

No.	Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
001	Avidyne Corporation	General	The attempts made in this AC to reduce the difficulty of transitioning from DO-178B to DO-178C to the minimum necessary to assure safety is much appreciated. In particular, focusing on specific changes made to system software and recommending the use of DO-178C only with regard to those changes will encourage its use rather than encouraging applicants to go to great lengths to avoid it. Continued recognition of DO-178B with appropriate caveats is also a major positive.		None	No response required.
002	Honeywell ODA	Overall	This transition to 178C described in this AC takes a different approach in some respects as compared to Order 8110.49 Chg 1 Chapter 10 regarding the transition to 178B. For example, the Order provides guidance for changed software vs. unchanged but affected software vs. unchanged/unaffected software.	Possible conflict across FAA policy documents.	Provide industry with insight into the changes to be made to Order 8110.49 Chg 1 for consistency with this AC.	Order 8110.49 chapter 10 will become obsolete after AC 20-115C is published. Our approach is to provide a means for accommodating existing DO-178B processes and a transition to DO-178C.
003	Eurocopter	/	Eurocopter appreciates the opportunity to provide comments on this AC, which is globally considered as very consistent.	/	/	No response required.
004	FAAC	All	This advisory circular is very much different from the EASA release of NPA 2012-11 on the same topic. The two agencies – the FAA and EASA do not appear to have a harmonized position on the topic.	This creates challenges and additional costs for applicants with certification compliance obligations in the US and in Europe.	Please harmonize with EASA.	No specific recommendation provided. We recognize the need to align the policy across authorities and to minimize differences. However, the final NPA has not been finalized.
005	FAAC	All	While EASA NPA contains a set of technical considerations for continuing to use DO-178B within already certified systems and equipment, no such guidance exists within the FAA proposed AC.	Such technical considerations guide the industry in a safer direction.	As noted.	No specific recommendation provided. Draft AC 20-115C has technical content on the continued use of DO-178B. Although we encourage the use of DO-178C, the AC does not mandate a date by which the AC needs to be used.

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006	FAAC	All	The biggest benefit of using DO-178C in many safety engineers point of view appears to be the improved system-software interaction. The FAA is silent on this topic although many of the FAA engineers have given presentations stating that the safety benefits are to be seen by improving system-software interactions.	Such technical considerations focus the applicant's attention on what is important.	As noted.	Not accepted. The AC would not be providing any new guidance regarding system-software interaction.
007	Rockwell Collins, Inc.	DO-178C, sections 2.5.1, 6.6 and 11.2.2	The Parameter Data Item addition detailed in DO-178C as it currently is written may pose significant problems for the current and future system aircraft systems. For example, an Aircraft Options Table may define some aircraft options and other aircraft strapping options that are used by IMA based system components, as well as some non-IMA based federated systems. The way DO-178C is written, these files would no longer be able to be modified by the customer which would cause significant issues for avionics manufacturers/integrators and aircraft manufacturers.		Please address this issue as part of this AC update to allow for the Software to define the parameters and their ranges and possible values, etc. but not have to provide the final life cycle data. This would then continue to allow the aircraft OEMs to modify these files within the bounds defined by the application itself. Failure to provide such additional means of compliance in this AC could cause significant system re-design in order to maintain compliance.	Not accepted. The commenter appears to misunderstand DO-178C. We do not see where 2.5.1 prohibits the user from making modifications.
008	UASC	General	Approval of Parameter Data Items under TC, ATC, STC, and TSO processes is not addressed by this AC. Looking at the DO-178C glossary definition; Parameter Data Items appear to include all types of loadable data that will be integrated with the software, including aeronautical (DO-200A), airborne system (DO-178), and all other types of data. Data may be field loaded, loaded during manufacturing,	We need clarity on how data is to be approved in light of the new DO-178C objectives for Parameter Data Items. Forcing approval of all types of data as DO-178C Parameter Data Items seems to go beyond the intent of DO-178C. For example, should approval of the actual configuration values for a particular aircraft require the signature	Clarify when the objectives for Parameter Data Items apply and when they don't; for example, by moving the "guidance" from Order 8110.49 Chapter 15 into this AC and stating that guidance for PDIs only applies to airborne system databases and	Not accepted. DO-178C, section 2.5.1 excludes aeronautical databases as PDI. Future guidance may be forthcoming regarding approval of PDI as part of the TC, STC, ATC.

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			created and validated on the aircraft, or saved and loaded onto another aircraft. Should all this data now require DO-178C approval as part of type certification?	of a software DER? During a class the week of March 12, 2012 in Ontario, CA, multiple DERs and FAA software experts explored this problem without resolution. The FAA took an action item to clarify how PDIs are to be approved.	that approval process details need to be coordinated with the FAA. Alternatively, simply state that this will be resolved on a per project basis. In their recent CRD for AMC 20-115, EASA responded to Marty Gasiorowski by stating "this kind of issue should be solved at a project, not a rule, level." If the FAA agrees then it would still be good to state that fact in the AC rather than leave the ambiguity unaddressed.	
009	Randall Fulton	General comment	The "tone" and wording is "we" and "you". Recommend that personal pronouns not be used.	Use a business style wording.	Change: "g. If <i>you</i> use the means in this AC, <i>you</i> must follow it entirely." To: "g. If applicants or developers use the means in this AC, then it must be entirely followed." Change: "2. Applicability. <i>We</i> wrote this AC for applicants, design approval holders, and developers of airborne systems ...". And " <i>We</i> recommend developers of TSO articles ..."	Not accepted. FAA Order 1320.46C, <i>Advisory Circular System</i> , paragraph 7, states that plain language writing techniques must be followed when writing advisory circulars. Subparagraph 7.e. states to use pronouns: "Research shows that readers relate better to documents that use pronouns. Pronouns make them feel the document is directed at them. It's especially important to use pronouns when you want people to do something, since pronouns help them understand they have a responsibility. When you write ACs, refer to the reader as "you." You may also use "we" to refer to FAA. But it's important to make sure

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					<p>To: “2. Applicability. The FAA wrote this AC for applicants, design approval holders, and developers of airborne systems ...” and “The FAA recommends developers of TSO articles ...”</p> <p>Change: “5. Using Previously Acceptable Means of Compliance..... However, if <i>you</i> propose DO-178B as the basis for compliance, the FAA may use project-specific issue papers to achieve an acceptable means of compliance.”</p> <p>To: “5. Using Previously Acceptable Means of Compliance..... However, if DO-178B is proposed as the basis for compliance, the FAA may use project-specific issue papers to achieve an acceptable means of compliance.”</p>	<p>your reader understands to whom a pronoun refers, especially if you are addressing more than one audience.”</p>
010	Honeywell ODA	Starts at Pg 2, section 1g	The use of “You” and “We” is too informal and unclear.	“You” could be SW developer, Applicant, COT’s supplier or many other participants in the SW development process. Likewise “We” I assume is the FAA but is not explicit.	Be explicit in the use of these roles by using terms like FAA, Applicant, TC or TSO holder etc.	Not accepted. “We” is defined in paragraph 1.a as the FAA. Paragraph 2 States that the AC was written for “applicants, design approval holders, and developers of airborne

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						systems and equipment containing software for type certificated aircraft, engines, and propellers.” That would be the “you”. The use of these terms is consistent with plain language writing techniques mandated by federal law.
011	Northwest Aerospace Technologies Inc.	This comment relates to DO-178C, section 2.3.3 (e).	While this paragraph may say that once you determine the software to be Level E, the guidance of DO-178C does not apply, the paragraph is not telling you that you do not need to meet 25.1301, 25.1309 etc!	The software still needs to be uniquely identified (have a part number), the design assurance level justified, system functions defined, etc. Also, suppliers tend to “sneak in” functions that may drive the software criticality to Level D. Since minimum of no data is offered for these systems, it is difficult to verify what other functions are included.	Add a note to the AC clarifying that while compliance to objectives in DO-178B or DO-178C is not required for Level E software, Level E airborne software is not exempt from showing compliance to 25.1301, including providing justification for Level E classification.	Not accepted. The concern that is addressed by the comment is a systems level or aircraft level issue related to the safety assessment and is out of scope of this AC.
Original Proposed Text	Paragraph 1.		<p>a. This AC describes an acceptable means, but not the only means, for showing compliance with the applicable airworthiness regulations for the software aspects only of airborne systems and equipment certification. This AC is not mandatory and is not a regulation. Other ACs may describe alternate means.</p> <p>b. We, the Federal Aviation Administration or FAA, wrote this AC to recognize the following RTCA, Inc. documents (RTCA DO):</p> <ul style="list-style-type: none"> (1) RTCA DO-178C, Software Considerations in Airborne Systems and Equipment Certification, dated December 13, 2011. (2) RTCA DO-330, Software Tool Qualification Considerations, dated December 13, 2011. (3) RTCA DO-331, Model-Based Development and Verification Supplement to DO-178C and DO-278A, dated December 13, 2011. (4) RTCA DO-332, Object-Oriented Technology and Related Techniques Supplement to DO-178C and DO-278A, dated December 13, 2011. (5) RTCA DO-333, Formal Methods Supplement to DO-178C and DO-278A, dated December 13, 2011. <p>Note: RTCA DO is hereafter referred to as DO.</p> <p>c. References to use of DO-178C in this AC include use of supplements and DO-330 as applicable.</p> <p>d. This AC also establishes guidance for transitioning to DO-178C when making changes to software previously approved using versions prior to DO-178C.</p> <p>e. This AC also explains the use of DO-178C for Technical Standard Order (TSO) authorizations.</p> <p>f. This AC does not obligate the FAA to approve any data or perform any activities as specified within the referenced RTCA documents.</p> <p>g. If you use the means in this AC, you must follow it entirely.</p>			

