68 comment by: <i>Dassault-Aviation</i></p> <p>Dassault-Aviation supports the comments made by ASD and has no additional comments.</p>
response	<p>Noted.</p> <p>Thank you for your feedback.</p>

comment	69	comment by: <i>Airbus Helicopters</i>
	<p>Airbus Helicopters thanks EASA and FAA for this fruitful cooperation with industry, which allowed the development of a harmonized AMC/AC.</p> <p>We hope that the ongoing task forces between Authorities and Industry for AEH and OPR will allow reaching an as good level of harmonization.</p>	
response	<p>Noted.</p> <p>Thank you for your positive feedback.</p>	
comment	70	comment by: <i>Airbus Helicopters</i>
	<p>Airbus Helicopters fully supports comments delivered by ASD and would like to submit some complementary comments.</p>	
response	<p>Noted.</p>	
comment	72	comment by: <i>DGAC France</i>
	<p>Please note that DGAC France has no specific comment on this NPA.</p>	
response	<p>Noted.</p> <p>Thank you for your feedback.</p>	
comment	79	comment by: <i>General Aviation Manufacturers Association</i>
	<p>The term “software components” is used in multiple places in this document. Since that term does not have a universally accepted definition, it would be helpful to include the definition intended for use in this document. If left up to interpretation, it could drive vastly differing levels of effort. For example, in section 8.a.(1).(b) the term “software components” is used to define the level at which you need to plan satisfaction of applicable objectives. How this is done will be very different, if Software Component is interpreted as a CSCI, CSC, or a module.</p>	
response	<p>Partially accepted.</p> <p>EASA and the FAA have reviewed all occurrences of the word ‘component’ and in all cases but two, ‘component’ has been removed as the term ‘software’ can be used alone, without ‘component’ adding any value.</p> <p>For the two occurrences kept, the definition of ‘component’ in the ED-12C/DO-178C Appendix B glossary is considered applicable and sufficient.</p>	

comment	98 comment by: <i>General Aviation Manufacturers Association</i> GAMA requests that the consolidated industry comments from ASD and GAMA submitted on December 1st 2016 are also addressed in this revision of the document by the Authority Team.
response	Noted. During the meetings of the informal working group that was used to draft NPA 2017-02 and consisted as well of industry representatives, EASA and the FAA addressed all inputs provided by General Aviation Manufacturers Association (GAMA), AeroSpace and Defence Industries Association of Europe (ASD) and Aerospace Industries Association (AIA). The outcome was reflected in Sections 3.1 and 3.2 of said NPA. Moreover, informal GAMA/ASD/AIA comments from 30 November 2016 referred to a outdated non-published draft document. These comments were not submitted using a public consultation tool, thus it would not be appropriate to address them in this publicly available CRD. However, those comments that were resubmitted through the comment-response tool (CRT) have been addressed in this CRD.

comment	99 comment by: <i>Rolls-Royce</i> We would like to thank you for the opportunity to respond to the NPA “Regular update of AMC-20: update of EASA AMC 20-115C and FAA AC 20-115C”. Rolls-Royce has reviewed the NPA and has no comments to submit.
response	Noted. Thank you for your feedback.

EXECUTIVE SUMMARY

p. 1-2

comment	2 comment by: <i>ECOGAS</i> 1. ECOGAS, represents maintenance organisations with a focus on SME's but also major MRO organisations. Quote Option 1: The harmonisation between the guidance of EASA and that of the FAA will relieve the current issues and allow for a smooth certification process. Harmonised AMC and ACs reflecting the state of the art and the best practices will aid the design, certification and validation processes, thereby reducing the costs. Quote from the NPA (2.4) : Overall, the proposed amendments would significantly increase the harmonisation of the EASA software guidance with that of the FAA, would have no safety, social nor environmental impacts, and would provide for economic benefits by
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	<p>streamlining the certification process.</p> <p>ECOGAS supports harmonisation. Avoid preference to any of the 32 EASA MS which would only increase complexity. We would ask EASA and FAA to proceed in due time to full harmonisation. A full harmonised solution will release resources on all three parties: the two administrations FAA and EASA and the stakeholders in the US and in 32 EASA MS alike.</p>
response	<p>Noted.</p> <p>EASA's intention is to be fully harmonised with the FAA.</p> <p>Within the EASA system on the other hand, acceptable means of compliance (AMC) are applicable across the 32 EASA Member States (MSs), therefore, no harmonisation issue exists.</p>

3. Proposed amendments and rationale in detail	p. 7
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comment	<p>31 comment by: <i>GE Aviation</i></p> <p>AC 20-115B was a single page and this AC (23 pages) complicates the application and use of 178. It includes many conditions and paths and does not provide any solid mechanism that entrusts legacy certifications. Ultimately 178C has not changed materially 178B except for the introductions of the DO-33X addendums and other areas that were previously addressed. The AC is also somewhat contrary to the flow to what the GAMA efforts are doing to reduce and simplify rules and regulations. In addition, this AC takes it a step further and adds prescriptive design items with such as Error Handling and how to design. The economic impact of this AC will be significant</p>
response	<p>Not accepted.</p> <p>Advisory Circular (AC) 20-115B was a single-page AC because it did not accommodate existing legacy processes using previous versions of ED-12B/DO-178B.</p> <p>The FAA and EASA realised that it would be prudent to develop AC/AMC 20-115C such that developers could continue using existing processes when modifying legacy software without the burden of updating all processes to ED-12C/DO-178C within a specific timeframe, allowing time to appropriately transition to ED-12C/DO-178C.</p> <p>While a single-page document recognising ED-12C/DO-178C and its related documents could also be developed, the harmonised AC/AMC 20-115D allows more latitude than the previous AC/AMC versions with regard to the use of existing processes when developing new software and modifying legacy software. Additionally, information has been relocated from other guidance sources and is provided through the EASA guidance material (GM) or FAA AC 00-SW as non-prescriptive 'best practices' material. Through GAMA, ASD, and AIA, industry participated extensively in the development of AC/AMC 20-115D.</p>



comment	<p data-bbox="359 235 391 280">37</p> <p data-bbox="1133 235 1484 280" style="text-align: right;">comment by: <i>Bell Helicopter</i></p> <p data-bbox="359 291 1484 660">3.1 (1)(a) Page 7 "<i>This [AMC]/[AC] describes an acceptable means, but not the only means, for showing compliance with the applicable airworthiness regulations for the software aspects of airborne systems and equipment certification. [<AMC> Compliance with this AMC is not mandatory and, therefore, an applicant may elect to use an alternative means of compliance. However, the alternative means of compliance must meet the relevant requirements, ensure an equivalent level of software safety, and be approved by EASA on a product or ETSO article basis.] [<AC> This AC is not mandatory and does not constitute a regulation. However, if you use the means described in the AC, you must follow it in all important respects.]</i>"</p> <p data-bbox="359 683 1484 840">Bell Comment: This sentence is ambiguous and unnecessary: "However, if you use the means described in the AC, you must follow it in all important respects." Who decides what the 'important' aspects are? Shouldn't it be assumed that if an applicant invokes this AC as a MOC, then the entire AC would be followed?</p> <p data-bbox="359 862 1484 940">Bell Recommendation: Delete the sentence. Alternatively, clarify what "all important respects" means to the applicants.</p>
response	<p data-bbox="359 985 478 1019">Accepted.</p> <p data-bbox="359 1041 1484 1120">'all important respects' is clarified in the revised wording: 'However, if you use the means described in the AC, you must follow it in all applicable respects.'</p>
comment	<p data-bbox="359 1198 391 1243">38</p> <p data-bbox="1133 1198 1484 1243" style="text-align: right;">comment by: <i>Bell Helicopter</i></p> <p data-bbox="359 1254 1484 1332">3.1 (1)(b) Page 7 "<i>This [AMC recognises]/[AC recognizes] the following EUROCAE and RTCA documents:</i></p> <p data-bbox="359 1355 1484 1467">(1) <i>EUROCAE ED-12C, Software Considerations in Airborne Systems and Equipment Certification, dated January 2012 and RTCA DO-178C, Software Considerations in Airbone Systems and Equipment Certification, dated December 13, 2011.</i>"</p> <p data-bbox="359 1489 1484 1568">Bell Comment: Why is ED-12B/DO-178B not listed as a recognized document, since it is heavily referenced and there is guidance provided to use it as a MOC?</p> <p data-bbox="359 1590 1228 1624">Bell Recommendation: Add ED-12B/DO-178B as a recognized document</p>
response	<p data-bbox="359 1668 582 1702">Partially accepted.</p> <p data-bbox="359 1724 1484 1848">AMC 20-115D allows the use of ED-12B/DO-178B, ED-12A/DO-178A and ED-12/DO-178 only under certain circumstances, as described in Sections 5 and 9 of said document; those documents are therefore not recognised as ED-12C/DO-178C-related documents.</p> <p data-bbox="359 1870 1420 1904">However, in response to your comment, we added the word 'current' in paragraph 1(b).</p>

comment	<p>100</p> <p>Paragraph: 3.1.1.a</p> <p>THE PROPOSED TEXT STATES:</p> <p><i>“...However, if you use the means described in the AC, you must follow it in all important respects.”</i></p> <p>REQUESTED CHANGE:</p> <p>Please remove or clarify the word “important.”</p> <p>JUSTIFICATION:</p> <p>The word “important” is subjective and open to interpretation.</p>	comment by: <i>The Boeing Company</i>
response	<p>Accepted.</p> <p>‘all important respects’ is clarified in the revised wording: ‘However, if you use the means described in the AC, you must follow it in all applicable respects.’</p>	

3.1. Draft acceptable means of compliance (EASA AMC/FAA AC)

p. 7-24

comment	<p>1</p> <p>Section 6 item b : To avoid any misinterpretation, could we refer to section <u>9.a</u> of ED-215/DO-330 instead of <u>9.0.a</u> ? (There is no sub-section 9.0 indeed.)</p>	comment by: <i>Benoit PINTA</i>
response	<p>Not accepted.</p> <p>ED-215/DO-330 Table T-10 references 9.0.a, therefore, 9.0.a is correct.</p>	
comment	<p>3</p> <p><i>8.a (2); If you intend to use any techniques addressed by the supplements to develop a qualified tool, then you should use the applicable supplements for those objectives (tool qualification levels (TQLs) 1, 2, 3 and 4 only). Your Tool Qualification Plan should describe:</i></p> <p><i>(a) How you will apply ED-215/DO-330 and the supplement guidance to the tool development or verification.</i></p> <p><i>(b) How you will address the applicable ED-215/DO-330 objectives and those added or modified by the supplements, which objectives apply to which components of each software tool, and how the planned activities will satisfy all the applicable objectives.</i></p> <p>Supplements are DO-178C supplements, not DO-330 supplements. They adapt DO-178C guidance when using some techniques.</p> <p>— There is no direct applicability of supplements to DO-330. For example some</p>	comment by: <i>Frederic Pothon</i>



objectives exist in DO-330 but have no equivalence in DO-178 (so in the supplements)
Example Table T-0.

- The sentence “How you will address the applicable ED-215/DO-330 objectives and those added or modified by the supplements,” is incorrect, as the supplements do not add or modify any DO-330 objectives.
- The impact of using some techniques on the tool may differ from using the same techniques in the airborne software. Example, problem of memory management, of execution time (addressed in OOT supplement) is recognized as not applicable to the tools. There are no such objectives for that kind of errors in DO-330.
- While some tool requirements may be developed in form of models, I have never seen anyone performing model simulation for tools. Tools are not real time software, most of them just produced outputs files. In consequence I don't see any benefit (from a safety perspective or user perspective) to apply Do-331 to tools.
- Some parts of DO-331 and DO-333 discusses about “tests in the target environment”. The concept of target environment doesn't exist in DO-330.

In consequence, I propose to replace all section (2) with

(2) If you intend to use any techniques addressed by the supplements to develop a qualified tool, tool qualification levels (TQLs) 1, 2, 3 and 4 only), then the Tool Qualification Plan should describe:

- Based on supplement analysis, to determine which tool qualification objectives are impacted by the use of those techniques.
- How the planned activities will satisfy those added or modified objectives

response

Accepted.

The following is part of the actual AMC 20-115D text:

‘If the applicant intends to use any techniques addressed by the supplements to develop a qualified tool (for tool qualification levels (TQLs) 1, 2, 3, and 4 only), then the tool qualification plan (TQP) should describe:

- a. based on supplement analysis, which tool qualification objectives are affected by the use of the technique(s); and
- b. how the planned activities will satisfy the added or modified objectives.’

comment

4

comment by: *Frederic Pothon*

6.a The applicant should ... “develop all the associated life-cycle data as specified in the outputs listed in the ED-12C/DO-178C Annex A tables”.

This sentence seems too prescriptive. Depending of the software life cycle, some data may be not produced. Typical example could be the number of requirement level. They be also some cases where EOC is generated directly from a model, in that case source code is not



	<p>produced. I could be also considered that for not complex software, source code may be directly developed from the Software Requirements. No design data are produced. We have also to remind that “trace data” as defined in the glossary “do not imply the production of any artefact”.</p> <p>I proposed “develop all the associated life-cycle data demonstrating the applicable objective satisfaction”</p>
response	<p>Accepted.</p> <p>The AMC 20-115D text has been changed as follows:</p> <p>‘The applicant should satisfy all of the objectives associated with the software level assigned to the software, and develop all of the associated life cycle data to demonstrate compliance with the applicable objectives, as listed in the Annex A tables of ED-12C/DO-178C and, where applicable, of ED-215/DO-330, ED-216/DO-333, ED-217/DO-332, and ED-218/DO-331. [...]’.</p>
comment	<p>5 comment by: <i>Frederic Pothon</i></p> <p><i>8.a (3) The intent of this subparagraph is to provide clarification and completeness of section MB.6.8.1 of ED-218/DO-331. If you are using models as defined in section MB.1.0 of ED-218/DO-331 as the basis for developing software, you should apply the guidance in ED-218/DO-331. When applying section MB.6.8.1 of ED-218/DO-331, you should:</i></p> <p>(a) <i>Identify what reviews and analyses objectives are planned to be satisfied by simulation alone or in combination with reviews and analyses; all other objectives should be satisfied by reviews and analyses as described in section MB.6.3 of ED-218/DO-331.</i></p> <p>(b) <i>For each identified objective justify in detail how the simulation activity alone</i></p> <p>I do'nt see any added value of this section, as it duplicates MB 6.8.1 a and b. I propose to remove this section</p>
response	<p>Not accepted.</p> <p>While AC 20-115C paragraphs 8(c)(1) and 8(c)(2) allowed the use of simulation with constrictions, they did not clarify the respective ED-218/DO-331 Sections. Upon further consideration, ED-218/DO-331, Section 6.8.2 was agreed to be sufficiently clarified but not Section 6.8.1; thus, AC/AMC 20-115D, paragraph 8(a)(3) provide the necessary clarification of Section 6.8.1.</p> <p>Note: said paragraph has been modified as proposed in comment No 71 below.</p>
comment	<p>6 comment by: <i>Marty Gasiorowski</i></p> <p>Section 9.b(7)(b) states that you can continue to use DO-178B as the MOC if you have maintained, and can still use, the plans, processes and life cycle environment, including process improvements resulting from 9.b(2)(c).</p> <p>An interpretation of this paragraph could be that the plans, processes and life-</p>

	<p>cycle environment can only be changed from the previously certified baseline to address 9.b(2)(c). However, there should be an allowance for process improvements and environment updates (potentially resulting in updates to the plans). Suggest changing the wording to something like:</p> <p>you can continue to use DO-178B as the MOC if you have maintained, and can still use, the plans, processes and life cycle environment, including process improvements resulting from 9.b(2)(c), or improvements to processes or the life cycle environment captured in revised plans.</p>
response	<p>Accepted.</p> <p>EASA and the FAA agree with the comment and have simplified the AC/AMC 20-115D text as follows:</p> <p>‘The applicant has maintained, and can still use, the software plans, processes, and life cycle environment, including improvements to processes or to the life cycle environment as captured in revised plans.’.</p>
comment	<p>8 comment by: <i>Leonardo Helicopters</i></p> <p>5.a.(1)</p> <p>Using ED-12B/DO-178B processes for new development</p> <p>The second sentence of this paragraph is stating that</p> <p>“Additionally evidence that the reused process has produced software with [favourable]/[favorable] usage history [...] may be requested”.</p> <p>COMMENT (MAJOR/CONCEPTUAL) RATIONALE:</p> <p>The intent of product-service history in ED-12B or ED-12C is to provide some compensation when a full coverage of objectives has not been reached.</p> <p>Moreover, the upgrade of ED-12B to ED-12C was not intended to correct deficiencies of issue B, but to bring some minor clarifications and to address tool qualification and specific techniques.</p> <p>Consequently, a process based on ED-12B should not be in principle considered as deficient.</p> <p>If issues in service due to deficiencies in the software development process have been observed, these deficiencies should be corrected in the frame of the continuing airworthiness process.</p> <p>PROPOSED RESOLUTION:</p> <p>The second sentence of § 5.a.(1) should be removed:</p> <p>Evidence that the reused process has produced software with [favourable]/[favorable] usage history [...] may be requested</p>

response Partially accepted.

Paragraph 5(a)(1) does not imply that ED-12B/DO-178B is deficient, but that improperly implemented ED-12B/DO-178B processes could be deficient.

The FAA and EASA agree that the wording ‘favourable usage history’ in said paragraph goes beyond what is expected in terms of evidence for the case of reusing an ED-12B/DO-178B process for new software development. Therefore, the second sentence of paragraph 5(a)(1) has been reworded as follows:

‘Evidence of resolution and closure of all process-related open problem reports (OPRs) and of all process-related audit or review findings may be requested.’

comment 9 comment by: *Leonardo Helicopters*

5.b

Using ED-12B/DO-178B processes for new development

“If the criteria of subparagraph 5.a. are not met, you should upgrade your processes and develop the new software using ED-12C/DO-178C; tool qualification processes should be addressed in accordance with ED-12C/DO-178C section 12.2 of ED-12C/DO-178C and paragraph 10.c of this document.”

COMMENT (MAJOR/CONCEPTUAL) RATIONALE:

Is complete upgrade to DO178C required whatever the criteria which is not fulfilled? This section is proposing to upgrade systematically the current processes to ED-12C/DO-178C in case the criteria identified in 5.a. are not met.

The criteria identified in 5.a. are not all addressing the same types of concerns and upgrading the processes to ED-12C may not be useful to solve the issues covered by the different criteria.

1. Are deficiencies identified in the process? *Industry interpretation:* If deficiencies are identified the scope is necessarily very limited to a small part of the process ->upgrade should be limited to the deficient part
2. Is DAL higher than previous? *Industry Interpretation:* Industry agrees to upgrade to DO178C in this case
3. Are MBD, OOT, FM processes compliant to CRIs/IPs or CMs? *Industry Interpretation:* Only the process not in accordance with any Authorities guidance (CRIs/IPs/CMs) should be upgraded to DO178C
4. Is the process for Config files/PDIs in place? *Industry interpretation:* If this process only was not already in place, only this process should comply to DO178C
5. Is there a significant change in processes or environment ? *Industry Interpretation:* Case by case – it may be necessary to upgrade all processes.

PROPOSED TEXT:



	<p><i>“b”b. If the criteria of subparagraph 5.a. are not met, you should:</i></p> <ul style="list-style-type: none"> • <i>For criteria 1 : correct, in the existing process, the identified deficiencies</i> • <i>For criteria 2 : upgrade your processes and develop the new software using ED-12C/DO-178C; tool qualification processes should be addressed in accordance with section 12.2 of ED-12C/DO-178C and paragraph 10.c of this document.</i> • <i>For criteria 3: upgrade your existing processes with the relevant supplement of ED-12C/DO-178C</i> • <i>For criteria 4: upgrade your existing processes with the relevant supplement of ED-12C/DO-178C</i> • <i>For criteria 5: on a case by case basis upgrade your processes and develop the new software using ED-12C/DO-178C; tool qualification processes should be addressed in accordance with section 12.2 of ED-12C/DO-178C and paragraph 10.c of this document.</i>
response	<p>Noted.</p> <p>Upgrading only part of the process to DO-178C/ED-12C would create an inconsistent mix of processes, not suitable for the development of new software products, which is the scope of Section 5.</p> <p>EASA and the FAA believe that appropriate criteria are provided for allowing continued use of existing processes.</p> <p>There are, however, two aspects for which it may be acceptable to upgrade only part of the process:</p> <ul style="list-style-type: none"> — paragraph 5(a)(4): for the use of parameter data items (PDIs), for which the guidance of DO-178C/ED-12C can be used in isolation, which is already covered by the current text; and — paragraph 5(a)(5): when the significance of a change to a process is indeed based on a case-by-case evaluation, which is already covered by the current text.
comment	<p>10 comment by: <i>Leonardo Helicopters</i></p> <p>8.a (2)</p> <p>Use of DO178C supplements for tools</p> <p>« (2) if you intend to use any techniques addressed by the supplements to develop a qualified tool , then you should use the applicable supplement ... »</p> <p>COMMENT (MAJOR/CONCEPTUAL) RATIONALE:</p> <p>Comment 1: DO330 is a stand alone document, DO178C supplements have to be used with the core document only.</p> <p>Comment 2: From a technical point of view some DO178C supplements objectives are not</p>

relevant for tools. For example some objectives of table T-0 of DO330 have no equivalence in DO178C; Problems related to memory management and execution time addressed in OOT supplement do not apply to the tools.

Comment 3: The intent of AMC 20-115 is not to add requirements to the standards, but to instantiate the standards. Adding requirements would invalidate the statement in the explanatory note § 2.4 that “*No drawbacks are expected*”, as well as the economic impact analysis in § 4.2.4 of this NPA.

PROPOSED TEXT:

“(2) If you intend to use any techniques addressed by the supplements to develop a qualified tool, then you may use the ED-12C/DO-178C relevant supplements as guidelines.”

response Partially accepted.

Your comment has been taken into account. The proposed wording, however, is less precise in terms of expectations than the one proposed in the similar comment No 3 above. Therefore, the text has been modified as per said comment.

comment

11

comment by: *Leonardo Helicopters*

9.b.(9)

Modifying and reusing software already approved

*“(9) If **any of the conditions** in subparagraph 9.b.(7) are not satisfied, update **all your processes and procedures (including tool qualification processes)**, using ED-12C/DO-178C and ED-215/DO-330, and make all modifications to the software using section 12.1 of ED-12C/DO-178C.”*

COMMENT (MAJOR/CONCEPTUAL) RATIONALE:

Requirement (9) is too much demanding; Upgrade should be limited to impacted processes instead of covering all processes. Upgrade of all processes, even processes verified as adequate, does not bring added value to safety and will generate only costly paper work.

PROPOSED TEXT:

*“(9)If any of the conditions in subparagraph 9.b.(7) are not satisfied, update **affected processes and procedures (including tool qualification processes)**, using ED-12C/DO-178C and ED-215/DO-330 or ED-12B/DO-178B and [EASA]/[FAA] guidance specific to the techniques used, such as that contained in associated [Certification Review Item (CRI) or published Certification Memorandum (CM)]/[issue paper or published advisory circular].”*

Figure 1 should be adapted consequently.

response Not accepted.

The intent of AC/AMC 20-115D is to allow a gradual transition to ED-12C/DO-178C, rather than a complete changeover on a particular date. EASA and the FAA consider necessary that



if an ED-12C/DO-178C supplement technique is incorporated into the processes, all processes should be upgraded to ED-12C/DO-178C.

It is important to note as well that the concept of transitioning to ED-12C/DO-178C in Section 9 is to allow declaration of the entire software as equivalent to satisfying ED-12C/DO-178C when even a small change is made in the software as long as the processes have been updated to ED-12C/DO-178C. This is an essential add-on compared to previous versions of this AC/AMC 20-115.

comment

13

comment by: *Leonardo Helicopters*

9.b (3) (b) , 9.b (6) (b) and 9.b (9) Use of ED-12B/DO-178B qualified tools

Sentence:

"All subsequent modifications to all your software **and tools** are to be made using your processes and procedures that satisfy ED-12C/DO-178C and ED-215/DO-330."

COMMENT (CONCEPTUAL/MINOR) RATIONALE:

The sentence in the above three paragraphs requires more than what is required in Chapter 10, and in particular in 10.b (2) (a). It is unclear which requirement takes precedence.

PROPOSED TEXT (in all three sections, leaving to Chapter 10 to define rules for Tools):

"All subsequent modifications to all your software ~~and tools~~ are to be made using your processes and procedures that satisfy ED-12C/DO-178C and ~~ED-215/DO-330~~."

response

Not accepted.

Section 9 deals with legacy software, whereas Section 10 concerns tools.

The applicant has the choice to keep their ED-12B/DO-178B legacy process or to transition to ED-12C/DO-178C and ED-215/DO-330.

The concept of transitioning to ED-12C/DO-178C is to allow declaration of the entire software as equivalent to satisfying ED-12C/DO-178C when even a small change is made in the software as long as the processes have been updated to ED-12C/DO-178C. This includes tool qualification processes even though there may not be any changes to the tools themselves. However, if a tool is not qualified using the new ED-215/DO-330 processes, it cannot be declared as satisfying ED-215/DO-330.

Part of the transition concept is that any future modifications or tool qualifications must be made using the ED-12C/DO-178C and ED-215/DO-330 processes.

Section 10 describes when a tool needs to be requalified using ED-12C/DO-178C and ED-215/DO-330.

comment

17

comment by: *Embraer S.A.*

6. a. "[The applicant]/[You] should... develop all the associated life-cycle data as specified in



	<p><i>the output listed in the ED-12C/DO-178C Annex A tables [...]"</i></p> <p>Depending of the software life cycle, some data may be not produced.</p> <p>Embraer proposal:</p> <p><u>"[The applicant]/[You] should satisfy all the objectives associated with the software level assigned to the software components and develop all the associated life-cycle data demonstrating the applicable objective satisfaction."</u></p>
response	<p>Accepted.</p> <p>The AMC 20-115 text has been changed as follows:</p> <p>'The applicant should satisfy all of the objectives associated with the software level assigned to the software and develop all of the associated life cycle data to demonstrate compliance with the applicable objectives, as listed in the Annex A tables of ED-12C/DO-178C and, where applicable, of ED-215/DO-330, ED-216/DO-333, ED-217/DO-332, and ED-218/DO-331.[...]'.</p>
comment	<p>19 comment by: <i>Aeronautics Corporation of America</i></p> <p>Consider adding to section 8, the guidance found in Order 8110.49 section 9-3 and SWCEH-002 section 11.4.a. See comment #18 for more details and justification.</p>
response	<p>Not accepted.</p> <p>EASA and the FAA worked together with industry (GAMA, ASD, and AIA) on AC/AMC 20-115D. A previous draft of the AC/AMC included the guidance suggested in this comment, which was removed after discussions with industry.</p>
comment	<p>20 comment by: <i>Embraer S.A.</i></p> <p>8. a. (2) (a) states that <i>"How you will apply ED-215/DO-330 and the supplement guidance to the tool development or verification."</i></p> <p>Based on this statement, the supplements DO-331, DO-332, and DO-333 should be applicable in conjunction with DO-330 if MBDV, OOT, and FM are used in Tool Development and Verification.</p> <p>This is expansion of scope in the supplements. All supplements were developed to be used with DO-178C/DO-278A. This is clearly identified in the titles and section 1.1 of each supplement that states "This supplement contains modifications and additions to DO-178C objectives, activities, explanatory text, and software life cycle data that should be addressed when model-based (or OOT, or FM) development and verification are used as part of the software life cycle."</p> <p>Embraer suggest to continue the usage of the supplement in the same scope as they were created, the scope limited to DO-178C and DO-278A and recommend to remove items 8.a.(2), 8.a.(2)(a) and 8.a.(2)(b).</p>

response	<p>Partially accepted.</p> <p>The comment has been taken into account. By removing said paragraphs, however, the expectations would remain unclarified. EASA and the FAA prefer, therefore, to modify the related text as per comment No 3.</p>
comment	<p>21 comment by: <i>Embraer S.A.</i></p> <p>9. b. (7) (b) states that you can continue to use DO-178B as the MOC if you have maintained, and can still use, the plans, processes and life cycle environment, including process improvements resulting from 9.b.(2)(c).</p> <p>This paragraph could be interpreted that processes and life-cycle environment can only be changed from the previously certified baseline to support 9.b.(2)(c) - upgrade of the software development baseline due to software level changes. This interpretation doesn't seem to be consistent with the intent of figure 1 (Legacy System Software Flow Chart).</p> <p>Embraer proposal is to adjust the text of Section 9.b.(7)(b) to: <u>"You have maintained, and can still use, the plans, processes and life cycle environment, including process improvements and changes resulting from 9.b.(2)(c), or improvements to processes or the life cycle environment captured in revised plans."</u></p>
response	<p>Accepted.</p> <p>EASA and the FAA agree with the comment and have simplified the AC/AMC 20-115D text as follows:</p> <p>'The applicant has maintained, and can still use, the software plans, processes, and life cycle environment, including improvements to processes or to the life cycle environment as captured in revised plans.'</p>
comment	<p>22 comment by: <i>Embraer S.A.</i></p> <p>9. b. (9) states <i>"If any of the conditions is subparagraph 9.b.(7) are not satisfied, update all your process and procedures (including tool qualification processes), using ED-12C/DO-178C and ED-215/DO-330, and make all modifications to the software using section 12.1 of ED-12C/DO-178C. [...]"</i></p> <p>This sentence seems not be clear. It refers to condition of subparagraph 9.b.(7) that is related only to software however it states to update all process and procedures of software and tool qualification processes also. Tool Qualification is treated in the section 10 (as showed in the Figure 1).</p> <p>Embraer proposal is: <u>"If any of the conditions is subparagraph 9.b.(7) are not satisfied, update all your process and procedures using ED-12C/DO-178C, and make all modifications to the software using section 12.1 of ED-12C/DO-178C. [...]"</u></p>