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012	Elbit Systems Ltd.	Page 1 § 1a	a. This AC describes an acceptable means, but not the only means, for showing compliance with the applicable airworthiness regulations for the software aspects only of airborne systems and equipment certification.	1. Generality and Simplification 2. To keep the "same LIKE" intention of the previous AC-20 115B	Removal of the word "only": a. This AC describes an acceptable means, but not the only means, for showing compliance with the applicable airworthiness regulations for the software aspects only of airborne systems and equipment certification.	Accepted.
013	EASA	§1.b, §12	DO-248C was updated in parallel with the core document and its supplements, and provides a lot of useful clarifications to support the use of DO-178C. DO-248C could be considered as well as a supplemental document to be used jointly with ED-12C.	Reference to the DO-248C document will indicate to applicants where they can find really useful clarifications to support the use of DO-178C.	Could you please consider adding a reference to DO-248C in §1.b & §12?	Partially accepted. DO-248C is not considered to be guidance and therefore it would not be appropriate to recognize it in this paragraph along with the documents that are considered guidance. DO-248C has been added to the documents listed in paragraph 11, <i>Related Regulatory, Advisory, and Industry Material</i> .
014	FAAC	1, 1	Add an acknowledgement to the AC regarding the release of DO-248C, Supporting Information for DO-178C and DO-248A. Further, the AC should clearly state that DO-248C may be helpful in understanding topics in DO-178C but that it does not constitute guidance and that its use is not mandatory.	Proactively define the status of DO-248C, as well as helping Applicants new to the airborne software approval process find industry consensus material to aid them.	As Noted.	Partially accepted. DO-248C has been added to the documents listed in paragraph 11, <i>Related Regulatory, Advisory, and Industry Material</i> .
015	FAAC	1,1	Add an acknowledgement to the AC regarding the release of DO-278A, Software Integrity Assurance Considerations for Communication, Navigation, Surveillance and Air Traffic Management (CNS/ATM) Systems. Further, the AC should clearly state that DO-278A is intended for ground and space-based systems and should not be used for airborne software approval although	Acknowledges another interpretation exists for CNS/ATM domains and highlights the potential need for care concerning any interfaces.	As noted.	Not accepted. The scope of the AC is limited to airborne systems, which would not include DO-278A.

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			airborne systems interfacing with such CNS/ATM systems should be aware of any interdependencies between the interfacing domains.			
016	BA EEDA	sect 1c.	Why only DO-330 is mentioned as applicable?	All supplements are used as applicable.	Modify text as following: “References to use of DO-178C in this AC include use of supplements as applicable.”	Not accepted. DO-330 is not a supplement. Therefore, we have identified it separately in addition to applicable supplements.
017	GE Aviation	1.d.	This states This AC also establishes guidance for transitioning to DO-178C when making change to software previously approved using versions prior to DO-178C.	The certification basis of a product is established at the time of the preliminary type board meeting. This would encompass use of DO-178B for existing products. Yet this AC may guide you to use DO-178C. This is a change in cert basis.	Aircraft or engines and the products used on them don’t have to change their cert basis when they are modified. Why is software handled differently?	Not accepted. The certification basis of an aircraft includes the applicable regulations, special conditions, ELOS findings, and exemptions. AC20-115C recognizes DO-178C as an acceptable means of compliance, and is not part of the certification basis. We have made provisions in the AC for continued use of DO-178B and earlier versions, within certain constraints.
018	Honeywell ODA	Page 1, 1.(d)	This section states: “This AC also establishes guidance for transitioning to DO-178C when making changes to software previously approved using versions prior to DO-178C”.	Clarity	Change this sentence to explicitly list all prior versions of DO-178x as follows: “.....software previously approved using versions prior to DO-178C (DO-178, DO-178A, DO-178B)”.	Accepted. Changed to: d. This AC also establishes guidance for transitioning to DO-178C when making modifications to software previously approved using DO-178, DO-178A, or DO-178B.
019	FAAC	1.f	FAA has no obligation to approve any data or perform any activities as specified within the referenced RTCA documents – does this mean that the applicant will know ahead of time whether or not the FAA intends to audit, including whether or not a DER should be	Unclear and ambiguous wording.	Clarify.	Not accepted. Compliance with this AC is not predicated on FAA or designee involvement.

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			involved in the project?			
020	Boeing	Page 2, Paragraph 1.g	Please delete paragraph 1.g. This “boilerplate” language appears often in FAA ACs and we have commented on its impracticality a number of times. While we understand that the FAA’s intent of the statement is to prevent applicants from “picking and choosing” from portions of an AC to comply with, we consider it inappropriate for this particular AC. Avionics for the transforming air traffic system, and especially software technology, are continually evolving. We maintain that applicants should have the flexibility to propose the use of all or parts of this AC in their project specific certification plans.	The restrictive paragraph remains an obstacle in providing a clear understanding of the intent of the AC as guidance material. Applicants should be able to use alternative methods for certain requirements described in this AC, as long as interoperability and intent are maintained. It should not be “all or nothing,” as the boilerplate language prescribes.	Delete the proposed text that states: <i>“g. If you use the means in this AC, you must follow it entirely.”</i>	Not accepted. AC 20-115C describes one acceptable means of compliance. Alternative means of compliance, including variations to AC 20-115C, should be proposed and agreed to by the certification authority.
021	Honeywell ODA	Page 2, Section 1g.	Statement is only applicable if AC 20-115C compliance is requested.	AMOC’s would not necessarily be compliant with this AC.	Change statement to: “The applicant must follow this AC in its entirety to claim compliance to AC 20-115C.”	Partially accepted. Changed to: “If you use the means in this AC as a means of compliance, you must follow it entirely.”
022	GE Aviation	1.g.	This states If you use the means in this AC, you must follow it entirely.	Is it acceptable to apply DO-330 on tool qual for existing DO-178B programs?	Allow use of DO-330 on DO-178B programs.	Not accepted. However, an applicant can propose to use DO-330 as an alternative for tool qualification on a DO-178B project. It does not need to be stated specifically in the AC.