response	<p>Not accepted.</p> <p>Section 9 deals with legacy software, whereas Section 10 concerns tools.</p> <p>The applicant has the choice to keep their ED-12B/DO-178B legacy process or to transition to ED-12C/DO-178C and ED-215/DO-330.</p> <p>The concept of transitioning to ED-12C/DO-178C is to allow declaration of the entire software as equivalent to satisfying ED-12C/DO-178C when even a small change is made in the software as long as the processes have been updated to ED-12C/DO-178C. This includes tool qualification processes even though there may not be any changes to the tools themselves. However, if a tool is not qualified using the new ED-215/DO-330 processes, it cannot be declared as satisfying ED-215/DO-330.</p> <p>Part of the transition concept is that any future modifications or tool qualifications must be performed using the ED-12C/DO-178C and ED-215/DO-330 processes.</p> <p>Section 10 describes when a tool needs to be requalified using ED-12C/DO-178C and ED-215/DO-330.</p>
comment	<p>23 comment by: <i>Embraer S.A.</i></p> <p>10. c. (3) (b) states that <i>"If TQL-4 is the required tool qualification level, you should requalify your verification tool using ED-215/DO-330."</i>, however this approach should be reevaluated. According to Table 2, the TQL 4 on DO-330 is equivalent to DO-178B Level D, so it seems that a previously qualified tool under DO-178B for Level D or higher level will achieve the TQL 4.</p> <p>Embraer suggests to include TQL 4 with TQL 5 in Section 10.c.(3)(a) and delete Section 10.c.(3)(b). The new Section 10.c.(3)(a) would become: <u>10.c.(3)(a) If TQL-4 or TQL-5 is the required tool qualification level, and your verification tool was previously qualified using ED-12B/DO-178B: [...]"</u></p>
response	<p>Not accepted.</p> <p>Paragraph 10(c)(3)(b) deals with verification tools, not development tools. TQL-4 correlates with Levels A and B verification tools of ED-12B/DO-178B. Therefore, an ED-12B/DO-178B verification tool qualified to Level C or D would need to be requalified if TQL-4 is required.</p>
comment	<p>24 comment by: <i>GE Aviation</i></p> <p>Need to clarify that RTCA/DO-248C does not carry the same "weight" as RTCA/DO-178. Suggest adding clarification at the end of this sub section.</p> <p>Propose:</p> <p>Add something to the effect of the following to the text: "The FAQ's and DP's may be taken into account where relevant, when assessing the software."</p>

response	<p>Not accepted.</p> <p>DO-248C/ED-94C are not formally recognised in paragraph 1(b); therefore, they do not carry the same weight as the formally recognised documents.</p> <p>Paragraph 1(c) introduces DO-248C/ED-94C as supporting material.</p>
comment	<p>25 comment by: <i>GE Aviation</i></p> <p>Need to make it clear, since this AC can not do anything else but recommend that all "new" TSO applications use RTCA/DO-178C, that this section doesn't apply to applicants who choose to meet the TSO requirements.</p> <p>See section 7. b. for more information</p> <p>Propose:</p> <p>Add an exception to this paragraph, something to the effect of: "unless meeting the requirements of a TSO"</p>
response	<p>Noted.</p> <p>The comment is no longer applicable as the relevant Section 7 text has been removed. Applicability to technical standard orders (TSOs) is clarified in paragraph 1(a).</p>
comment	<p>26 comment by: <i>GE Aviation</i></p> <p>There is no data in table A-10 that is not applicable for all software levels. Recommend you remove table A-10.</p> <p>Propose:</p> <p>Modify the text to read: "If a data item specified in section 9.4 of ED-12C/DO-178C is not required in Table A-2 for a given software level, then this data item is not part of the type design data."</p>
response	<p>Partially accepted.</p> <p>For clarification purposes, said sentence has been reworded as follows:</p> <p>'[...] specifically the design description and the source code are not part of the type design data for Level D software.'</p>
comment	<p>27 comment by: <i>GE Aviation</i></p> <p>There is confusion among certification authorities and designees as to what constitutes a criteria 2 tool versus criteria 3. Below is an actual response to an action item, from the FAA, concerning two differing opinions from certification authorities:</p> <p><u><i>[Note: **Content deleted for confidentiality purposes**]</i></u></p>

response	<p>Noted.</p> <p>The comment is unclear with respect to the proposed modification.</p> <p>This related topic continues to be actively discussed.</p> <p>Please note that part of the comment has been deleted as it contained confidential information.</p>
comment	<p>33 comment by: ASD</p> <p><u>Page 9, Paragraph 5.a.(1): Using ED-12B/DO-178B processes for new development.</u></p> <p>Reference Text:</p> <p>The second sentence of this paragraph is stating that:</p> <p>“Additionally, evidence that the reused process has produced software with [favourable]/[favorable] usage history [...] may be requested”.</p> <p>Comment:</p> <p>The intent of product-service history in ED-12B or ED-12C is to provide some compensation when a full coverage of objectives has not been reached.</p> <p>Moreover, the upgrade of ED-12B to ED-12C was not intended to correct deficiencies of issue B, but to bring some minor clarifications and to address tool qualification and specific techniques.</p> <p>Consequently, a process based on ED-12B should not be in principle considered as deficient.</p> <p>If issues in service due to deficiencies in the software development process have been observed, these deficiencies should be corrected in the frame of the continuing airworthiness process.</p> <p>Proposed Resolution:</p> <p>The second sentence of § 5.a.(1) should be removed:</p> <p>Evidence that the reused process has produced software with [favourable]/[favorable] usage history [...] may be requested</p>
response	<p>Partially accepted.</p> <p>Paragraph 5(a)(1) does not imply that ED-12B/DO-178B is deficient, but that improperly implemented ED-12B/DO-178B processes could be deficient.</p> <p>The FAA and EASA agree that the wording ‘favourable usage history’ in said paragraph goes beyond what is expected in terms of evidence for the case of reusing an ED-12B/DO-178B process for new software development. Therefore, the second sentence of paragraph 5(a)(1) has been reworded as follows:</p> <p>‘Evidence of resolution and closure of all process-related OPRs and of all process-related audit or review findings may be requested.’.</p>

comment	<p>39 comment by: <i>Bell Helicopter</i></p> <p>5 (a)(1) Page 9 "<i>The software development assurance processes can be shown to have no known process deficiencies, such as those discovered during internal or external audit or review, or identified in open problem report(s) resulting in non-compliance to one or more ED-12B/DO-178B objectives. Additionally, evidence that the process has produced software with [favourable]/[favorable] usage history, based on evaluation of previous projects, including review of safety-related service difficulties, airworthiness directives, and process-related problem reports may be requested.</i>"</p> <p>Bell Comment: <i>Certification authorities could unnecessarily make this evidence difficult to show for product(s) that were just recently certified. For example, what if there is less than 1 year of product service history? Re-using the same previously approved processes should not be disallowed purely because the previous completed project was recent.</i></p> <p><i>Bell Recommendation:</i> Recommend adding sentence "There is no minimum required length of time for establishing this usage history."</p>
response	<p>Partially accepted</p> <p>The FAA and EASA agree that the wording 'favourable usage history' in said paragraph goes beyond what is expected in terms of evidence for the case of reusing an ED-12B/DO-178B process for new software development. Therefore, the second sentence of paragraph 5(a)(1) has been reworded as follows:</p> <p>'Evidence of resolution and closure of all process-related OPRs and of all process-related audit or review findings may be requested.'</p>
comment	<p>40 comment by: <i>Bombardier</i></p> <p>Page 9, 5.a.(1) refers to "no known process deficiencies" but does not define criteria for identifying something as a process deficiency. We recommend this be better defined.</p>
response	<p>Accepted.</p> <p>The second sentence of said paragraph has been reworded to provide clearer expectations regarding evidence that the process has no known deficiencies.</p>
comment	<p>41 comment by: <i>Bombardier</i></p> <p>Page 9, 5.a.(3) refers to processes developed in accordance with EASA and FAA guidance. We recommend that the text also allow processes to be developed in accordance with equivalent third party guidance.</p>
response	<p>Not accepted.</p> <p>Model-based development (MBD), object-oriented technology (OOT), and formal methods</p>

(FMs) processes prior to publication of the associated ED-12C/DO-178C supplements should have been developed under authority oversight as would be the case when an EASA certification review item (CRI) or FAA issue paper (IP) was to be applied. ‘Equivalent third party guidance’ does not guarantee appropriate oversight.

comment

42

comment by: *Bombardier*

Figure 1 does not mention minor or major software functionality change as a criteria for the migration to DO-178C. We recommend a statement that migration should be limited to major functionality changes.

response

Not accepted.

AC/AMC 20-115, Section 9 focusses on the process. If a process is currently in place, then a change can be made using that process, provided that the flow chart conditions are met; otherwise a transition to ED-12C/DO-178C is required. The classification of a change as major or minor does not enter into the decision.

comment

43

comment by: *Bell Helicopter*

5 (a)(1) Page 9 *"The software development assurance processes can be shown to have no known process deficiencies, such as those discovered during internal or external audit or review, or identified in open problem report(s) resulting in non-compliance to one or more ED-12B/DO-178B objectives. Additionally, evidence that the process has produced software with [favourable]/[favorable] usage history, based on evaluation of previous projects, including review of safety-related service difficulties, airworthiness directives, and process-related problem reports may be requested. "*

Bell Comment: There is a significant difference between the text in this paragraph and what is implied by the Figure 1 flowchart. The flowchart implies that if this review finds anything unacceptable in the usage history, then the way forward is to "correct product and process deficiencies."

Bell Recommendation: Recommend adding sentence "This criteria will be considered satisfied once all known software process deficiencies (if any) are resolved and once plans are in place to resolve all known software product deficiencies from safety-related service difficulties/airworthiness directives (if any)".

response

Not accepted.

The main difference between Sections 5 and 9 (including the Figure 1 flow chart) is that Section 5 allows new software development using legacy processes; therefore, it is an essential criterion that the proposed legacy process is flawless.



comment	<p>44 comment by: <i>Bombardier</i></p> <p>Page 16, 9.b.(3)(b): When referring to "all processes and procedures" being upgraded, does this mean that development and verification activities also need to be augmented to show compliance to the new processes and procedures?</p>
response	<p>Noted.</p> <p>Yes, for the portions modified and for the ones impacted by the modification as per the software change impact analysis (CIA); no, for the other portions of the software component.</p>
comment	<p>45 comment by: <i>Bell Helicopter</i></p> <p>5 (a)(3)" page 9 <i>Model-based development, object-oriented technology, or formal methods will not be used, unless processes incorporating these methods were evaluated and found to be acceptable by [EASA]/[the FAA]. These processes should have been developed in accordance with [EASA]/[FAA] guidance specific to the technique, such as that contained in associated [Certification Review Item (CRI) or published Certification Memorandum (CM)]/[issue paper or published advisory circular]. "</i></p> <p><i>Bell Comment: Assumes that the FAA/EASA directly evaluated previous use of these technologies. Does not account for use of designees who may have done the previous evaluation.</i></p> <p><i>Bell Recommendation: Change From: "evaluated and found to be acceptable by [EASA]/[the FAA]" To: "evaluated and found to be acceptable by [EASA]/[the FAA] or its designee(s)".</i></p>
response	<p>Not accepted.</p> <p>The applicant's proposal for satisfying a CRI or IP should have been evaluated by the competent authority. For the FAA, once an applicant's proposed method for satisfying an IP is accepted, oversight over the agreed-upon method may be delegated; however, this does not need to be stated in the AC.</p> <p>Subpart J — DESIGN ORGANISATION APPROVAL (DOA) of Annex I (Part 21) to Regulation (EU) No 748/2012 does not provide for designees.</p>
comment	<p>46 comment by: <i>Bell Helicopter</i></p> <p>5 (a)(4) Page 9 "<i>Existing processes for using configuration data (as defined under "Parameter Data Item" in ED-12C/DO-178C) were evaluated and found to be acceptable by [EASA]/[the FAA]. In the absence of processes for using configuration data, the applicant should establish new processes for using parameter data items in accordance with ED-12C/DO-178C. "</i></p> <p><i>Bell Comment: Assumes that the FAA/EASA directly evaluated previous use of these technologies. Does not account for use of designees who may have done the previous</i></p>

	<p><i>evaluation.</i></p> <p><i>Bell Recommendation:</i> Change to “found to be acceptable by [EASA]/[the FAA] or its designee(s)”.</p>
response	<p>Not accepted.</p> <p>FAA designees act on behalf of the FAA when delegated. This does not need to be stated in the AC.</p> <p>Subpart J — DESIGN ORGANISATION APPROVAL (DOA) of Part 21 does not provide for designees.</p>
comment	<p>47 comment by: <i>Bombardier</i></p> <p>Page 16, 9.b.(6) The expectation that DO-178C equivalence applies to both modified and unmodified software is inconsistent with the statement in 9.b.(3)(b): One could decide to circumvent this item (6) by applying (3b) first to obtain the certification of DO-178C, then later proceed a modification to the software. Since the unchanged software was already declared as DO-178C, there is no need to apply this item (6) for the unmodified software.</p>
response	<p>Noted.</p> <p>Equivalence declaration applies to both modified and unmodified software, and requires all processes to be updated to ED-12C/DO-178C; all subsequent changes must be made using ED-12C/DO-178C processes.</p>
comment	<p>48 comment by: <i>Bombardier</i></p> <p>Page 19, 10.c.(2)(a). It is unclear what TQL is required if the DO-178B TQL exceeds that required for DO-178C (the existing TQL, or the DO-178C TQL).</p> <p>We recommend clarifying this.</p>
response	<p>Noted.</p> <p>Paragraph 10(c)(2)(a) states the following:</p> <p>‘[...] If the ED-12B/DO-178B software level assigned to the tool <u>correlates with or exceeds the required TQL established by ED-12C/DO-178C, the applicant may continue to use their ED-12B/DO-178B tool qualification processes.</u> [...]’.</p>
comment	<p>49 comment by: <i>Bell Helicopter</i></p> <p>5 (a)(5) Page 9 <i>“There are no significant changes to the software processes described in the plans or to the software development environment. This should be supported through analysis of changes to the previously accepted software development processes and</i></p>

	<p><i>environment."</i></p> <p>Bell Comment: <i>No "significant" changes – ambiguous. Is a new compiler version significant in this context? A new version of a qualified tool? Or does significant refer to the addition of new tools / automation?</i></p> <p><i>Certification authorities could unnecessarily label any tool version change or any revision to plans/standards documents as a significant change.</i></p> <p>Bell Recommendation: Clarify or provide examples of what type of change is considered significant and non-significant.</p>
response	<p>Not accepted.</p> <p>One way of solving this issue would be to remove the word 'significant' (as proposed under comment No 108), but this would forbid any change to a process.</p> <p>It is the purpose of the second sentence of paragraph 5(a)(5): '[...]' This should be supported through analysis of the changes [...]' to allow the applicant to clarify what is considered to be significant or not.</p> <p>Early coordination with the certification authorities is always necessary in this case, as for any other criteria of Section 5.</p>
comment	<p>50 comment by: Bell Helicopter</p> <p>6(b) Page 10 "<i>[The applicant]/[You] should submit [to EASA,]/[,] as a minimum, the life-cycle data specified in section 9.3 of ED-12C/DO-178C and section 9.0.a of ED-215/DO-330, as applicable for tool qualification [<AC>, to the appropriate project certification office]. [EASA's]/[Our] involvement in [the]/[your] software development assurance processes will be at [its]/[our] discretion. Regardless of [EASA]/[our] involvement, it is [the applicant's]/[your] responsibility to perform the planned activities and produce the life-cycle data necessary to satisfy all applicable objectives."</i></p> <p>Bell Comment: Regarding the sentence: "<i>[The applicant]/[You] should submit [to EASA,]/[,] as a minimum, the life-cycle data specified in section 9.3 of ED-12C/DO-178C and section 9.0.a of ED-215/DO-330, as applicable for tool qualification [<AC>, to the appropriate project certification office]."</i></p> <p>This data should only be submitted to FAA/EASA if required based on level of involvement in the project. Otherwise they should be submitted to the designees.</p> <p>Bell Recommendation: Change From: "<i>[to EASA,]"</i> To: "<i>[to EASA or its designee]"</i></p> <p>Change From: "<i>to the appropriate project certification office"</i> To: "<i>to the appropriate project certification office or its designee(s)"</i></p>
response	<p>Not accepted.</p> <p>FAA designees act on behalf of the FAA when delegated. This does not need to be stated in</p>

the AC.

Subpart J — DESIGN ORGANISATION APPROVAL (DOA) of Part 21 does not provide for designees.

comment

51

comment by: *Bell Helicopter*

6(d) Page 10 "You should make available to [EASA]/[us], upon request, any of the data described in section 11 of ED-12C/DO-178C, applicable tool qualification data, data outputs from any applicable supplements, and any other data needed to substantiate satisfaction of all the applicable objectives."

Bell Comments: Same as previous comment regarding use of designees.

Bell Recommendations: Change From: "make available to [EASA]/[us], upon request," To: "make available to [EASA]/[us] or our designee(s), upon request,"

response

Not accepted.

FAA designees act on behalf of the FAA when delegated. This does not need to be stated in the AC.

Subpart J — DESIGN ORGANISATION APPROVAL (DOA) of Part 21 does not provide for designees.

comment

52

comment by: *Bell Helicopter*

9(b) Page 12 "Figure 1 presents a flow chart for using legacy system software. Use the flow chart while following the procedures in this subparagraph if you are modifying or reusing legacy system software. Although these procedures will apply to the majority of projects, you should coordinate situations that do not follow this flow with [EASA]/[the certification office]."

Bell Comment: Same as previous comment regarding use of designees.

Bell Recommendation: Change From: "you should coordinate situations that do not follow this flow with [EASA]/[the certification office]." To: "you should coordinate situations that do not follow this flow with [EASA]/[the certification office] or its designee(s)."

response

Not accepted.

Designees act on behalf of the FAA when delegated. This does not need to be stated in the AC. 'Certification office' includes organization designation authorization (ODA).

Subpart J — DESIGN ORGANISATION APPROVAL (DOA) of Part 21 does not provide for designees.



comment	<p>53 comment by: <i>Bell Helicopter</i></p> <p>Figure 1 page 13,14 [<i><AMC> Figure 1 — Legacy System Software Process Flow Chart</i>]</p> <p>Bell Comment: Regarding the flowchart item “Correct product and process deficiencies. See 9.b.(1)” There is a circular logic here – if there is a product deficiency requiring a software modification to resolve, then it can’t be resolved until the applicant knows whether they can re-use their DO-178B process or are forced to transition to DO-178C.</p> <p>Bell Recommendation: Change the flowchart item From: “Correct product and process deficiencies. See 9.b.(1)” To: “Correct process deficiencies. See 9.b.(1)”</p>
response	<p>Partially accepted.</p> <p>In response to comment No 55, paragraph 9(b)(1) has been modified as follows:</p> <p>‘[...] Prior to modifying or reusing the legacy software, the applicant should correct any related development process deficiencies, [...]’.</p> <p>The Figure 1 flow chart has also been revised accordingly.</p>
comment	<p>54 comment by: <i>Bell Helicopter</i></p> <p>Figure 1, page 13 7 14: [<i><AMC> Figure 1 — Legacy System Software Process Flow Chart</i>]</p> <p>Bell Comment: Regarding the flowchart item “Correct product and process deficiencies. See 9.b.(1)” The implication of the text in 5.a.1 and 9.b.1 is that if these deficiencies are not corrected, then the criteria is not satisfied, and therefore per 5.a applicants would not be allowed to continue using their DO-178B processes for new development.</p> <p>This is not reflected in the flow chart – there should be a path showing that if deficiencies are not corrected, then the applicant has to “Upgrade software baseline including all processes & procedures using ED-12C and ED-215.”</p> <p>Bell Recommendation: Change the flowchart item “Correct product and process deficiencies. See 9.b.(1)” to a DECISION item (diamond) with the “Yes” path going to the next decision item, and a “No” path going to a “Upgrade software baseline including all processes & procedures using ED-12C and ED-215” block.</p>
response	<p>Not accepted.</p> <p>Your comment has been taken into account but the solution you suggest would unnecessarily overload Figure 1.</p> <p>The decision you mention is already covered as 9(b)(1) states: ‘[...] Prior to modifying or reusing the legacy software, the applicant should correct any related development process deficiencies, [...]’. If the applicant does not correct the deficiencies, then they cannot modify or reuse the software. Correcting deficiencies could include upgrading to ED-12C/DO-178C.</p>

comment	<p>55 comment by: <i>Bell Helicopter</i></p> <p>9 (b)(1) page 15: <i>"Assess the legacy system software to be modified or reused for its usage history from previous installations. If the software has safety-related service difficulties, airworthiness directives, or open problem reports that may have a safety impact on the proposed installation, correct the known software and development process deficiencies prior to modifying or reusing the software."</i></p> <p>Bell Comment: Regarding the phrase: "...correct the known software and development process deficiencies prior to modifying or reusing the software." There is a circular logic here – software product deficiencies can't be resolved without modifying the software, which requires the applicant and cert authority to agree on whether to use existing process or transition to DO-178C processes.</p> <p>Bell Recommendation: Change From: "...correct the known software and development process deficiencies prior to modifying or reusing the software." To: "...correct the known development process deficiencies prior to modifying or reusing the software." Or To: "...correct the known development process deficiencies prior to modifying or reusing the software and establish plans to resolve all related software product deficiencies."</p>
response	<p>Accepted.</p> <p>The related text has been changed as follows:</p> <p>'[...] If the software has safety-related service difficulties, airworthiness directives, or OPRs with a potential safety impact on the proposed installation, the applicant should establish plans to resolve all related software deficiencies. Prior to modifying or reusing the legacy software, the applicant should correct any related development process deficiencies, [...]'</p>
comment	<p>56 comment by: <i>Bell Helicopter</i></p> <p>9 (b)(3) page 15 <i>"If the usage history of your legacy system software is acceptable, the software level has a "}" entry in Table 1 (or the baseline has been upgraded appropriately), and modifications to the software are not required, then:"</i></p> <p>Bell Comment: Again, the following phrase has ambiguity and is incomplete in terms of allowing usage history issues to be resolved: "If the usage history of your legacy system software is acceptable"</p> <p>Bell Recommendation: Rather than repeating text, re-word 9(b)(3) to say: "If the criteria in 9(b)(1) and 9(b)(2) are satisfied, and modifications to the software are not required, then:"</p>
response	<p>Accepted.</p> <p>The proposed change has been included into the AMC 20-115D text.</p>
comment	<p>57 comment by: <i>Bell Helicopter</i></p>

9 (b)(3)(b) page 16 *"If you upgraded the software development baseline using ED-12C/DO-178C and updated all processes and procedures, including tool qualification processes, to ED-12C/DO-178C and ED-215/DO-330, then you may declare your software as equivalent to satisfying ED-12C/DO-178C. However, you cannot declare your unmodified tools as equivalent to having satisfied ED-12C/DO-178C and ED-215/DO-330. All subsequent modifications to all your software and tools are to be made using your processes and procedures that satisfy ED-12C/DO-178C and ED-215/DO-330."*

Bell Comment: Disagree with the following statement for DO-178B Verification Tools that are now classified as DO-178C/DO-330 TQL5 tools. "However, you cannot declare your unmodified tools as equivalent to having satisfied ED-12C/DO-178C and ED-215/DO-330." There are no significant documentation or process differences required for TQL-5 tools, so there should be no issue stating that this type of unmodified tool has satisfied DO-178C/DO-330 TQL5.

Bell Recommendation: Change From: "However, you cannot declare your unmodified tools as equivalent to having satisfied ED-12C/DO-178C and ED-215/DO-330." To: "However, you cannot declare your unmodified tools as equivalent to having satisfied ED-12C/DO-178C and ED-215/DO-330 except for tools classified as TQL-5."

response

Not accepted.

EASA considers that it would be inappropriate to allow any ED-12B/DO-178B tool to be declared as satisfying ED-215/DO-330 if the tool's qualification process does not satisfy the standard.

TQL5 tools should not be treated any differently even though their qualification may be similar to ED-12B/DO-178B qualification.

comment

58

comment by: Bell Helicopter

9 (b)(6) page 16 *"If you upgraded the software baseline to ED-12C/DO-178C in accordance with subparagraph 9.b.(2), make all modifications to the software using section 12.1 of ED-12C/DO-178C. If you want to declare your software as equivalent to satisfying ED-12C/DO-178C, your equivalence declaration applies to both modified and unmodified software and is valid even if you use unmodified tools that have not been qualified using ED-12C/DO-178C. However, you cannot declare your unmodified tools as equivalent to having satisfied ED-12C/DO-178C and ED-215/DO-330. All subsequent modifications to all your software and tools are to be made using your processes and procedures that satisfy ED-12C/DO-178C and ED-215/DO-330. "*

Bell Comment: There are no significant documentation or process differences required for TQL-5 tools, so there should be no issue stating that this type of unmodified tool has satisfied DO-178C/DO-330 TQL5.

response

Not accepted.



EASA considers that it would be inappropriate to allow any ED-12B/DO-178B tool to be declared as satisfying ED-215/DO-330 if the tool's qualification process does not satisfy the standard.

TQL5 tools should not be treated any differently even though their qualification may be similar to ED-12B/DO-178B qualification.

comment 59

comment by: *Bell Helicopter*

9 (b)(7)(a) Page 16 "*Model-based development, object-oriented technology or formal methods will not be used unless processes incorporating these methods were evaluated and found to be acceptable by [EASA]/[the FAA]. These processes should have been developed in accordance with the [EASA]/[FAA] guidance specific to the technique, such as that contained in associated [Certification Review Item (CRI) or published Certification Memorandum (CM)]/[issue paper or published advisory circular].*"

Bell Comments: This data should only be submitted to FAA/EASA if required based on level of involvement in the project. Otherwise they should be submitted to the designees.
Bell Recommendation: Change From: "evaluated and found to be acceptable by [EASA]/[the FAA]" To: "evaluated and found to be acceptable by [EASA]/[the FAA] or its designee(s)"

response

Not accepted.

For FAA projects, processes developed using one of the above-mentioned technologies prior to ED-12C/DO-178C would have been accomplished using an IP. The cognisant aircraft certification office (ACO) could have delegated oversight to a designee if the ACO determined it was appropriate. Since designees act on behalf of the FAA, the wording can remain unchanged.

Subpart J — DESIGN ORGANISATION APPROVAL (DOA) of Part 21 does not provide for designees.

comment 60

comment by: *Bell Helicopter*

9 (b)(8)(b) page 17 "*You may use existing processes for configuration data (as defined under 'Parameter Data Item' in ED-12C/DO-178C) that were evaluated and found to be acceptable by [EASA]/[the FAA]. In the absence of processes for using configuration data, [the applicant]/[you] should establish new processes for using parameter data items in accordance with ED-12C/DO-178C.*"

Bell Comment: This data should only be submitted to FAA/EASA if required based on level of involvement in the project. Otherwise they should be submitted to the designees.