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023	GE Aviation Systems	Page 2, paragraph 1.g.	This states If you use the means in this AC, you must follow it entirely.	Since RTCA/DO-330 clearly identifies what is required for tool qualification, it should be acceptable for RTCA/DO-178B programs to use RTCA/DO-330	Allow use of RTCA/DO-330 on RTCA/DO-178B programs.	Not accepted. However, an applicant can propose to use DO-330 as an alternative for tool qualification on a DO-178B project. It does not need to be stated specifically in the AC.	
	Final Text	Paragraph 1	<p>a. This AC describes an acceptable means, but not the only means, for showing compliance with the applicable airworthiness regulations for the software aspects only of airborne systems and equipment certification. This AC is not mandatory and is not a regulation. Other ACs may describe alternate means.</p> <p>b. We, the Federal Aviation Administration of (FAA), wrote this AC to recognize the following RTCA, Inc. documents (RTCA DO):</p> <ul style="list-style-type: none"> (1) RTCA DO-178C, Software Considerations in Airborne Systems and Equipment Certification, dated December 13, 2011. (2) RTCA DO-330, Software Tool Qualification Considerations, dated December 13, 2011. (3) RTCA DO-331, Model-Based Development and Verification Supplement to DO-178C and DO-278A, dated December 13, 2011. (4) RTCA DO-332, Object-Oriented Technology and Related Techniques Supplement to DO-178C and DO-278A, dated December 13, 2011. (5) RTCA DO-333, Formal Methods Supplement to DO-178C and DO-278A, dated December 13, 2011. <p>Note: RTCA DO is hereafter referred to as DO.</p> <p>c. References to use of DO-178C in this AC include use of supplements and DO-330 as applicable.</p> <p>d. This AC also establishes guidance for transitioning to DO-178C when making changes <u>modifications</u> to software previously approved using versions prior to DO-178C <u>DO-178, DO-178A, or DO-178B</u>.</p> <p>e. This AC also explains the use of DO-178C for Technical Standard Order (TSO) authorizations.</p> <p>f. This AC does not obligate the FAA to approve any data or perform any activities as specified within the referenced RTCA documents.</p> <p>g. If you use the means in this AC <u>as a means of compliance</u>, you must follow it entirely.</p>				
	Original Proposed Text	Paragraph 2	<p>2. Applicability. We wrote this AC for applicants, design approval holders, and developers of airborne systems and equipment containing software for type certificated aircraft, engines, and propellers. The term “type certificate” (TC) applies to the original TC, supplemental TC, and amended original or supplemental TC. We recommend developers of TSO articles to use this AC for software assurance.</p>				
024	FAAC	2,2	Do not understand the weakness of the language concerning TSO applicability. Most TSOs have been updated to callout DO-178 to its latest revision. Why would the FAA make it a recommendation only in this AC.	The TSO process is already weak in terms of addressing highly complex devices including both SW and AEH. There is no reason for adding further ambiguity as to whether TSOs have to follow the industry/regulatory standard	Reword the last sentence (and add a new sentence) in section 2 to read: “Developers of TSO articles that include software should	Not accepted. Most TSOs specify use of DO-178B for software assurance, and older TSOs may specify an earlier version. Therefore, AC 20-115C cannot force TSOA applicants to use DO-178C, and we can only recommend that TSOA	

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				for software design assurance. Further, TSO articles are increasingly being installed under the umbrella of a TC program where the FAA is then imposing on the airframer the responsibility of ensuring DO-178 compliance. Strengthening the statement in this AC will help eliminate problems found in the TSO supporting data.	follow the guidance concerning software given in the TSO. For older TSOs that may predate the release of DO-178B or C, guidance concerning the applicability of software design assurance should be discussed with the cognizant ACO early in the TSO development process.”	applicants use DO-178C. When applying for a TSOA, you are required to meet the TSO unless you obtain a deviation for some aspects, such as software assurance requirements.
025	L-3 Communications	Page 2, Paragraph 2.	Last sentence should be simplified.	To improve clarity of sentence.	Change “We recommend developers of TSO articles to use this AC ...” to “We recommend developers of TSO articles use this AC ...”	Accepted.
026	Boeing	Page 2, Paragraph 2. Applicability	We support the FAA’s recommendation that this AC <u>should</u> apply to TSO articles.	If the TSO developer has used this AC for the article’s software assurance, then aircraft manufacturers would be able to install TSO articles into their products more easily and effectively. Applying the AC methods to TSO articles would eliminate a possible certification “gap” between the widely varying software-related TSO requirements and the software-related airworthiness requirements of aircraft. It would also eliminate the manufacturers’ cost burden required to manage this “gap.”	Strengthen the proposed text that states: <i>“2. ... We recommend developers of TSO articles to use this AC for software assurance.”</i>	Not accepted. AC 20-115C cannot force TSOA applicants to use DO-178C, and we can only recommend that TSOA applicants use DO-178C. When applying for a TSOA, you are required to meet the TSO unless you obtain a deviation for some aspects, such as software assurance requirements.
027	Greg Turgeon	Page 2 Para 2	Last sentence is incomplete without acknowledging that some TSOs already refer to DO-178		Add reference to paragraph 7. “We recommend developers of TSO articles use this AC for software assurance (refer to	Accepted.

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					paragraph 7)”	
028	FAAC	2	Use of this AC is optional for TSO applicants. How can TSOA articles compliant to DO-178B be used on aircraft?	Unclear direction. We have the possibility of weak links in safety of the chain of aircraft functions and possibility of uneven mix of regulations.	Add how TC applicants will be able to use TSO data: if not compliant to DO-178C but compliant to DO-178B without the use of any issue papers	Not accepted. Paragraph 5 explains that DO-178B may continue to be used; this includes TSO articles. Paragraph 9 also applies to TSO articles.
	Final Text	Paragraph 2	<p>2. Applicability. We wrote this AC for applicants, design approval holders, and developers of airborne systems and equipment containing software for type certificated aircraft, engines, and propellers. The term “type certificate” (TC) applies to the original TC, supplemental TC, and amended original or supplemental TC. We recommend developers of TSO articles to use this AC for software assurance (see paragraph 7).</p>			
	Original Proposed Text	Paragraph 3	<p>3. Cancellation. This AC cancels AC 20-115B, RTCA, Inc., Document RTCA/DO-178B, dated January 11, 1993.</p>			
			NO COMMENTS; NO CHANGES			
	Original Proposed Text	Paragraph 4	<p>4. Background. DO-178C addresses several issues discovered through the use of DO-178B. See DO-178C, Appendix A, paragraph 3, for a summary of differences between DO-178C and DO-178B.</p>			
			NO COMMENTS; NO CHANGES			
	Original Proposed Text	Paragraph 5	<p>5. Using Previously Acceptable Means of Compliance. In previous certification projects, DO-178B was found to be inadequate for use with certain software development techniques, and was supplemented with project-specific issue papers to achieve an acceptable means of compliance. DO-178B also contains ambiguities that could lead to an unacceptable means of compliance if interpreted incorrectly. Means of compliance that the FAA has previously accepted, including ones based on DO-178B, may be acceptable for certification projects. However, if you propose DO-178B as the basis for compliance, the FAA may use project-specific issue papers to achieve an acceptable means of compliance.</p>			

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029	EASA	§5	<p>It seems that it is proposed to continue to accept DO-178B as the basis for compliance for future programs, provided that project-specific issue papers are used to achieve means of compliance.</p> <p>In addition, no deadline is specified, so it appears that this alternative is not proposed only for a transition period.</p>	<p>This § might introduce some confusion, and might make unclear the scope of application of DO-178C.</p> <p>In our opinion, after a period of transition, DO-178C should be applied to any new application.</p>	<p>Could you please clarify the FAA position on that point?</p>	<p>The FAA position is that safe software has been produced using the guidance of DO-178B for many years. We cannot justify forcing developers who have been successfully producing software under existing processes to update their processes for no additional safety benefit (within certain constraints). The FAA's goal is to assist in fostering the earliest adoption of the industry developed and approved update of DO-178B to DO-178C and its supplements. We expect applicants who are establishing a software development process to do so in accordance with DO-178C.</p>
030	Avidyne Corporation	Page 2 Paragraph 5	<p>Preservation of DO-178B as an acceptable means of compliance is very positive, but the issue paper process is badly deficient with regard to software certification. Many, if not most, systems are initially approved by TSOA and the DO-178() compliance activities are conducted in that context. Issue papers, however, are applied only in TC/STC projects. The prevailing practice with regard to issue paper reuse in follow-on installation approval of identical or similar system software is inefficient for both the applicant and FAA and contributes little or nothing to safety.</p>	<p>DO-178() compliance is independent of aircraft type and depends only on the software development assurance level. Follow-on projects should validate the software levels (an SSA process, not a software process) and full DO-178() credit should be given with no further action if the levels are appropriate and no disqualifying software changes have been made.</p>	<p>Amend the issue paper process to make it applicable to TSOA projects or to streamline follow-on approvals of identical or similar system software.</p>	<p>Not accepted. Amending the issue paper process is out of scope of this AC.</p>
031	Honeywell ODA	Page 2 Paragraph 5	<p>Paragraph implies that the FAA may issue additional issue papers for applicants proposing earlier versions of DO-178 as means of compliance. The text is not clear if this means IPs may be applied to projects which</p>	<p>Confusion as to when IPs may be applied. If the applicant follows the guidance of this AC (especially Figure 1), IPs should not be necessary</p>	<p>Clarify.</p>	<p>The intent of the statement is that use of DO-178C should reduce the requirement for certain issue papers that have been used on projects in the past (using DO-178B), such as the OOT IP. If an</p>