Bell Recommendation: Change From: "evaluated and found to be acceptable by [EASA]/[the FAA]" To: "evaluated and found to be acceptable by [EASA]/[the FAA] or its designee(s)"



response	<p>Not accepted.</p> <p>For FAA projects, processes developed using one of above-mentioned technologies prior to ED-12C/DO-178C would have been accomplished using an IP. The cognisant ACO could have delegated oversight to a designee if the ACO determined it was appropriate. Since designees act on behalf of the FAA, the wording can remain unchanged.</p> <p>Subpart J — DESIGN ORGANISATION APPROVAL (DOA) of Part 21 does not provide for designees.</p>
comment	<p>61 comment by: <i>Bell Helicopter</i></p> <p>9 (b)(9) page 17 <i>"If any of the conditions in subparagraph 9.b.(7) are not satisfied, update all your processes and procedures (including tool qualification processes), using ED-12C/DO-178C and ED-215/DO-330, and make all modifications to the software using section 12.1 of ED-12C/DO-178C. If you want to declare your software as equivalent to satisfying ED-12C/DO-178C, your declaration applies to both the modified and unmodified software and is valid even if you use unmodified tools that have not been qualified using ED-12C/DO-178C and ED-215/DO-330. However, you cannot declare your unmodified tools as equivalent to having satisfied ED-12C/DO-178C and ED-215/DO-330. All subsequent modifications to all your software and tools are to be made using your processes and procedures that satisfy ED-12C/DO-178C and ED-215/DO-330."</i></p> <p>Bell Comments: There are no significant documentation or process differences required for TQL-5 tools, so there should be no issue stating that this type of unmodified tool has satisfied DO-178C/DO-330 TQL5.</p> <p>Bell Recommendation: Change From: "However, you cannot declare your unmodified tools as equivalent to having satisfied ED-12C/DO-178C and ED-215/DO-330." To: "However, you cannot declare your unmodified tools as equivalent to having satisfied ED-12C/DO-178C and ED-215/DO-330 except for tools classified as TQL-5."</p>
response	<p>Not accepted.</p> <p>EASA considers that it would be inappropriate to allow any ED-12B/DO-178B tool to be declared as satisfying ED-215/DO-330 if the tool's qualification process does not satisfy the standard.</p> <p>TQL5 tools should not be treated any differently even though their qualification may be similar to ED-12B/DO-178B qualification.</p>
comment	<p>62 comment by: <i>Bell Helicopter</i></p> <p>10(3)(c) page 18 <i>"You may declare your tool as equivalent to having satisfied ED-215/DO-330 if all changes to the tool and your tool qualification processes satisfy ED-215/DO-330. "</i></p> <p>Bell Comment: Section 10(3)(c) assumes that the tool version is changing. Needs to be updated to also apply to the case where the existing tool version is to be re-qualified to DO-</p>

	<p>330.</p> <p>Bell Recommendation:</p> <p>Change From: “(c) You may declare your tool as equivalent to having satisfied ED-215/DO-330 if all changes to the tool and your tool qualification processes satisfy ED-215/DO-330.”</p> <p>To: “(c) You may declare your tool as equivalent to having satisfied ED-215/DO-330 if all changes to the tool (if applicable) and your tool qualification processes satisfy ED-215/DO-330.”</p>
response	<p>Accepted.</p> <p>The proposed change has been included into the AMC 20-115D text.</p>

comment	<p>64</p> <p style="text-align: right;">comment by: ASD</p> <p><u>Page 10 Paragraph 5.b: Using ED-12B/DO-178B processes for new development</u></p> <p>Reference Text:</p> <p>“If the criteria of subparagraph 5.a. are not met, you should upgrade your processes and develop the new software using ED-12C/DO-178C; tool qualification processes should be addressed in accordance with ED-12C/DO-178C section 12.2 of ED-12C/DO-178C and paragraph 10.c of this document.”</p> <p>Comment:</p> <p>This section is proposing to upgrade systematically the current processes to ED-12C/DO-178C in case the criteria identified in 5.a. are not met.</p> <p>As already mentioned in November 2016 by ASD, the criteria identified in 5.a. are not all addressing the same types of concerns and upgrading all the processes to ED-12C/DO-178C could be costly and without safety added value.</p> <p>5.a criteria are discussed hereafter:</p> <p>Is DAL higher than previous? Industry Interpretation: Industry agrees to upgrade to DO178C in this case</p> <p>3. 3. Are MBD, OOT, FM processes compliant to CRIs/IPs or CMs? Interpretation: Only the process not in accordance with any Authorities guidance (CRIs/IPs/CMs) should be upgraded to DO178C</p> <p>4. 4. Is the process for Config files/PDIs in place? Industry interpretation: If this process only was not already in place, only this process should comply to DO178C</p> <p>5. 5. Is there a significant change in processes or environment? Industry Interpretation: Case by case – it may be necessary to upgrade all process</p> <p>Proposed Resolution:</p> <p>Consistently with November 2016 proposal, ASD proposal is the following text:</p>
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	<p>“b. If the criteria of subparagraph 5.a. are not met, you should:</p> <p>For criterion 1: correct, in the existing process, the identified deficiencies</p> <p>For criterion 2: upgrade your processes and develop the new software using ED-12C/DO-178C; tool qualification processes should be addressed in accordance with section 12.2 of ED-12C/DO-178C and paragraph 10.c of this document.</p> <p>For criterion 3: upgrade your existing processes with the relevant supplement of ED-12C/DO-178C</p> <p>For criterion 4: upgrade your existing processes with the relevant sections of ED-12C/DO-178C</p> <p>For criterion 5: on a case by case basis upgrade your processes and develop the new software using ED-12C/DO-178C; tool qualification processes should be addressed in accordance with section 12.2 of ED-12C/DO-178C and paragraph 10.c of this document.</p>
response	<p>Noted.</p> <p>Upgrading only part of the process to DO-178C/ED-12C would create an inconsistent mix of processes, not suitable for the development of new software products, which is the scope of Section 5).</p> <p>EASA and the FAA believe that appropriate criteria are provided for allowing continued use of existing processes.</p> <p>There are, however, two aspects for which it may be acceptable to upgrade only part of the process:</p> <ul style="list-style-type: none"> — paragraph 5(a)(4): for the use of PDIs, for which the guidance of DO-178C/ED-12C can be used in isolation; which is already covered by the current text; and — paragraph 5(a)(5): when the significance of a change to a process is indeed based on a case-by-case evaluation, which is already covered by the current text.
comment	<p>65 comment by: ASD</p> <p><u>Page 11 Paragraph 8.a (2): Use of DO178C supplements for tools</u></p> <p>Reference Text:</p> <p>“(2) if you intend to use any techniques addressed by the supplements to develop a qualified tool, then you should use the applicable supplement ...”</p> <p>Comment:</p> <p>Comment 1: DO330 is a standalone document, DO178C supplements (MBD, OOT, FM supplements) have to be used with the core document only.</p> <p>Comment 2: From a technical point of view some DO178C supplements objectives are not relevant for tools. For example, some objectives of table T-0 of DO330 have no equivalence in DO178C; Problems related to memory management and execution time addressed in OOT</p>

	<p>supplement do not apply to the tools.</p> <p>Comment 3: The intent of AMC 20-115D is not to add requirements to the standards, but to instantiate the standards. Adding requirements would invalidate the statement in the explanatory note § 2.4 that “No drawbacks are expected”, as well as the economic impact analysis in § 4.2.4 of this NPA.</p> <p>Proposed Resolution:</p> <p>Consistently with November 2016 proposal, ASD proposal is the following text:</p> <p>“(2) If you intend to use any techniques addressed by the supplements to develop a qualified tool, then you may use the ED-12C/DO-178C relevant supplements as guidelines.”</p>
response	<p>Partially accepted.</p> <p>Your comment has been taken into account. The proposed wording, however, is less precise in terms of expectations than the one proposed in the similar comment No 3 above. Therefore, the text has been modified as per said comment.</p>
comment	<p>71 comment by: Airbus Helicopters</p> <p>Page 11, § 8.a.(3)</p> <p>This section is intending to complete ED-218/DO-331 section MB.6.8.1.</p> <p>It is not the purpose of this A(M)C to complete an industrial standard.</p> <p>The explanatory note in § 2 of this NPA is summarizing why the current A(M)C is updated, what is updated and how. And it is nowhere identified that the objective is to complete the industrial standard.</p> <p>Suggestion</p> <p>We suggest updating the first sentence as indicated below:</p> <p><i>“(3) The intent of this subparagraph is to provide clarification of section MB.6.8.1 of ED-218/DO-331.”</i></p>
response	<p>Accepted.</p> <p>‘and completeness’ has been removed from the text.</p>
comment	<p>73 comment by: Transport Canada Civil Aviation Standards Branch</p> <p>Paragraph</p> <p>5 a, 5 a (2)</p> <p>Comment</p> <p>The criteria under 5 a, in particular 5 a (2), create an unfair level playing field between new</p>



and existing airborne software manufacturers.

Rational for Comment

Most, if not all, significant avionics SW houses have previously developed and fielded level A software and will not be compelled to step up to 178C. New entrants into the field will have to meet a higher software development bar than the legacy companies.

Recommendation

Applicants should upgrade their processes to DO-178C / ED-12C for new development.

response

Not accepted.

Developers should be able to continue using approved ED-12B/DO-178B processes under the conditions described in Section 5.

EASA and the FAA consider that they have provided appropriate criteria for selecting the existing processes that may be used for new software development. In particular, the focus of paragraph 5(a)(1) is on the resolution of any known process issue.

comment

74

comment by: *Transport Canada Civil Aviation Standards Branch*

Page

9

Paragraph

5 a (3)

Comment

The criteria under 5 a, in particular 5 a (3), create an unfair level playing field between all manufacturers.

Rationale for Comment

EASA / FAA guidance material vs MBD, OOT and FM prior to DO-178C / ED-12C is not harmonized, and is quite different. The applicant position is considered as IP and is not visible to other authorities and applicants. Besides, new applicants will have to adopt a higher standard in most cases.

Recommendation

Applicants should upgrade their processes to DO-178C / ED-12C for new development.

response

Not accepted.

Experience has shown that many applicants have developed acceptable processes to use techniques like MBD or OOT. EASA believes that transitioning to ED-12C/DO-178C is not justified when these acceptable processes exist.

Oversight over an applicant’s satisfaction of a CRI or IP is conducted by the competent



authority. Addressing the equivalence between CRIs and IPs is not the intent of AC/AMC 20-115D, paragraph 5(a)(3). In the case of a validation, it is at the validating authority's discretion to accept or not the method that has been accepted by another authority. This is at the applicant's risk, who always has the option of establishing new or modified processes.

comment	<p>75 comment by: <i>Transport Canada Civil Aviation Standards Branch</i></p> <p>Page</p> <p>9</p> <p>Paragraph</p> <p>5 a (3)</p> <p>Comment</p> <p>It is very hard to conceive of how that criteria would be evaluated.</p> <p>Rationale for Comment</p> <p>The criteria does not require these methodologies to be used in a previously certified product. What is the certification vehicle for previous acceptance of these processes?</p> <p>Recommendation</p> <p>Define the certification vehicle for previously certified products.</p>
response	<p>Accepted.</p> <p>The text has been modified as follows:</p> <p>'[...] existing processes incorporating these methods should have been evaluated and found to be acceptable by EASA on a <u>previous certified project</u>. [...]'.</p>
comment	<p>76 comment by: <i>Transport Canada Civil Aviation Standards Branch</i></p> <p>Page</p> <p>13</p> <p>Paragraph</p> <p>Figure 1</p> <p>Comment</p> <p>First Decision ("Is the software usage history acceptable?"): if No, then the applicant should to the latest standard.</p> <p>Rationale for Comment</p> <p>Unacceptable usage history should not be treated differently from software with</p>



	<p>unacceptable DAL.</p> <p>Recommendation</p> <p>There is no reason why deficient processes are not treated the same as unacceptable DAL.</p>
<p>response</p>	<p>Partially accepted.</p> <p>The developer should be given the opportunity to resolve a software or process problem without being forced to use DO-178C/ED-12C. The safety impact of the deficiencies needs of course to be accounted for in the decision to modify or reuse a software component, but the transition to a brand-new process (DO-178C/ED-12C) is not automatically the right solution (it is only one possibility in case the deficiencies cannot be resolved to the satisfaction of the certification authority).</p> <p>The paragraph at stake has been reworded as per other comments.</p>
<p>comment</p>	<p>77 comment by: <i>Transport Canada Civil Aviation Standards Branch</i></p> <p>Page 15</p> <p>Paragraph Table 1</p> <p>Comment DO-178A Level 2 should not be automatically considered equivalent to DAL B. Same as DO-178 "Essential".</p> <p>Rational for Comment DO-178A Level 2 corresponds to DAL C. Hazardous / DAL B was introduced after DO-178A to account for higher risk than Level 2.</p> <p>Recommendation Analysis required to demonstrate equivalency.</p>
<p>response</p>	<p>Not accepted.</p> <p>As ED-12A/DO-178A introduced elements of structural coverage verification from a risk-based perspective, it was decided that it would be acceptable to allow equivalency between Level 2 and Level B.</p>
<p>comment</p>	<p>78 comment by: <i>Transport Canada Civil Aviation Standards Branch</i></p> <p>Page 16</p>

Paragraph

9 b (4)

Comment

A software CIA cannot determine the potential impact of the software modifications on the continued operational safety of the aircraft in a conclusive way. This part should be removed.

Rationale for Comment

There is no way to demonstrate or rule out that a software change has a potential impact on safety. Any change to DAL A software may have catastrophic impact if not implemented properly.

Recommendation

Remove "...determine the potential impact of the modifications on the continued operational safety of the aircraft on which the system and software components are to be installed. The CIA should..."

response

Accepted.

As proposed, this part has been removed from the text.

comment

80

comment by: *Rodrigo Magalhaes (ANAC)*

In Chapter 5:

Item 5.a.(5) includes the following condition: "There are no **significant** changes to the software processes described in the plans or to the software development environment. This should be supported through analysis of changes to the previously accepted software development processes and environment."

In Chapter 9:

Item 9.b.(7).(b) includes the following condition: "You have **maintained, and can still use**, the software plans, processes, and life-cycle environment, including process improvements and changes resulting from subparagraph 9.b.(2)(c)."

Although Chapters 5 and 9 have different purposes, apparently there is room for changes in the processes when applying Chapter 5 (Using ED-12B/DO-178B Processes and Procedures for New Development) whereas there should be no room for changes in the processes when applying Chapter 9 (Modifying and Reusing Software Approved using ED-12/DO-178, ED-12A/DO-178A or ED-12B/DO-178B), unless there are improvements and changes resulting from subparagraph 9.b.(2)(c).

However, when modifying an approved software using legacy processes (Chapter 9), it seems adequate to allow some improvements and changes to the processes if they are not considered significant (such as proposed for Chapter 5) and still consider the use of the same ED-12()/DO-178() version as the original approval. This could be clarified in the text of Chapter 9.



	<p>Rationale: some "small" (or not significant) improvements and changes may be beneficial to the process but the applicant may decide not to implement them just because it does not want to have the "burden" (or at least the risk) to be driven to change all life-cycle data to comply with ED-12C/DO-178C.</p>
response	<p>Partially accepted.</p> <p>Based on comments No 6 and No 21, paragraph 9(b)(7)(b) has been revised as follows:</p> <p>'The applicant has maintained, and can still use, the software plans, processes, and life cycle environment, including improvements to processes or to the life cycle environment as captured in revised plans.'</p>
comment	<p>84 comment by: <i>General Aviation Manufacturers Association</i></p> <p>2. NPA section 3.1, paragraph 2.2 pg.4: It is not clear what the future of FAA Order 8110.49 Chg. 2/Rev A or EASA CM-SWCEH-002 will be. We suggest that EASA cancels CM-SWCEH-002 when AMC 20-115D is published and FAA revise 8110.49 to remove content that is now covered by AC 20-115D when it is published.</p> <p>3. NPA section 3.1, paragraph 2. pg. 8: As presently written, this AC does not apply to (E)TSOs. Revise this paragraph to also apply to (E)TSOs.</p> <p>4. NPA section 3.1, paragraph 5.a.(1) pg. 9: Seems very broad. It says the software development assurance processes can be shown to have no non-compliances to one or more DO-178B objectives. This could be interpreted that if a review raised a process Finding (non-compliance to a DO-178B objective), then you couldn't continue to use the DO-178B process. There should be qualifiers like unaddressed / systemic non-compliances.</p> <p>Change the final portion of the sentence to: "resulting in systemic non-compliance of the process to one or more ED-12B/DO-178B objectives."</p> <p>Also, this section has the only use of "audit", so suggest removing it.</p> <p>5. NPA section 3.1, paragraph 5.a.(3) pg. 9: Since the intent is to avoid issuing CRIs & IPs for these, it should be more specific; e.g., there are CRIs and IPs for these techniques issued on previous projects and there is no intention of creating new CRIs and IPs for these techniques or applying such CRIs and IPs to new projects.</p>
response	<p>Comment No°2 is noted.</p> <p>EASA Certification Memorandum (CM)-SWCEH-002 will not be applicable to any project using AMC 20-115D. It will be cancelled, however, it will remain available on the EASA website for projects still using it (e.g. previous projects making reference to this CM).</p> <p>FAA Order 8110.49, Change 2 will be changed to Revision A, where the guidance material of Chapters 5 through 16 will be removed.</p> <p>Comment No°3 is accepted.</p>

The related paragraph has been changed as follows:

‘This AMC/AC applies to applicants, design approval holders (DAHs), and developers of airborne systems and equipment containing software to be installed on type-certified/type certificated] aircraft, engines, and propellers, or to be used in ETSO/TSO articles.’.

Comment No°4 is partially accepted.

The second sentence of paragraph 5(a)(1) has been reworded to provide clearer expectations regarding evidence that if the process has known deficiencies, they have been corrected. This allows a previously non-compliant process to be used when that deficiency has been corrected.

Comment No°5 is not accepted.

EASA and the FAA agree that Section 3.1, paragraph 5(a)(3) is sufficient as written and, therefore, does not require specific clarification.

comment	<p>85 comment by: <i>General Aviation Manufacturers Association</i></p> <p>6. NPA section 3.1, paragraph 6.e pg. 10: It's unclear why item was added, but If EASA/FAA publish CS or regulations, these are more than acceptable means of compliance.</p> <p>Suggest removing this item, but if it's kept, then propose the following changes:</p> <p>"... may publish specific [Certification Specifications]/[regulations]," and</p> <p>"Such [Certification Specifications] / [regulations] will take precedence..."</p> <p>7. NPA section 3.1, paragraph 7 and 7.a pg. 10: Editorial: Should be "TSO Authorizations"</p>
response	<p>Comment No°6 is not accepted.</p> <p>AC/AMC 20-115D refers to ‘AMC to specific certification specifications[/regulations]’, not to certification specifications (CSs)/regulations themselves.</p> <p>Comment No°7 is noted.</p> <p>The comment is no longer applicable as part of Section 7 text has been removed.</p>
comment	<p>86 comment by: <i>General Aviation Manufacturers Association</i></p> <p>8. NPA section 3.1, paragraph 7.b pg. 11: Regarding FAA TSOs’ specification of DO-178() version, this paragraph states, “If you use a version other than that specified in the TSO, you should request a deviation in accordance with the requirements of Title 14 of the Code of Federal Regulations (14 CFR) part 21, Subpart O.”</p> <p>Several recent TSOs that do specify DO-178C also contain the statement (e.g. TSO-C118a): “You may also develop the software according to RTCA, Inc. document RTCA/DO-178B, dated December 1, 1992, if you follow the guidance in AC 20-115C, Airborne Software Assurance, dated July 19, 2013.”</p>

	<p>The FAA is encouraged to make it clear that AC 20-115D applies for TSOs that currently reference AC 20-115C.</p>
response	<p>Comment No°8 is noted.</p> <p>The content of a TSO cannot be changed by an AC, therefore, this comment cannot be addressed in the frame of this AC.</p> <p>Note: part of Section 7 text has been removed and the applicability to TSOs clarified in paragraph 1(a).</p>
comment	<p>88 comment by: <i>General Aviation Manufacturers Association</i></p> <p>9. NPA section 3.1, paragraph 8. pg. 11: Misleading title, since this section is focused on the Additional considerations aspects only. Replace with "Guidance for Additional Considerations of ED-12B/DO-178B or ED-12C/DO-178C."</p>
response	<p>Comment No°9 is not accepted.</p> <p>'Additional Considerations' implies Section 12 of ED-12B/C and DO-178B/C. The topics addressed in Section 8 are not addressed in Section 12 of ED-12B/C and DO-178B/C.</p>
comment	<p>89 comment by: <i>General Aviation Manufacturers Association</i></p> <p>10. NPA section 3.1, paragraph 8.a.(3) pg. 11: Missing specific guidance for MB6.8.2 for Executable Object code. Consider moving this to a new section of this AMC/AC, which is not titled DO-178.</p>
response	<p>Comment No°10 is not accepted.</p> <p>EASA and the FAA agree that Section MB 6.8.2 of ED-218/DO-331 is sufficient as written and, therefore, does not require specific clarification in AC/AMC 20-115.</p>
comment	<p>90 comment by: <i>General Aviation Manufacturers Association</i></p> <p>11. NPA section 3.1, Paragraph 8.b & 8.cpg. 10, 11: Consider moving this to a new section of this AMC/AC, which is not titled DO-178.</p>
response	<p>Comment No°11 is not accepted.</p> <p>This guidance is complementary to both DO-178B/ED-12B and DO-178C/ED-12C and therefore located in the right Section.</p>
comment	<p>91 comment by: <i>General Aviation Manufacturers Association</i></p> <p>12. NPA section 3.1, paragraph 8.b.(1) pg.12: Editorial: The item references in the</p>

response	<p>following are confusing: “...the system-level guidance identified in section 2.5.5 of ED-12C/DO-178C, items a, b, c and d, and section 2.5 of ED-12B/DO-178B, items a, b, c and d.”</p> <p>The following reference is clearer: “...the system-level guidance identified in items a, b, c and d of ED-12C/DO-178C section 2.5.5; and items a, b, c and d of ED-12B/DO-178B section 2.5.”</p> <p>Comment No°12 is accepted.</p> <p>The change has been implemented as proposed.</p>
comment	<p>92 comment by: <i>General Aviation Manufacturers Association</i></p> <p>13. NPA section 3.1, paragraph 8.b.(2) pg. 12: The paragraph states, “The FLS should be protected against corruption or partial load to an integrity level appropriate for the software level of the FLS.” DO-178B/C system guidance is to provide detection of corrupt or partial uploads, not to prevent them. (Ref. DO-178B 2.5 item a. and DO-178C 2.5.5 item a.)</p> <p>Suggested revision: “Mechanism(s) should be implemented to detect corrupted or partially uploaded software to an integrity level appropriate for the software level of the FLS.”</p>
response	<p>Comment No°13 is not accepted.</p> <p>‘To detect corrupted or partial uploads’ is not sufficient to ensure protection against corruption.</p> <p>Therefore, the wording of FAA Order 8110.49, Change 1 and EASA CM-SWCEH-002 is preferable.</p>
comment	<p>93 comment by: <i>General Aviation Manufacturers Association</i></p> <p>14. NPA section 3.1, paragraph 8.c.(1) pg. 12: Editorial: The item references in the following are confusing: “...system-level guidance identified in section 2.5.2 of ED-12C/DO-178C, items a, b, c and f, and section 2.4 of ED-12B/DO-178B, items a. and b.”</p> <p>The following reference is clearer: “...system-level guidance identified in items a, b, c and f of ED-12C/DO-178C section 2.5.2; and items a. and b. of ED-12B/DO-178B section 2.5.2.”</p>
response	<p>Comment No°14 is accepted.</p> <p>Note that your references to ‘ED-12B/DO-178B section 2.5.2’ should read ‘2.4’.</p> <p>The proposed change has been implemented as follows:</p> <p>‘As the developer, the applicant should provide the necessary information to support the system-level guidance identified in items a, b, c and f of ED-12C/DO-178C, Section 2.5.2, as well as items a and b of ED-12B/DO-178B, Section 2.4.’</p>

comment	<p>94 comment by: <i>General Aviation Manufacturers Association</i></p> <p>15. NPA section 3.1, last part of the last sentence in 9.b.(1) The last part of the last sentence in 9.b.(1) seems unclear. Does the following “..., correct the known software and development process deficiencies prior to modifying or reusing the software.” mean that the Legacy System needs to do this work and recertify it prior to use? If not, then the new project is using an uncertified baseline to start with. If this work is being done by the new project, it would be better to reword the above to “..., ensure the project’s processes are updated to address the development process deficiencies.”</p>
response	<p>Comment No°15 is partially accepted.</p> <p>The last sentence has been modified as per comment No 55, which achieves the same result as your proposal.</p>
comment	<p>95 comment by: <i>General Aviation Manufacturers Association</i></p> <p>16. NPA section 3.1, paragraph 9.b.(4)(b) & 9.b.(4)(c) pg. 16: Items (b) performing verification per CIA and (c) documenting CIA in SAS have nothing to do with the legacy evaluation.</p> <p>Suggest removing these two items. Or remove item (b) and change item (c) to state the outcome of the Legacy evaluation should be documented in the PSAC and/or SAS.</p>
response	<p>Comment No°16 is partially accepted.</p> <p>EASA and the FAA consider that inclusion of a CIA in the flow of modification to legacy software is important and therefore should not be omitted.</p> <p>As it has been agreed that the CIA may be summarised in the plan for software aspects of certification (PSAC) or in the software accomplishment summary (SAS), a related reference has been added.</p>
comment	<p>96 comment by: <i>General Aviation Manufacturers Association</i></p> <p>17. NPA section 3.1, paragraph 9.b.(2)(c) pg. 15: Editorial: The use of commas in the following is confusing: “...using section 12.1.4 of ED-12B/DO-178B or ED-12C/DO-178C, and ED-215/DO-330.”</p> <p>The following reference is clearer: ‘...using section 12.1.4 of ED-12B/DO-178B, or using section 12.1.4 of ED-12C/DO-178C and ED-215/DO-330.’</p>
response	<p>Comment No°17 is not accepted.</p> <p>The original grouping is correct. The placement of commas groups ED-12B/DO-178B and ED-12C/DO-178C together, so ‘Section 12.1.4’ applies to both ED-12B/DO-178B and ED-12C/DO-178C. The requested change would separate Section 12.1.4 from</p>

ED-12C/DO-178C. Additionally, ED-215/DO-330 should be separated from ED-12C/DO-178C because tool qualification processes are based on ED-215/DO-330.

comment	<p>97 comment by: <i>General Aviation Manufacturers Association</i></p> <p>18. NPA section 3.1, paragraphs 9.b.(7)(a), 9.b.(7)(b), and 9.b.(7)(c), 9.b.(8)(a) and 9.b.(8)(b) pg. 16, 17: Repeat of the contents added in Section 5.</p> <p>Delete this text in Section 9 and provide reference from Figure 1 to section 5. Update section 5 to also discuss the older versions of DO-178, namely DO-178 and DO-178A, as the guidance remains the same for any revision of DO-178 prior to DO-178C.</p>
response	<p>Comment No°18 is not accepted.</p> <p>Sections 5 and 9 serve different purposes and are not to be intermixed. Section 5 is for new software development using existing processes, whereas Section 9 is for using legacy software. While EASA believes that it is appropriate to allow previously developed software to be reused under certain conditions, using ED-12/DO-178 and ED-12A/DO-178A, these older documents should not be used for developing new software. However, as there is a high grade of similarity between ED-12B/DO-178B and ED-12C/DO-178C, it is acceptable to continue using ED-12B/DO-178B processes for new development, but only under certain conditions.</p>
comment	<p>101 comment by: <i>ASD</i></p> <p><u>Page 17 Paragraph 9.b (9): Modifying and reusing software already approved</u></p> <p>Reference Text:</p> <p>“(9) If any of the conditions in subparagraph 9.b.(7) are not satisfied, update all your processes and procedures (including tool qualification processes), using ED-12C/DO-178C and ED-215/DO-330, and make all modifications to the software using section 12.1 of ED-12C/DO-178C.”</p> <p>Comment:</p> <p>Requirement (9) is too demanding. Upgrade should be limited to impacted processes instead of covering all processes. Upgrade of all processes does not bring added value to safety and will generate only costly paper work.</p> <p>Proposed Resolution:</p> <p>Consistently with November 2016 proposal, ASD proposal is the following text:</p> <p>“(9) If any of the conditions in subparagraph 9.b.(7) are not satisfied, update affected processes and procedures using:</p> <p>ED-12C/DO-178C and, for tool qualification using section 12.2 of ED12C/DO 178C and paragraph 10.c of this document</p>

	<p>or</p> <p>ED-12B/DO-178B and [EASA]/[FAA] guidance specific to the techniques used, such as that contained in associated [Certification Review Item (CRI) or published Certification Memorandum (CM)]/[issue paper or published advisory circular].”</p> <p>And adapt Figure 1 accordingly</p>
response	<p>Not accepted.</p> <p>The intent of AC/AMC 20-115D is to allow a gradual transition to ED-12C/DO-178C, rather than a complete changeover on a particular date. EASA and the FAA consider necessary that if an ED-12C/DO-178C supplement technique is incorporated into the processes, all processes should be upgraded to ED-12C/DO-178C.</p> <p>It is important to note as well that the concept of transitioning to ED-12C/DO-178C in Section 9 is to allow declaration of the entire software as equivalent to satisfying ED-12C/DO-178C when even a small change is made in the software as long as the processes have been updated to ED-12C/DO-178C. This is an essential add-on compared to previous versions of AC/AMC 20-115D.</p>
comment	<p>102 comment by: <i>The Boeing Company</i></p> <p>Paragraph: 3.1.4.a</p> <p>THE PROPOSED TEXT STATES:</p> <p>There are two occurrences of the word "guidance".</p> <p>REQUESTED CHANGE:</p> <p>Please replace the word “guidance” with “information.”</p> <p>JUSTIFICATION:</p> <p>The word “guidance” implies that an applicant must follow/comply with all text in the document. ED-12C/DO-178C contain “activities” which are not mandatory but are a possible means to satisfying an objective.</p>
response	<p>Not accepted.</p> <p>AC/AMC 20-115D recognises DO-178C/ED-12C as guidance. Nevertheless, as any recognised AMC, DO-178C/ED-12C remains only one possible means for satisfying the FAA/EASA certification requirements.</p>
comment	<p>103 comment by: <i>Airbus Helicopters</i></p> <p>Page 12, § 8.c.(2), Guidance for User Modifiable Software (UMS).</p>

"The modifiable part of the component should be developed to a software level at least as high as the software level assigned to that software component."