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			follow the guidance of this document (including Figure 1) to determine which version of DO-178 is acceptable, or may be applied only if the applicant chooses to deviate from the guidance in this AC			applicant continues to use DO-178B (or earlier version), then they can expect the same IPs that were previously issued to be applied to a follow-on project. This is not to imply that no IPs will be required when using DO-178C, as the applicant's approach may have considerations that are not covered in DO-178C.
032	FAAC	5	The last sentence of this section seems to imply that moving to DO-178C will eliminate the likelihood of receiving one or more issue papers for your project. While this would certainly be ideal, this would not seem to be the FAA's intent. Some rewording is in order.	As Noted	Restate the last sentence in a more positive way: "The adoption of DO-178C should reduce the use of project-specific issue papers thus reducing the regulatory burden."	Not accepted. The intent of the paragraph is to tell the reader that issue papers that were applied to previous projects using DO-178B will likely be applied again if DO-178B is used. Readers should not assume that using DO-178C will eliminate the need for any IPs, as the applicant's approach may have considerations that are not covered in DO-178C. The paragraph has been rewritten and encourages the use of DO-178C.
033	TCCA	Page 2 paragraph 5	The last two sentences of the paragraph are confusing and discourage use of DO-178C	For new development use of DO-178 B as a means of compliance is not acceptable.	Delete the last two sentences of the paragraph 5	Not accepted. DO-178B has been used successfully in the past and does not present a safety hazard. Therefore, we cannot justify requiring applicants who have an established assurance process using DO-178B, and successfully used the process to develop safe software, to use DO-178C. The paragraph has been rewritten and encourages the use of DO-178C.

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034	TCCA	Page 2, para 5	<p>COMMENT: The AC should enforce the use of version C of RTCA DO-178 should RTCA DO-178 be used as a means of compliance by Applicant.</p>	<p>REASON: DO-178C and supplements provide clearer and more complete guidance that accounts for the evolution of technology and methodology since 1992, and from lessons learned from the use of version B. Not using DO-178 consistently (allowing B and C) presents a major risk of inconsistency in the application of software certification standards across applicants and across jurisdictions around the world. It will also cause undue burden for Certification Authorities in establishing equivalency between means of compliance on different project, and in developing IP/CM/CRIs.</p>	<p>Within para 5, delete the part of the paragraph starting with “Means of compliance [..]” until the end of the paragraph</p>	<p>Not accepted. We agree that DO-178C and the supplements provide clearer and more complete guidance than DO-178B. We also agree that continued use of DO-178B may cause an undue burden for certification authorities in maintaining policy and guidance directed at DO-178B. However, use of DO-178B, along with current guidance and issue papers, does not present a safety hazard. Therefore, we cannot justify requiring applicants who have an established assurance process using DO-178B, and successfully used the process to develop safe software, to use DO-178C. The paragraph has been rewritten and encourages the use of DO-178C.</p>
	Final Text	Paragraph 5	<p>5. Using Previously Acceptable Means of Compliance. In previous certification projects, DO-178B was found to be inadequate for use with certain software development techniques, and was supplemented with project-specific issue papers to achieve an acceptable means of compliance. DO-178B also contains ambiguities that could lead to an unacceptable means of compliance if interpreted incorrectly. Means of compliance that the FAA has previously accepted, including ones based on DO-178B, may be acceptable for certification projects. However, if you propose DO-178B as the basis for compliance, the FAA may use project-specific issue papers to achieve an acceptable means of compliance.</p> <p>5. Using Previously Acceptable Means of Compliance. <u>Our experiences working with applicants using DO-178B for software assurance have revealed that there are areas that DO-178B does not adequately address. DO-178B also contains ambiguities that could be misinterpreted by the applicant. This may result in the applicant failing to meet some of the DO-178B objectives. Therefore, we used project-specific issue papers to clarify our expectations and document how the applicant complies. Applicants who have used DO-178B in the past, or other means of compliance that were accepted by the FAA, may still be able to use the same means of compliance for certification projects. If you want to use DO-178B for software assurance, the FAA may continue to use project-specific issue papers to achieve an acceptable means of compliance. We recommend, however, that you upgrade your processes to DO-178C. New applicants or developers who are establishing software life cycle processes should do so in accordance with DO-178C.</u></p>			

No.	Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
	Original Proposed Text	Paragraphs 6. and 6.a	<p>6. Using DO-178C for Type Certification. DO-178C is an acceptable means of compliance for the software aspects of type certification. If you use DO-178C:</p> <p>a. You should satisfy all the objectives associated with the software level assigned to the software components and develop all of the associated data as specified in the outputs listed in the DO-178C Annex A tables, DO-330 Annex A tables for tool qualification, and the DO-331, DO-332, and DO-333 Annex A tables where applicable. You should describe activities that will satisfy the objectives. You may either use the activities listed in DO-178C or adopt your own equivalent activities. If the FAA chooses not to be involved in the certification liaison process, you can consider the certification liaison process objectives and activities to be satisfied after the associated data is produced.</p>			
035	TCCA	Page 2, para 6	<p>COMMENT: The AC should enforce the use of version C of RTCA DO-178 should RTCA DO-178 be used as a means of compliance by Applicant.</p>	<p>REASON: Significant improvements were made to through DO-178C and Supplements, as a result of an effort involving the industry that will, if applied, lead to increased safety by providing a clearer and more complete body of guidance. Risk of inconsistency in the application of software certification standards across applicants and jurisdiction around the world. Undue burden for Certification Authorities in establishing equivalency between means of compliance on different projects, and in developing IP/CM/CRIs.</p>	<p>In first paragraph, replace “If you use DO-178C” with “when applying DO-178C”</p>	<p>Partially accepted. We agree with the suggested wording that is more suggestive toward using DO-178C. However, use of DO-178B, along with current guidance and issue papers, does not present a safety hazard. Therefore, we cannot justify requiring applicants who have an established assurance process using DO-178B, and successfully used the process to develop safe software, to use DO-178C.</p>
036	TCCA	Page 2 Para 6 a.	<p>COMMENT: The section and AC in general does not convey that that compliance to DO-178C requires that all DO-178C activities be planned and performed, and that their execution, and the evidence of their execution, are integral part of the compliance demonstration. The section is objective and data centric, in a way that is in contradiction with the stated intent of RTCA DO-178C (in particular sections 1.1 “Purpose” and 1.4 “How to use this document”).</p>	<p>REASON: The guidance in DO-178C includes objectives and data, but also activities and artifacts produced by activities. Activities should be planned, and plans should be accepted by Certification authorities.</p>		<p>Partially accepted. Changed to: “You should plan and execute activities that will satisfy each objective.”</p>

No.	Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
037	TCCA	Page 2 Para 6 a.	COMMENT: The following sentence [“You may either use the activities listed in DO-178C or adopt your own equivalent activities.”] weakens the position taken in RTCA DO-178C that states (section 1.4 d) that “the applicant may <u>plan</u> and, <u>subject to the approval of the certification authority</u> , adopt alternative activities to those described in this document”	REASON: Risk of weakening the design assurance processes performed by applicants if alternative activities are not approved by the certification authority at the planning stage. Provision in section 1.4 d of RTCA DO-178C is adequate and sufficient to provide the applicant the option to propose alternate activities in a structured way.		Accepted. Removed the offending sentence.
038	TCCA	Page 2 para 6	COMMENT: The following sentence “You should describe [..]” should be replace with “You should plan [..]”	REASON: The notion that activities are part of the guidance and that they should be planned is of paramount importance, and is lost in this paragraph. Provision in section 1.4 d of RTCA DO-178C is adequate and sufficient to provide the applicant the option to propose alternate activities in a structured way.	The following sentence “You should describe [..]” should be replace with “You should plan [..]”	Accepted. Replaced with “You should plan and execute activities that will satisfy each objective.”
039	Randall Fulton	Page 2-6.a	“You should describe activities that will satisfy the objectives. You may either use the activities listed in DO-178C <u>or adopt your own equivalent activities.</u> ” Further explanation should be included as to what “or adopt your own equivalent activities” might entail.	For inexperienced suppliers or developers, this could easily be interpreted in a very open or loose fashion. Some may be tempted to ignore DO-178C and do whatever they want. As a DER, it makes life very difficult trying to get folks to stay within the guidance.	Further explanation should be included as to what “or adopt your own equivalent activities” might entail.	Not accepted. Comment no longer applicable. The offending sentence has been removed.
040	L-3 Communications	Page 2, Paragraph 6.a.	Punctuation of first sentence should be improved.	To improve readability of comma separated list.	Change “... and the DO-331, DO-332 and DO-333 Annex tables ...” to “... and the DO-331, DO-332, and DO-333	Accepted.

No.	Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
					Annex tables ...”	
041	L-3 Communications	Page 2, Paragraph 6.a	Early notification if the FAA plans to participate in the DO-178C process.	Prevention of missing objectives during a project’s life cycle.	Provide a method to determine if the FAA will be involved early on in a project's planning phase.	Not accepted. The applicant should treat a project the same regardless if he knows up front whether or not the FAA will be involved; the activities would remain the same regardless. Life cycle data is always subject to review by the certification authorities. A Partnership for Safety Plan (PSP) may establish agreement regarding FAA involvement.
042	TCCA	Page 2 paragraph 6a	It says that developer may adopt its own equivalent activities rather than the activities from the guidance. That is not quite true.	DO-178 C in 1.4 d clearly describes what an applicant should do if it plans to replace the required activities with its own and it is not simple. It is at discretion of the authority to approve them. The applicants should not be encouraged to do it.	Delete the sentence that says that you may adopt your own activities instead of those listed in DO-178C.	Accepted.
043	Greg Turgeon	Page 2 Para 6.a	Reword first sentence for clarity	Clarify that supplements are only required when applicable.	You should satisfy all the objectives associated with the software level assigned to the software components and develop all of the associated data as specified in the outputs listed in the DO-178C Annex A tables, DO-330 Annex A tables for tool qualification, and, where applicable , the DO-331, DO-332 and DO-333 Annex A tables, where applicable .	Accepted.

No.	Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
044	Greg Turgeon	Page 2 Para 6.a	Reword second sentence for clarity	Emphasize that every objective has to be satisfied.	You should describe activities that will satisfy the <u>each</u> objectives	Accepted. Replaced with “You should plan and execute activities that will satisfy each objective.”
045	Greg Turgeon	Page 2 Para 6.a	Last sentence. Producing the data should not be enough to satisfy the liaison process objectives.	Data must have some approval, even it if only applicant approval when the FAA chooses not to be involved. For example, on a TSO project liaison objectives should not be consider complete until TSO application submittal. For aircraft certification, approval by the airframer should be required.	If the FAA chooses not to be involved in the certification liaison process, you can consider the certification liaison process objectives and activities to be satisfied after the associated data is produced <u>verified and approved by the applicant.</u>	Not accepted. The SAS requires that the applicant make a statement of compliance with DO-178(). Changed to: “If the FAA chooses not to be involved in the certification liaison process, you can consider the certification liaison process objectives and activities to be satisfied after <u>you have produced the life cycle data in DO-178C, Table A-10.</u> ”
046	FAAC	6a	6a requires all of the data in Annex A tables (even when using equivalent activities).	What if the equivalent activity does not produce the same data?	Add a clause to state that if that data is not produced by an equivalent activity can an alternate data be used.	Not accepted. Comment no longer applicable. The offending sentence has been removed.
	Final Text	Paragraphs 6. and 6.a	<p>6. Using DO-178C for Type Certification. DO-178C is an acceptable means of compliance for the software aspects of type certification. If <u>When</u> you use DO-178C:</p> <p>a. You should satisfy all the objectives associated with the software level assigned to the software components and develop all of the associated <u>life cycle</u> data as specified in the outputs listed in the DO-178C Annex A tables, DO-330 Annex A tables for tool qualification, and, <u>where applicable</u>, the <u>DO-330</u>, DO-331, DO-332, and DO-333 Annex A tables where applicable. You should <u>describe plan and execute</u> activities that will satisfy <u>the each</u> objectives. You may either use the activities listed in DO-178C or adopt your own equivalent activities. If the FAA chooses not to be involved in the certification liaison process, you can consider the certification liaison process objectives and activities to be satisfied after <u>you have produced the life cycle data in DO-178C, Table A-10.</u></p>			
	Original Proposed Text	Paragraph 6.b	<p>b. You should submit the life cycle data specified in DO-178C, section 9.3, and DO-330, section 9.0.a. (as applicable for tool qualification), to the appropriate project certification office (e.g., aircraft certification office (ACO)). Early submittal of your planning documents helps reduce your project risk; however, our involvement in your software assurance processes will be at our discretion. Regardless of our involvement, it is your responsibility to perform the planned activities and develop the associated data necessary to satisfy all applicable objectives.</p>			
047	Greg Turgeon	Page 2 Para 6.b	Reference for approval is the project certification office. What about delegated organizations?	Many projects are now approved by delegated organizations.	You should submit the life cycle data specified in DO-178C, section 9.3, and DO-330, section 9.0.a. (as applicable for tool	Not accepted. The example has been removed from the sentence.

No.	Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
					qualification), to the appropriate project certification office (e.g., aircraft certification office (ACO) or delegated organization)	
048	Greg Turgeon	Page 3 Para 6.b	Emphasize verification of lifecycle data	Ensure applicants are aware of responsibilities to verify data	Regardless of our involvement, it is your responsibility to perform the planned activities, and develop and verify the associated data necessary to satisfy all applicable objectives.	Accepted.
049	Honeywell ODA	Page 2, section 6 b.	AC does not recognize order 8100.15, ODA Organizations.	With the release of FAA order 8100.15, the SW approval may occur either at the FAA ACO or the ODA Unit organizations.	Change to, “(e.g., aircraft certification office (ACO) or Organization Designation Authorization (ODA)”	Not accepted. The example has been removed from the sentence.
050	FAAC	6b	While previously, planning data had to be submitted, this AC specifies that the planning data is needed only if the applicant wants to reduce risk.	This may cause the compliance process to be a paperwork exercise in the applicant writing the plans at the end of the project just to satisfy section 11 and not to use the plans on the project. The foundation for compliance namely planning and executing to plans can be violated within the direction in this AC.	Clarify the implications of not submitting the plans.	Not Accepted. Comment no longer applicable. The offending sentence has been removed.
	Final Text	Paragraph 6.b	<p>b. You should submit the life cycle data specified in DO-178C, section 9.3, and DO-330, section 9.0.a. (as applicable for tool qualification), to the appropriate project certification office. (e.g., aircraft certification office (ACO)). Early submittal of your planning documents early to helps reduce your project risk; however, oOur involvement in your software assurance processes will be at our discretion. Regardless of our involvement, it is your responsibility to perform the planned activities and develop the associated produce the life cycle data necessary to satisfy all applicable objectives.</p>			

No.	Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition																																
	Original Proposed Text	Paragraph 6.c	<p>c. Table 1 identifies the applicability of software life cycle data by software level that are used, in part, to define the configuration and design features of the type certified product as specified in Title 14, Code of Federal Regulations (14 CFR) 21.31.</p> <p style="text-align: center;">Table 1 - Software Life Cycle Data Applicable to Type Design by Software Level</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Description</th> <th>DO-178C Reference</th> <th>Levels A, B, C</th> <th>Level D</th> </tr> </thead> <tbody> <tr> <td>Software Requirements Data</td> <td>11.9</td> <td>Applicable</td> <td>Applicable</td> </tr> <tr> <td>Design Description</td> <td>11.10</td> <td>Applicable</td> <td>Architecture Only</td> </tr> <tr> <td>Source Code</td> <td>11.11</td> <td>Applicable</td> <td>Not applicable</td> </tr> <tr> <td>Executable Object Code</td> <td>11.12</td> <td>Applicable</td> <td>Applicable</td> </tr> <tr> <td>Parameter Data Item Files (if any)</td> <td>11.22</td> <td>Applicable</td> <td>Applicable</td> </tr> <tr> <td>Software Configuration Index</td> <td>11.16</td> <td>Applicable</td> <td>Applicable</td> </tr> <tr> <td>Software Accomplishment Summary</td> <td>11.20</td> <td>Applicable</td> <td>Applicable</td> </tr> </tbody> </table>	Description	DO-178C Reference	Levels A, B, C	Level D	Software Requirements Data	11.9	Applicable	Applicable	Design Description	11.10	Applicable	Architecture Only	Source Code	11.11	Applicable	Not applicable	Executable Object Code	11.12	Applicable	Applicable	Parameter Data Item Files (if any)	11.22	Applicable	Applicable	Software Configuration Index	11.16	Applicable	Applicable	Software Accomplishment Summary	11.20	Applicable	Applicable			
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051	FAAC	6c and Table 1	Architecture was previously interpreted to be not needed for level D since 178B considered architecture as part of design.	If 14CFR 21.31 requires this data, are all of the 178B approved software non-compliant with 14 CFR 21.31?	Clarify.	Not accepted. Comment no longer applicable. Paragraph 6.c has been replaced and Table 1 has been removed.																																
052	FAAC	6c and Table 1	FAA Order 8110.49 Change 1 does not require PDS level D to produce architecture data. The logic used in this order applies to 178C also but the direction by the FAA appears to be contradictory.	Contradictory statements by the FAA.	Clarify.	Not accepted. Comment no longer applicable. Paragraph 6.c has been replaced and Table 1 has been removed.																																
053	FAAC	Table 1	While the Level D applicability requirement for “Architecture Only” accurately reflects SC-205’s inclusion of applicability for this in Table A-2, there is no corresponding verification required. This is analogous to the	Inconsistency in DO-178C should be proactively addressed. Either provide a statement concerning the criteria to be used to determine if the provided architecture data is acceptable to the	Delete the requirement for demonstration of Architecture at DAL D, i.e. remove the ‘dot’ in Table A-2 via this AC.	Not accepted. Comment no longer applicable. Paragraph 6.c has been replaced and Table 1 has been removed.																																