By definition, UMS:

- should not adversely affect safety, operational capabilities, etc.
- is intended to be modified by the user,
- will not be submitted to airworthiness approval.

Consequently, UMS cannot have another level than E.

On the contrary, as written in ED-12C § 2.5.2 item c, the software that provides the protection for user modification should be at the same software level as the function it is protecting from errors in the modifiable component.

Also, specifying what the user should do when modifying the UMS should not be the subject of A(M)C 20-115, as this document is part of the certification domain.

Suggestion

We suggest:

- removing 8.c(2), which does not seem relevant,
- adding a reference to § 5.2.3 of ED-12B/DO-178B and ED-2C/DO-178C, which provides adequate guidance on the design for UMS.

NOTE: The difference in § 5.2.3 item a between issue B and C of ED-12/DO-178 is compensated by the second sentence of ED-12B/DO-178B § 2.4 item b.

response

Not accepted.

User-modifiable software (UMS) could be developed at any software level, provided that the 'modification constraints' keep the modifications within allowable safety margins. Therefore, paragraph 8(c)(2) is relevant.

The purpose of paragraph 8(c) on UMS is to provide complementary guidance, where needed, not to repeat already available DO-178/ED-12 guidance. Therefore, references to DO-178/ED-12 are not considered appropriate.

comment

104

comment by: Airbus Helicopters

Page 16, § 9.b.(3)(b)

§ 9.b.(3), including (a), is stating that, if all previous conditions in the diagram are fulfilled, including the software level criteria in table 1, the original approval of the unmodified legacy software is acceptable in the installation approval of the proposed system.

§ 9.b.(3)(b) introduces a concept of declaring the software as "equivalent to satisfying ED-



	<p>12C/DO-178C”, with a limitation that this equivalence cannot apply to unmodified tools.</p> <p>This concept is not understood and might be misleading.</p> <p>The fact that the legacy software is acceptable despite an “old” development process does not mean that the development process is satisfying ED-12C/DO-178C.</p> <p>Suggestion</p> <p>We suggest removing § 9.b.(3)(b) and merging the text of § 9.b.(3)(a) with the first sentence of § 9.b.(3).</p>
response	<p>Not accepted.</p> <p>9(b)(3)(a) and 9(b)(3)(b) refer to two different cases and, therefore, should be kept in separate subparagraphs.</p> <p>9.b.(3)(b) provides two conditions that allow the applicant to claim equivalence to ED-12C/DO-178C:</p> <ul style="list-style-type: none"> — upgrade the software development baseline; and — update your processes to ED-12C/DO-178C. <p>Even though the legacy software may be 98 % ED-12B/DO-178B except for some changes that may have been made while upgrading the development baseline, as long as the processes have been updated, the software is allowed to be declared equivalent to ED-12C/DO-178C. Any subsequent modifications have to be made using the ED-12C/DO-178C processes, which is the concept of transitioning to ED-12C/DO-178C.</p>
comment	<p>107 comment by: <i>The Boeing Company</i></p> <p>Paragraph: 3.1.5</p> <p>THE PROPOSED TEXT STATES:</p> <p>This section is good that it allows use of existing ED- 12B/DO-178B processes and procedures for new development.</p> <p>REQUESTED CHANGE:</p> <p>We request adding additional content to this subparagraph to ensure that existing ED-12B/DO-178B based qualified software tools may be used for new development.</p> <p>JUSTIFICATION:</p> <p>The additional content will communicate/clarify certification authority intent.</p>
response	<p>Accepted.</p> <p>‘(including tool qualification processes)’ has been added in paragraph 5(a).</p>

comment	<p>108 comment by: <i>The Boeing Company</i></p> <p>Paragraph: 3.1.5 (5)</p> <p>THE PROPOSED TEXT STATES:</p> <p>“(5) There are no significant changes to the software processes described in the plans or to the software development environment...”</p> <p>REQUESTED CHANGE:</p> <p>Please remove or clarify the word “significant.”</p> <p>JUSTIFICATION: The word “significant” is subjective and open to interpretation.</p>
response	<p>Not accepted.</p> <p>One way of solving this issue would be to remove the word ‘significant’ (as proposed), but this would forbid any change to a process.</p> <p>It is the purpose of the second sentence of paragraph 5(a)(5): ‘[...] This should be supported through analysis of the changes [...]’ to allow the applicant to clarify what is considered to be significant or not.</p> <p>Early coordination with the certification authorities is always necessary in this case, as for any other criteria of Section 5.</p>
comment	<p>109 comment by: <i>The Boeing Company</i></p> <p>Paragraph: 3.1.6</p> <p>THE PROPOSED TEXT STATES:</p> <p>“Using EUROCAE ED-12C and RTCA DO-178C [<ac> certification].”<="" for="" p="" type=""> <p>REQUESTED CHANGE:</p> <p>Delete the text “for Type Certification” in the Advisory Circular.</p> <p>JUSTIFICATION:</p> <p>Use of ED-12C and DO-178C should be allowed for all types of certification projects: type certification, amended type certification, supplemental type certification, amended supplemental type certification and type design changes. Other FAA documentation identifies more than type certification.</p> </ac>></p>
response	<p>Not accepted.</p> <p>Text extracted from Order 8110.4C, paragraph 1-5.a, as follows:</p> <p>‘the term “type certificate,” or “TC,” applies to the original TC, supplemental TCs, and amended TCs, unless otherwise specified.’</p> <p>‘Within the scope of this order, the basic type certification process described in chapter 2 is to be followed for STCs and amendments to the TC that are deemed major changes in type</p>

design.’.

comment	<p>110 comment by: <i>The Boeing Company</i></p> <p>Paragraph: 3.1.8.a (2)</p> <p>THE PROPOSED TEXT STATES:</p> <p>The whole subparagraph of 3.1.8.a (2) discusses the application of the technology al supplements to qualified software tools.</p> <p>REQUESTED CHANGE:</p> <p>We recommend deleting paragraph 3.1.8.a (2).</p> <p>JUSTIFICATION:</p> <p>The technology supplements were written to be used in conjunction with ED-12C/DO-178C, not ED-215/DO-330 “Software Tool Qualification Considerations.”</p>
response	<p>Partially accepted.</p> <p>Your comment has been taken into account. However, the removal of the paragraph would not help clarify the expectations. Therefore, the text has been modified as per comment No 3.</p>
comment	<p>111 comment by: <i>The Boeing Company</i></p> <p>Paragraph: 3.1.8.a (3)</p> <p>THE PROPOSED TEXT STATES:</p> <p>The whole subparagraph of 3.1.8.a (3) desires to provide clarification and completeness of section MB.6.8.1 in ED- 218/DO-331.</p> <p>REQUESTED CHANGE:</p> <p>We recommend deleting paragraph 3.1.8.a (3).</p> <p>JUSTIFICATION:</p> <p>We find section MB.6.8.1 in ED-218/DO-331 to be sufficiently clear. If there is a significant completeness concern about MB.6.8.1, ED-218/DO- 331 should be updated.</p>
response	<p>Not accepted.</p> <p>While AC 20-115C paragraphs 8(c)(1) and 8(c)(2) allowed the use of simulation with constrictions, they did not clarify the respective ED-218/DO-331 Sections. Upon further consideration, ED-218/DO-331, Section 6.8.2 was agreed to be sufficiently clarified but not Section 6.8.1; thus, AC/AMC 20-115D, paragraph 8(a)(3) provide the necessary clarification of Section 6.8.1.</p>

Note 1: it is unlikely that ED-218/DO-331 is revised in the near term.

Note 2: said paragraph has been modified as proposed in comment No 71 above.

comment	<p>112</p> <p>Paragraph: 3.1.8.b</p> <p>THE PROPOSED TEXT STATES:</p> <p>“b. Guidance for Field Loadable Software (FLS)...”</p> <p>REQUESTED CHANGE:</p> <p>We recommend deleting paragraph 3.1.8.b</p> <p>JUSTIFICATION:</p> <p>This is system related guidance, not software guidance that should be moved to AC 20-174 "Development of Civil Aircraft and Systems."</p>	comment by: <i>The Boeing Company</i>
response	<p>Not accepted.</p> <p>Order 8110.49, Change 1 and CM-SWCEH-002, Issue 1, Revision 1 guidance on field loadable software (FLS) has been streamlined and reduced to minimal guidance addressing only software-relevant aspects.</p>	
comment	<p>113</p> <p>Paragraph: 3.1.8.c</p> <p>THE PROPOSED TEXT STATES:</p> <p>“c. Guidance for User Modifiable Software (UMS)...”</p> <p>REQUESTED CHANGE:</p> <p>We recommend deleting paragraph 3.1.8.c</p> <p>JUSTIFICATION:</p> <p>This is system related guidance, not software guidance that should be moved to AC 20-174 "Development of Civil Aircraft and Systems."</p>	comment by: <i>The Boeing Company</i>
response	<p>Not accepted.</p> <p>Order 8110.49, Change 1 and CM-SWCEH-002, Issue 1, Revision 1 guidance on UMS has been streamlined and reduced to minimal guidance addressing only software-relevant aspects.</p>	
comment	<p>114</p> <p>Paragraph: 3.1.9.b(2)</p>	comment by: <i>The Boeing Company</i>

	<p>THE PROPOSED TEXT STATES:</p> <p>“(2)... For example, legacy system software with development assurance to ED-12A/DO-178A software Level 2 can be considered to satisfy software Levels B, C, and D. A blank indicates that the software level is not acceptable...”</p> <p>REQUESTED CHANGE:</p> <p>Request that clarification text be added to the example to state that this process does not apply when a legacy software level translates to "Assigned Software Level" E.</p> <p>JUSTIFICATION:</p> <p>Past FAA information in FAA Order 8110.49 Change 1 Chapter 10 Figure 10-1 has included information with regards to Software Level E.</p>
response	<p>Not accepted.</p> <p>ED-12C/DO-178C, Section 2.3.3.e states the following:</p> <p>‘if a software component is determined to be level E, and this is confirmed by the certification authority, no further guidance contained in this document applies’.</p> <p>EASA therefore considers that it is consistent not to include level E in AC/AMC 20-115D.</p>
comment	<p>115 comment by: <i>The Boeing Company</i></p> <p>Paragraph: 3.1.9.b(2)(c)</p> <p>THE PROPOSED TEXT STATES:</p> <p>“(c) If your legacy system software was developed using ED-12B/DO-178B, and the software level is not acceptable, upgrade the software development baseline, including all processes and procedures (including tool qualification processes), using section 12.1.4 of ED-12B/DO-178B or ED-12C/DO-178C, and ED-215/DO-330.”</p> <p>REQUESTED CHANGE:</p> <p>Please change “ED-12B/DO-178B or ED- 12C/DO-178C, and ED-215/DO-330.” to ED-12B/DO-178B, or ED- 12C/DO-178C and ED-215/DO-330.” [Changing location of comma to correctly associate documents.]</p> <p>JUSTIFICATION:</p> <p>Change location of comma to correctly associate documents.</p>
response	<p>Not accepted.</p> <p>The original grouping is correct. The placement of commas groups ED-12B/DO-178B and ED-12C/DO-178C together, so ‘Section 12.1.4’ applies to both ED-12B/DO-178B and ED-12C/DO-178C. The requested change would separate Section 12.1.4 from ED-12C/DO-178C. Additionally, ED-215/DO-330 should be separated from ED-12C/DO-178C</p>

because tool qualification processes are based on ED-215/DO-330.

comment	<p>116 comment by: <i>The Boeing Company</i></p> <p>Paragraph: 3.1.9.b(4)(a)</p> <p>THE PROPOSED TEXT STATES:</p> <p>“(a) Identify the software changes to be incorporated and conduct a CIA consisting of one or more analyses associated with the software change as identified in section 12.1 of ED-12C/DO-178C.”</p> <p>REQUESTED CHANGE:</p> <p>Please clarify the required medium for the identification of the software changes. We assume that this could be an uncontrolled artifact that could be disposed at during or at the end of the certification project.</p> <p>JUSTIFICATION:</p> <p>The AMC/AC is absent on how the certification authority may want to review the software changes.</p>
response	<p>Not accepted.</p> <p>AC/AMC 20-115D does not prescribe the format of the CIA, which is at the discretion of the applicant. Paragraph 9(b)(4)(c) states that the CIA results should be summarised in the SAS. If the certificating authority has questions or concerns based on its review of the SAS, the applicant should (be prepared to) provide additional information.</p>
comment	<p>117 comment by: <i>The Boeing Company</i></p> <p>Paragraph: 3.1.9.b(4)(c)</p> <p>THE PROPOSED TEXT STATES:</p> <p>“(c) Summarise the results of the CIA in the Software Accomplishment Summary (SAS).”</p> <p>REQUESTED CHANGE:</p> <p>We recommend deleting paragraph 3.1.9.b(4)(c)</p> <p>JUSTIFICATION:</p> <p>Including a final change impact analysis in the software accomplishment is more content that required by ED-12C/DO-178C.</p>
response	<p>Not accepted.</p> <p>A summary of the CIA results in the SAS is required, not the entire CIA. The relevant text is already included in AC/AMC 20-115C.</p>

comment	<p data-bbox="363 271 411 309">118</p> <p data-bbox="1054 271 1477 309">comment by: <i>The Boeing Company</i></p> <p data-bbox="363 331 651 369">Paragraph: 3.1.9.b(7)(b)</p> <p data-bbox="363 392 715 430">THE PROPOSED TEXT STATES:</p> <p data-bbox="363 452 1484 564">“(b) You have maintained, and can still use, the software plans, processes, and life-cycle environment, including process improvements and changes resulting from subparagraph 9.b.(2)(c).”</p> <p data-bbox="363 586 625 624">REQUESTED CHANGE:</p> <p data-bbox="363 647 1136 685">Change from “subparagraph 9.b(2)(c)” to “subparagraph 9.b(2).”</p> <p data-bbox="363 707 549 745">JUSTIFICATION:</p> <p data-bbox="363 768 1484 835">Subparagraph (c) limits to ED-12B/DO-178B only. Boeing believes that subparagraph (a) would be acceptable as well.</p>
response	<p data-bbox="363 887 587 925">Partially accepted.</p> <p data-bbox="363 947 1484 1014">Your comment has been taken into account, however, based on comments No 6 and No 21, paragraph 9(b)(7)(b) has been revised as follows:</p> <p data-bbox="363 1037 1484 1149">‘The applicant has maintained, and can still use, the software plans, processes, and life cycle environment, including improvements to processes or to the life cycle environment as captured in revised plans.’.</p> <p data-bbox="363 1171 1177 1209">Therefore, the reference to paragraph 9(b)(2)(c) has been removed.</p>