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			<p>situation concerning a number of objectives in DO-178B that are now addressed in FAA Order 8110.49, Chapter 8 as, as well as DO-248C, FAQ #84. The FAA should address this inconsistency rather than simply repeating it.</p> <p>SC-205 did not explain this change in the rationale included in DO-248C and without an explanation, it is difficult to understand what having a documented architecture buys in terms of increased safety. It is also unclear what the FAA or its designees are to use as criteria for evaluating the provided architecture as none of the verification objectives in Table A-4 are shown as applicable for DAL D.</p>	Administrator OR proactively delete the objective applicability at DAL D.	<p>Note: if the FAA feels strongly that this needs to be retained, then constrain the required ‘showing’ to address the only A-4 objective that does apply. This could be done with a statement similar to the following:</p> <p>“Architectural data produced for DAL D need only be sufficient to confirm any partitioning present in the system, presumably between DAL D and DAL E.”</p>	
054	Garmin	Page 3, Table 1, Design Description row	Clarify “Architecture Only”.	Perhaps this AC text was merely trying to exclude Low Level Requirements for Level D in this row to match the fact that the objective tables do not require LLR for Level D. However, the term “architecture” has no specific definition in the glossary and could be rather open-ended.	Change to “Low Level Requirements Not Applicable”	Not accepted. Comment no longer applicable. Paragraph 6.c has been replaced and Table 1 has been removed.
055	Boeing	Page 3, Paragraph 6.c. Table 1 Row: “Design Description,” Column: “Level D”	<p>We recommend changing the text to read:</p> <p>“Architecture only when partitioning is utilized.”</p>	Our recommended change would better align this AC with RTCA/DO-178C, Table A-4.	Revise text per our recommendation.	Not accepted. Comment no longer applicable. Paragraph 6.c has been replaced and Table 1 has been removed.

No.	Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
056	EASA	§6.c	<p>For DAL D, it is obvious that the Source Code itself is not subject to compliance demonstration against DO-178C objectives.</p> <p>However as clarified per DO-248C FAQ #84, if source code is produced by the applicant, it should be configuration-managed to achieve compliance with DO-178C objective 7 of Table A-2 and objective 4 of Table A-8.</p>	If caution is not applied, applicants may miss the necessary step of configuration management.	Could you please consider the guideline from FAQ #84 when identifying the necessity to manage Source Code under configuration?	Not accepted. Comment no longer applicable. Paragraph 6.c has been replaced and Table 1 has been removed.
057	Greg Turgeon	Page 3 Para 6.c	The reference to the table is slightly different than the table title and contents	Consistency	Table 1 identifies the applicability of software life cycle data applicable to the Type Design by software level that are used,	Not accepted. Comment no longer applicable. Paragraph 6.c has been replaced and Table 1 has been removed.
058	GE Aviation Systems	Page 3, Table 1	States that source code is not required for Level D programs. Yet in RTCA/DO-178C sections 9.4.c., 11.11, 11.16.c and 11.20.i. requires source code to be present. In addition please see RTCA/DO-248C, FAQ #84	I believe RTCA/DO-178C in this area is ambiguous and the clarification in RTCA/DO-248C only serves to make this a hidden objective	Clarify if the applicant has to show any evidence for source code for level D applications. No configuration control, no mention in the SCI, not taken into consideration for worst case timing, etc...	Not accepted. Comment no longer applicable. Paragraph 6.c has been replaced and Table 1 has been removed.
059	Rockwell Collins, Inc.	Section 6 Table 1	<p>The intent of declaring Source Code Not Applicable for Level D is unclear. My assumption is that it might be trying to allow for use of COTS software (especially operating systems) to be approved at DAL D w/o access to source code.</p> <p>We understand that DO-178C would not require development of source code for DAL-D, but the rationale for this exemption is not clear for readers who were not part of the SC-205 committees.</p>		Please provide an explanation in the AC of the rationale for this exemption, or examples of when this case might occur.	Not accepted. Comment no longer applicable. Paragraph 6.c has been replaced and Table 1 has been removed.

No.	Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition																				
060	Elbit Systems Ltd.	Page 3 § 6c Table 1	Addition of PSAC to the applicable Software Life Cycle Data	The PSAC is needed since the SAS will be <u>also</u> evaluated against this PSAC	Addition of PSAC to the applicable Software Life Cycle Data	Not accepted. Comment no longer applicable. Paragraph 6.c has been replaced and Table 1 has been removed.																				
061	BA EEDA	sect 6c.	The intent of the table 1 is not clear. Does it mean that in the context of Type Design, only the life cycle data identified in the table 1 are required?	This section could mislead to a reduction of the life cycle data identified in the table 1 in the context of Type Design.	Make the intention clear for this section or remove the section completely.	Accepted. Paragraph 6.c has been replaced and Table 1 has been removed.																				
062	Rockwell Collins, Inc.	Section 6 Table 1	Because section 7 also refers to Table-1, the Table-1 title should read "Software Life Cycle Data Applicable to Type Design or TSO-Authorization, by Software Level", instead of "Software Life Cycle Data Applicable to Type Design by Software Level".		Please consider this editorial correction in the AC.	Not accepted. Comment no longer applicable. Paragraph 6.c has been replaced and Table 1 has been removed.																				
063	FAAC	6	Different subsections of this section require different sets of data; the presentation is confusing.	Confusing presentation	It is clearer to state that all data needs to be produced.	Partially accepted. Paragraph 6.c has been replaced and Table 1 has been removed. This should remove the confusion.																				
	Final Text	Paragraph 6.c	<p>c. DO-178C, section 9.4, specifies the software life cycle data related to the type design of the certified product. However, not all of the specified data applies to all software levels. For the data specified in DO-178C, section 9.4, if it is not required in Table A2 or Table A-10 for a given software level, then it is not part of the type design data.</p> <p>Table 1 identifies the applicability of software life cycle data by software level, that are used, in part, to define the configuration and design features of the type-certified product as specified in Title 14, Code of Federal Regulations (14 CFR) 21.31.</p> <p>Table 1 - Software Life Cycle Data Applicable to Type Design by Software Level</p> <table border="1"> <thead> <tr> <th><i>Description</i></th> <th><i>DO-178C Reference</i></th> <th><i>Levels A, B, C</i></th> <th><i>Level D</i></th> </tr> </thead> <tbody> <tr> <td>Software Requirements Data</td> <td>11.9</td> <td>Applicable</td> <td>Applicable</td> </tr> <tr> <td>Design Description</td> <td>11.10</td> <td>Applicable</td> <td>Architecture Only</td> </tr> <tr> <td>Source Code</td> <td>11.11</td> <td>Applicable</td> <td>Not applicable</td> </tr> <tr> <td>Executable Object Code</td> <td>11.12</td> <td>Applicable</td> <td>Applicable</td> </tr> </tbody> </table>				<i>Description</i>	<i>DO-178C Reference</i>	<i>Levels A, B, C</i>	<i>Level D</i>	Software Requirements Data	11.9	Applicable	Applicable	Design Description	11.10	Applicable	Architecture Only	Source Code	11.11	Applicable	Not applicable	Executable Object Code	11.12	Applicable	Applicable
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	Original Proposed Text	Paragraph 6.d	d. You should make available to us any of the data described in section 11 of DO-178C, applicable tool qualification data, data outputs from any applicable supplements, and any other data needed to substantiate satisfaction of all applicable objectives. We may perform our review of the data at any location we deem necessary.			
064	Greg Turgeon	Page 3 Para 6.d	The intent of this paragraph is not clear. If the intent is that the applicant must make all the lifecycle data available to the FAA at the FAA facility, then it should be stated more explicitly. If the intent is that the review may be conducted at the applicants suppliers, then this should be explicit.	Ensure that intent is clear.	We may perform our review of the data at any location we deem necessary, including applicant facilities or supplier facilities.	Not Accepted. Comment no longer applicable. The offending sentence has been removed.
065	Green Hills Software	Page 3 6.d last sentence	The statement “We may perform our review of the data at any location we deem necessary.” does not seem appropriate for inclusion in this AC.	Topic of the AC is for defining acceptable means for showing compliance of the software. This sentence dictates an operational procedure that is intended to be followed by those responsible for determining compliance, rather than the applicant that is intending to show compliance. This sentence also can be interpreted such that a large additional compliance burden is placed on the applicant. For example, a reviewer may deem necessary that all data be reviewable at a FAA ACO facility. This may require the use of special tools, equipment, and licenses to host software that is required	Remove the entire sentence.	Accepted. The offending sentence has been removed.

No.	Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
				to view some data. Based on the AC, an FAA DER could make the same demands.		
066	FAAC	6	How soon after the plan submittal does the FAA inform the applicant whether or not there would be any involvement?	Unclear direction. We have the possibility of applicants not knowing whether or not a certification liaison is needed on a project.	Add a time limitation on the time period of wait after plans are submitted after which the applicant can assume that the FAA has chosen not to be involved in the project.	Not accepted. The applicant should treat a project the same regardless if he knows up front whether or not the FAA will be involved; the activities would remain the same regardless. Life cycle data is always subject to review by the certification authorities. A Partnership for Safety Plan (PSP) may establish agreement regarding FAA involvement.
067	FAAC	6b and d	While d states that ANY of the section 11 data should be made available in ANY location of FAA's choice -	This would mean that a lot of proprietary materials will be submitted to the FAA. This introduces a business risk to the applicants.	Clarify whether the FAA requires the submission to an FAA location or an applicant location. Clarify whether the delineation between what should be submitted vs. what should be made available has changed.	Partially accepted. Paragraph 6.b clearly states what data needs to be submitted by reference to the appropriate DO-178C and DO-330 sections. Also, the last sentence in paragraph 6.d has been removed.
	Final Text	Paragraph 6.d	<p>d. You should make available to us any of the data described in section 11 of DO-178C, section 11, applicable tool qualification data, data outputs from any applicable supplements, and any other data needed to substantiate satisfaction of all applicable objectives. We may perform our review of the data at any location we deem necessary.</p>			
	Original Proposed Text	Paragraph 7.	<p>7. Using DO-178C for TSO Authorization.</p> <p>a. Many FAA TSOs do not specify DO-178C for software assurance. For TSOs that specify a version prior to DO-178C, or do not specify any version of DO-178, we recommend that you use DO-178C. If you use DO-178C in lieu of the specified version, you should request a deviation in accordance with the requirements of 14 CFR part 21, subpart O. This type of deviation may be approved by the project ACO without Aircraft Engineering Division (AIR-100) coordination.</p>			
068	Honeywell ODA	Page 3 Paragraph 7	Paragraph recommends use of DO-178C on TSO projects. It does not contain a minimum standard for when DO-178C must be used. Recommend additional guidance for TSO	Eliminate potential confusion on AMOC for TSO projects.	For TSO projects, include guidance on when DO-178C must be used vs when previous versions of DO-178 can be	Not accepted. Each TSO specifies what version of DO-178 to use; therefore, we can only recommend that DO-178C be used.

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			projects, both new projects and projects which are modifying or re-using software developed to an earlier standard of DO-178. Would the criteria be different than a TC project?		used. This includes new TSO projects and TSO projects which are modifying or re-using software developed to an earlier standard of DO-178. If the criteria are the same as a TC project, consider removing section 7 and modifying TC-specific sections to be TC and TSO.	
069	GE Aviation Systems	Page 3 Section 7	Why should the applicant have to seek a deviation to use RTCA/DO-178C.? In addition according to Figure 1 in this AC there are circumstance in which this AC is telling the applicant they have to use RTCA/DO-178C.	If the FAA wants the applicant to use RTCA/DO-178C why not let the approval of the PSAC serve as the acceptance of RTCA/DO-178C. To put the burden on the applicant to seek a deviation might be enough of a reason for the applicant NOT to use RTCA/DO-178C.	Let the PSAC/planning documents serve as the deviation request and the subsequent approval of the PSAC/planning documents serve as the approval of the deviation.	Not accepted. For TSOA projects, the applicant is not required to obtain approval of the PSAC early in the development process. When a TSO states to use a particular standard, such as DO-178B for software development, then the applicant must apply for a deviation in accordance with § 21.618 if they want to use a different standard. This type of deviation can be approved by the ACO without AIR-100 coordination when the applicant requests to use DO-178C instead of DO-178B or earlier versions. Because it can be approved at the ACO level, it should not be a burden on the applicant or the ACO.
070	FAAC	7	This section has two cases – DO-178C and no specification of version of DO-178. If an FAA TSO does not specify DO-178 at all (previously the functions may not have been performed using software), does the applicant have to use DO-178 (any version) if using software?	Unclear.	Clarify that if the TSO applicant is using software to satisfy any of the TSO functionality DO-178C should be applied.	Not accepted. The paragraph addresses three cases: DO-178C, a version prior to DO-178C, and no version of DO-178(). The TSOA applicant can use the DO-178 version specified in the TSO. Most current TSOs specify DO-178B. We can only recommend that the software be developed using DO-178C. If the TSO

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						does not specify DO-178 at all, then the TSO applicant can meet the requirements of the TSO without using DO-178 for software development. However, since a TSO authorization is not an installation approval, the installer of the article will be required to show that their software development satisfies §2X.1301 and §2X.1309.
071	Green Hills Software	Page 3 7.a last sentence	The way the last sentence is phrased is ambiguous and could result in varied interpretations.	Improve the grammar.	Rephrase to “Coordination with the Aircraft Engineering Division (AIR-100) is not required in order for the project ACO to approve this type of deviation”. or “The project ACO may approve this type of deviation without Aircraft Engineering Division (AIR-100) coordination. “	Accepted.
072	Sikorsky Aircraft ODA	Pg 3 para 7a	Is the deviation mentioned in this paragraph necessary	Seems that, once this AC is finalized, DO-178C is mandated and there is no longer need to document a deviation Have implementers of TSOs calling out DO-178A had to get deviations for developing to DO-178B?	Delete requirement	Not accepted. Once published, AC 20-115C becomes an acceptable means of compliance and is not a mandatory requirement. The version of DO-178() that is specified by the TSO is what is required for TSO authorization. However, since a TSO authorization is not an installation approval, the installer of the article will be required to show that their software development satisfies §2X.1301 and §2X.1309. When a TSO states to use an earlier version of DO-178 for software development, then the applicant must

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						apply for a deviation in accordance with § 21.618 if they want to use a later version. Since a later version, such as DO-178C, is preferable, that type of deviation can be approved by the ACO without involving AIR-100.
073	Eurocopter	Page 3 (§ 7.a)	<p>Although the text recommends the use of DO-178C for TSOs, this still appears as an option, and even as a deviation.</p> <p>Moreover, as far as we know, there is no enforcement of AC 20-115 in the TSO specifications.</p>	<p>A significant gap will be introduced with EASA CS-ETSO, where subpart A specifies as AMC for software the use of the last version of AMC 20-115.</p> <p>TC applicants willing to integrate a COTS US TSOA equipment where software is developed using previous versions of DO-178 may face difficulties.</p>	FAA should find a solution to make the last issue of DO-178 the standard AMC for TSOA, either by specifying DO-178C or by specifying the use of the last issue of AC 20-115.	Not accepted. Each TSO specifies the version of DO-178() to be used. DO-178C can be used and we recommend it. We do not have a guidance document that makes a blanket statement that applies to all TSOs.
074	FAAC	3,7a	Same as comment above on section 2. Wording should be strengthened to make it clear that TSO articles that include SW should apply DO-178C.	See comment on section 2	As noted.	Not accepted. Although use of DO-178C is preferable, we cannot force its use on TSO applicants, especially when the TSO specifies a different version.
	Final Text	Paragraph 7	<p>a.b. Many FAA TSOs do not specify DO-178C for software assurance. For TSOs that specify a version prior to DO-178C, or do not specify any version of DO-178, we recommend that you use DO-178C. If you use DO-178C in lieu of the a specified <u>earlier</u> version, you should request a deviation in accordance with the requirements of 14 CFR part 21, subpart O. This type of deviation may be approved by the project ACO <u>may approve this type of deviation</u> without Aircraft Engineering Division (AIR-100) coordination.</p>			
	Original Proposed Text	Paragraph 7.b.	<p>b. For TSO authorization, table 1 identifies the software life cycle data that are used to satisfy § 21.616 for design data necessary to determine conformity.</p>			
075	Randall Fulton	Page 3-7.b	Reference to Table 1 should be Capitalized.	Reference to <i>table</i> 1 should be Table 1 to match the table label.	Capitalize “Table 1”	Not accepted. Comment no longer applicable. Paragraph 7.b and Table 1 have been removed.