3.2. Draft EASA guidance material (GM)/FAA AC 00-SW

p. 25-29

comment	<p data-bbox="363 1404 411 1442">18</p> <p data-bbox="874 1404 1477 1442">comment by: <i>Aeronautics Corporation of America</i></p> <p data-bbox="363 1464 1484 1621">Add a best practice to section 3.0 which addresses the guidance currently in Order 8110.49 section 9-3 and SWCEH-002 section 11.4.a regarding the determination of whether or not a tool needs to be qualified. The minimum text should be one that asks the three questions the answers to which must all be "Yes" if the tool needs qualification.</p> <p data-bbox="363 1644 1484 1890">Justification: ED-12C/DO-178C identifies criteria for determining the impact of a tool, but that is after the need for tool qualification has been determined. Both ED-12C/DO-178C and ED-12B/DO-178B included the same statement in 12.2.1 about when qualification of a tool is needed, but the Order 8110.49 and SWCEH-002 provided more guidance about how to determine whether tool qualification is necessary. The three questions serve as an extremely helpful guidance and should appear in this section or alternatively in 3.1, section 8.</p>
response	<p data-bbox="363 1944 533 1982">Not accepted.</p> <p data-bbox="363 2004 1484 2033">EASA and the FAA worked together with industry (GAMA, ASD, and AIA) on</p>



AC/AMC 20-115D. A previous draft of AC/AMC 20-115D included the guidance suggested in this comment, which was removed after discussions with industry.

comment	<p>28 comment by: <i>GE Aviation</i></p> <p>"A topic that I would like to see addressed and harmonized in the Appendix A is the subject of how to handle Open Problem Reports. I recommend that the guidance of EASA CM-SWCEH-002 Issue 01 Rev 01, section 16 be used, complete with the actual OPR classifications and their meaning, with the exception of OPR=4 to identify features. Of course this classification can be described as "an acceptable means but not the only means". While this may be considered prescriptive guidance, it has been found extremely useful in creating a language that everyone understands. Since there is still no conflicting FAA guidance, this classification may be useful to adopt broadly."</p> <p>The response was: "Partially accepted OPR guidance will exist but in a separate A(M)C, not in A(M)C20-115D."</p> <p>Propose:</p> <p>Please add a section to handle OPRs</p>
response	<p>Noted.</p> <p>A separate AC/AMC-20 is currently being drafted with industry involvement to address OPRs.</p>
comment	<p>29 comment by: <i>GE Aviation</i></p> <p>The guidance has been streamlined to a point that it offers no best practice suggestions.</p> <ol style="list-style-type: none"> a. The current guidance does not cover the verification and reverification aspects of subparagraph 9.b.(4) of AMC -115D. b. In addition the guidance of section 11-2 (b) of FAA order 8100.49 Change 1 has been overlooked in order to address the safety aspects of subparagraph 9.b.(4) of AMC - 115D. <p>Propose:</p> <p>Model this subsection of section 11-2 of FAA order 8110.49 - in order to address all aspects of subparagraph 9.b.(4) of AMC -115D.</p>
response	<p>Not accepted.</p> <p>EASA and the FAA developed in close cooperation with industry (GAMA, ASD, and AIA) this streamlined AC/AMC 20-155D (including GM).</p> <p>Nobody is prohibited from using FAA Order 8110.49, Section 11 as input to their CIA process.</p>



comment	<p>30 comment by: <i>GE Aviation</i></p> <p>Use of Formal Methods according to ED-216/DO-333 may enhance the detection of runtime errors.</p> <p>There is an anticipation that applicants will follow/adhere with applicable AMCs/ACs that are relevant to their project</p> <p>I understand that applicants are not bound by AMCs/ACs - but the reality is certification authorities cite them and quote them in issue papers. My concern is this paragraph will translate into guidance in the future</p> <p>Propose:</p> <p>Remove this paragraph</p>
response	<p>Not accepted.</p> <p>GM and AC 00-SW are just ‘best practices’, namely complementary information not recognised as AMC.</p> <p>Furthermore, an authority is not allowed to require an applicant to apply or use a specific methodology, tool, or technique, e.g. FMs.</p>
comment	<p>81 comment by: <i>General Aviation Manufacturers Association</i></p> <p>19. NPA section 3.2, GM1/AC 00 paragraph 3.1 b.(2) pg. 25: The item states: “A listing and descriptions of the open problem reports and/or change requests related to those changes”.</p> <p>Although it may usually be the case that problem reports related to the changes in the CIA are open at the time of the CIA, it may not always be the case. Additionally, “open problem reports” are most often associated with problem reports that will be left open after a change is complete where these open problem reports are documented in the SAS.</p> <p>To avoid confusion, it is suggested that the item be revised to remove the word ‘open’ so that it states: “A listing and descriptions of the problem reports and/or change requests related to those changes”.</p> <p>20. NPA section 3.2, GM 3/AC 00 paragraph 3.3 Error Handling at Design Level b.(3) pg. 26: Wording is confusing: “Specification of protection mechanisms in the software requirements (high level requirements or low level requirements), which in particular include the specification and verification”. The text should not conflate requirements and verification. Once the requirements are established, then they can be verified. Suggest removing the phrase “, which in particular include the specification and verification”.</p> <p>21. NPA section 3.2, GM1/AC 00 paragraph 3.1 d pg. 26: The paragraph states that for each change, the CIA “identifies the activities to be performed to satisfy ED-12C/DO-178C and ED-12B/DO-178B and to continue to satisfy requirements for safe operation.”</p> <p>It is not clear what is intended by this paragraph. Does this mean that each change should</p>

include specific ED-12C/DO-178C or ED-12B/DO-178B activities? Or are these “activities” referring to something else?

If “activities” are referring to something else, the word “activities” should be replaced with a more concise term and a term that is less likely to be associated with ED-12C/DO-178C or ED-12B/DO-178B activities.

If “activities” are referring to ED-12C/DO-178C or ED-12B/DO-178B activities, all ED-12C/DO-178C or ED-12B/DO-178B activities are usually identified in common software processes and would not need to be enumerated on a per-change basis. In which case, d should be removed.

22. NPA section 3.2, GM1/AC 00 paragraph 3.1 d pg.26: Editorial: The item includes the phrase “ED-12C/DO-178C and ED-12B/DO-178B”. It seems most likely that an applicant will use either ED-12C/DO-178C or ED-12B/DO-178B; consequently, this phrase should be changed to “ED-12C/DO-178C or ED-12B/DO-178B”.

23. NPA section 3.2, GM3/AC 00 paragraph 3.3 b.4 pg. 26: The item states: “For software levels A and B, recommended mitigations to address dynamic features are runtime protection mechanisms because it is not appropriate to rely solely on probabilistic approaches or static analyses.”

Hardware is often relied upon to support runtime protection mechanisms such as memory management units (MMUs). However, not all processors implement such features. In such circumstances, static analyses and probabilistic approaches may be the only feasible mechanism available to an applicant. The text should indicate runtime protection is preferred, but should not imply it is the only acceptable method.

Suggestion:

“For software levels A and B, it is recommended that consideration be given to incorporating runtime protection mechanisms since reliance on probabilistic approaches or static analyses alone may not be adequate.”

response

Comment No°19 is accepted.

The word ‘open’ has been removed as proposed.

Comment No°20 is partially accepted.

It is agreed not to mix requirements with verification. Consequently, ‘and verification’ has been removed.

EASA considers the specification of error-handling mechanisms relevant, therefore the other part of the sentence was kept.

Comment No°21 is not accepted.

A CIA should identify the specific ED-12C/DO-178C or ED-12B/DO-178B activities that need to be reperformed, such as verification activities, as a result of the change.

Comment No° 22 is accepted.



Change implemented as proposed.
 Comment No°23 is accepted.
 Change implemented as proposed.

comment	<p>105 comment by: Airbus Helicopters</p> <p>Page 25, § 3.0 b(2)</p> <p>The text asks for providing “A listing and descriptions of the open problem reports and/or change requests related to those changes”.</p> <p>However, “open problem reports” might lead to interpretation. It should be explicit that it relates to problem reports to be corrected as part of the intended change.</p> <p>Suggestion</p> <p>We suggest clarifying the text the following way:</p> <p><i>“A listing and descriptions of the open problem reports to be corrected and/or change requests related to those changes”.</i></p>
response	<p>Accepted.</p> <p>The following text has been added:</p> <p>‘A listing and descriptions of the problem reports to be corrected as part of the intended change and/or change requests related to those changes;’.</p> <p>The word ‘open’ before ‘problem report’ has been removed as per comment No 81.</p>
comment	<p>106 comment by: Airbus Helicopters</p> <p>Page 26, § 3.3 b(4)</p> <p><i>“For software levels A and B, recommended mitigations to address dynamic features are runtime protection mechanisms [...]”</i></p> <p>We suggest making more explicit the concept of “dynamic features”, e.g.:</p> <p>Suggestion</p> <p>We suggest clarifying the text the following way:</p> <p><i>“For software levels A and B, recommended mitigations to address dynamic features (stacks, dynamic memory allocation ...) are runtime protection mechanisms [...]”</i></p>
response	<p>Noted.</p> <p>‘dynamic features’ has been removed in reply to comment No 81.</p>



comment	<p>119 comment by: <i>The Boeing Company</i></p> <p>Paragraph: 3.2.3.c(5)</p> <p>THE PROPOSED TEXT STATES:</p> <p>“(5) Processor or other hardware components and interfaces;”</p> <p>REQUESTED CHANGE:</p> <p>We recommend deleting paragraph 3.2.3.c(5)</p> <p>JUSTIFICATION:</p> <p>Changes to the hardware should be identified in a system change impact analysis or a hardware change impact analysis.</p>
response	<p>Not accepted.</p> <p>Changes to the processors or other hardware affecting the software should be listed in the CIA.</p>
comment	<p>120 comment by: <i>The Boeing Company</i></p> <p>Paragraph: [<AMC> GM2 to AMC 20-115D]/[<AC> 3.2]</p> <p>THE PROPOSED TEXT STATES:</p> <p>Clarification on Data Coupling and Control Coupling</p> <p>REQUESTED CHANGE:</p> <p>We recommend deleting the whole subparagraph [<AMC> GM2 to AMC 20-115D]/[<AC> 3.2]</p> <p>JUSTIFICATION:</p> <p>This whole subparagraph does not provide additional information on data coupling and control coupling.</p>
response	<p>Not accepted.</p> <p>Section 3.2 of both AC-115D and AMC 20-115D refers to ED-94C/DO-248C FAQ #67, and provides additional useful information regarding data coupling and control coupling, based on experience in the field.</p>
comment	<p>121 comment by: <i>The Boeing Company</i></p> <p>Paragraph: [<AMC> GM3 to AMC 20-115D]/[<AC> 3.3]</p> <p>THE PROPOSED TEXT STATES:</p> <p>a...“However, in order to protect against foreseeable unintended software [behaviour]/[behavior], it is beneficial and recommended to handle these sources of error at</p>

	<p>the design level.”</p> <p>REQUESTED CHANGE:</p> <p>We recommend deleting the sentence “However, in order to protect against foreseeable unintended software [behaviour]/[behavior], it is beneficial and recommended to handle these sources of error at the design level.”</p> <p>JUSTIFICATION:</p> <p>While the words “beneficial and recommended” may be meant to be an example, they could be construed to be prescriptive.</p>
response	<p>Not accepted.</p> <p>GM and AC 00-SW are just ‘best practices’, namely complementary information not recognised as AMC, unless proposed by an applicant as an AMC for their product.</p>
comment	<p>122 comment by: <i>The Boeing Company</i></p> <p>Paragraph: 3.3.b(1)</p> <p>THE PROPOSED TEXT STATES:</p> <p>This subparagraph identifies a list of foreseeable sources of software errors.</p> <p>REQUESTED CHANGE:</p> <p>Please add “counter and timer overrun/wrap-around” to the list.</p> <p>JUSTIFICATION:</p> <p>Make a more complete list.</p>
response	<p>Accepted.</p> <p>The aforementioned item has been added to the list of examples under (a).</p>
comment	<p>123 comment by: <i>The Boeing Company</i></p> <p>Paragraph: 3.3.b(4)</p> <p>THE PROPOSED TEXT STATES:</p> <p>“(4) For software levels A and B, recommended mitigations to address dynamic features are runtime protection mechanisms because it is not appropriate to rely solely on probabilistic approaches or static analyses. It may be a good practice to implement such runtime mechanisms for the other software levels.”</p> <p>REQUESTED CHANGE:</p> <p>We recommend deleting paragraph 3.3.b(4)</p>

	<p>JUSTIFICATION:</p> <p>The subparagraph is a mixture of prescribed methodology and possible best practices.</p>
response	<p>Partially accepted.</p> <p>Subparagraph 3(3)(b)(4) has not been removed but reworked as per comment No 81 to provide for a more flexible best practice.</p>
comment	<p>124 comment by: <i>The Boeing Company</i></p> <p>Paragraph: 3.3c</p> <p>THE PROPOSED TEXT STATES:</p> <p>“c. Use of Formal Methods according to ED-216/DO-333 may enhance the detection of runtime errors.”</p> <p>REQUESTED CHANGE:</p> <p>We recommend deleting paragraph 3.3.c</p> <p>JUSTIFICATION:</p> <p>While the subparagraph may be meant to be an example/best practice, it could easily be construed to be prescriptive.</p>
response	<p>Not accepted.</p> <p>GM and AC 00-SW are just ‘best practices’, namely complementary information not recognised as AMC, unless proposed by an applicant as an AMC for their product.</p> <p>Furthermore, an authority is not allowed to require an applicant to apply or use a specific methodology, tool, or technique, e.g. FMs.</p>

4. Impact assessment (IA)	p. 30-31
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comment	<p>82 comment by: <i>General Aviation Manufacturers Association</i></p> <p>24. NPA section 4.2.4 pg. 30: Option 1 states: “The harmonisation between the guidance of EASA and that of the FAA will relieve the current issues and allow for a smooth certification process.”</p> <p>Although it can be assumed that stakeholders greatly prefer a “smooth” certification process, the harmonization of guidance can scarcely guarantee that.</p> <p>It is suggested to change “smooth” to “smoother” so that Option 1 states: “The harmonisation between the guidance of EASA and that of the FAA will relieve the current issues and allow for a smoother certification process.”</p>
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response

Noted.

The NPA 2017-02 text does not need to be modified as it is not included in the revised AMC 20-115D.