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076	Garmin	Page 3, 7.b.	For the purposes of establishing conformity prior to TSOA, the data in Table 1 may not be available in its final (TSOA) configuration.	Often in the TC and TSOA process, preliminary TSOA software will be used in “for-credit” testing prior to the TSOA. The TSOA release of SAS, SCID and exact Executable Object Code will not be available yet the software will have been conformed per 8110.49, Chapter 4.	Add a sentence to b. “For the purposes of testing for certification credit prior to receipt of TSOA, software lifecycle data of Table 1, with maturity appropriate to the credit being sought, should be used to determine conformity.”	Not accepted. Comment no longer applicable. Paragraph 7.b and Table 1 have been removed.
	Final Text	Paragraph 7.b	b. For TSO authorization, table 1 identifies the software life cycle data that are used to satisfy § 21.616 for design data necessary to determine conformity.			
	Original Proposed Text	Paragraph 7.c.	c. Requirements for submitting life cycle data for TSO authorization are stated in each applicable TSO.			
077	Green Hills Software	Page 3 7.c	Use of the term “life cycle data” may be inconsistent with terminology used in a TSO, especially a TSO that does not discuss software.	Improve consistent use of the terminology. Paragraph 7.b already establishes that life cycle data will be used for design data.	In 7.c, change “life cycle data” to “design data”.	Partially accepted. Recent TSOs state “...the appropriate documentation defined in RTCA/DO-178B including all data supporting the applicable objectives...” Therefore, “life cycle data” has been changed to “software documentation.”
078	Avidyne Corporation	Page 3 Paragraph 7c	I don’t see any reason not to standardize TSO data submittal requirements. Since none of them are currently written with respect to DO-178C, they are all out of date.	Standardization promotes simplicity of handling for both applicant and FAA and a uniform compliance approach.	Change Paragraph 7c to reflect current FAA policy relating to TSO data.	Not accepted. Each TSO specifies what data needs to be submitted. More recent TSOs are standardized, and Order 8150.1C, Appendix G, describes the software data submittal requirements to be incorporated in new TSOs. However, older TSOs do not always get revised to the latest requirements. There is no blanket policy that overrides what is stated in each TSO regarding data submittal.
	Final Text	Paragraph 7.c	e. a. Requirements for submitting life cycle data <u>software documentation</u> for TSO authorization are stated in each applicable TSO.			

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	Original Proposed Text	Paragraph 8	8. Use of Supplements. Supplements add, delete, or modify objectives, activities, and life cycle data in DO-178C and therefore should be used only in conjunction with DO-178C. The supplements are not to be used separately or with versions prior to DO-178C. DO-331, DO-332 and DO-333 address issues related to the use of certain software development techniques.			
079	GE Aviation	8	It states that The supplements are not to be used separately or with versions prior to DO-178C. Why isn't it acceptable to apply DO-330 on tool qual to DO-178B?	DO-330 addresses vague areas of DO-178B. Furthermore, it is not classified as a supplement, but stand-alone guidance.	Permit use of DO-330 on programs with a cert basis of DO-178B or even DO-178A.	Not accepted. However, although we don't explicitly state it in the AC, an applicant can propose to use DO-330 as an alternative for tool qualification on a DO-178B project.
080	Honeywell ODA	Page 4, Paragraph 8.	Not clear why the supplements can't be used with earlier version of DO178 if applicant wishes to do so.	A legacy DO178B system could only be enhanced by the guidance of DO-330 for Tool Qualification.	Would mention that full credit will not be given for DO178C if supplements are utilized with earlier versions. This would be an AMOC that would need coordination with the certifying authority.	Not accepted. Supplements (DO-331, DO-332, DO-333) add, delete, or modify objectives, activities, and life cycle data in DO-178C. They specifically address DO-178C and therefore should be used only in conjunction with DO-178C. An applicant may propose to use a supplement with DO-178B, and show how they will map to the DO-178B objectives, but seems like a lot of additional work. DO-330 is not a supplement and therefore Paragraph 8 does not apply to DO-330. An applicant can always propose to use DO-330 with DO-178B.
081	Greg Turgeon	Page 4 Para 8	Clarify supplements only needed if the specified technology is used.	Clarify that supplements are not always required.	Supplements add, delete, or modify objectives, activities, and life cycle data in DO-178C and therefore should be used only in conjunction with DO-178C when the specified software technology is used.	Accepted, but restated as "You should apply the guidance within a particular supplement when you use the addressed technique."
082	FAAC	8	This section prevents an applicant from using the supplements when DO-178C is not being used. There is also a statement in section 5 to state that if DO-178B is proposed, the FAA	Apparently contradictory statements	Clarify.	Some applicants have established their processes in a manner that satisfies certain issue papers, such as OOT. Forcing applicants to change their processes to

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			will include project specific issue papers. Project specific issue papers on the topics within supplements have not been as elaborate as the supplements. Does the FAA intend to use these supplements as issue papers?			coincide with any particular supplement with no increase in safety benefit would be inappropriate. The FAA does not intend to use supplements as issue papers. Also, issue papers have been used to address topics that are not covered in supplements, but are addressed in DO-178C, such as supplier control.
	Final Text	Paragraph 8	<p>8. Use of Supplements. DO-331, DO-332 and DO-333 address issues related to the use of certain software development techniques. Supplements add, delete, or modify objectives, activities, and life cycle data in DO-178C. and therefore should be used only in conjunction with DO- You should apply the guidance within a particular supplement when you use the addressed technique. Your Plan for Software Aspects of Certification (PSAC) should identify which supplements apply and describe how you intend to use each applicable supplement. You cannot use supplements as stand-alone documents. The supplements are not to be used separately or with versions prior to DO-178C. DO-331, DO-332 and DO-333 address issues related to the use of certain software development techniques.</p>			
	Original Proposed Text	Paragraph 8.a.	<p>a. When multiple software development strategies are used together, more than one DO-178C supplement may apply. When using multiple supplements, your Plan for Software Aspects of Certification (PSAC) should describe:</p> <p>(1) How DO-178C and the supplements will be applied together.</p> <p>(2) How the applicable DO-178C objectives and those added or modified by the supplements will be applied, which objectives apply to which software components, and how all applicable objectives will be satisfied.</p>			
083	EASA	§8.a	Sentence "... When using multiple supplements, your PSAC should describe:...", seems to exclude the need for a description when a single supplement is applied.	Even when only one supplement is applied, it is deemed necessary to describe its use in the PSAC (for instance to address a combination of DO-178C + DO-332).	Could you please consider also making this paragraph applicable when only one supplement is used?	Accepted. Paragraph 8.a applies to multiple supplements. The recommendation was added to paragraph 8.
084	Green Hills Software	Page 4 8.a	Paragraph should state that each PSAC should state the applicability of each supplement, regardless of whether it is being used or not.	When a PSAC is silent on the subject of a supplement, it cannot be determined whether the silence means the supplement is truly not applicable or just represents that the project did not look at or consider the supplements as part of their planning efforts (or choose not to mention them).	In 8.a, after the 1st sentence, add "The PSAC should describe the applicability of each supplement."	Partially accepted. Paragraph 8.a applies to multiple supplements. The recommendation for addressing in the PSAC was added to paragraph 8; however, we do not agree that it is necessary to address supplements that are not used. The resulting text is: "Your Plan for Software Aspects of Certification

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						(PSAC) should identify which supplements apply and describe how you intend to use each applicable supplement.”
085	Garmin	Page 4, 8.a.	Use of word “strategies” introduces a new term.	Strive for consistency of terms.	Change “strategies” to “techniques”; e.g. “...software development techniques are used	Accepted.
086	Garmin	Page 4, 8.a.(2)	Need to make it clear that this guidance requires the “how” in objective satisfaction via a description of the activities.	DO-178C places emphasis on the activities associated with complying with the objectives. Thus the word “activities” should be used versus “how all applicable objectives will be satisfied.”	Change to “...to which software components, and the activities used to satisfy all applicable objectives.”	Partially accepted. Changed to: “...and how your planned activities will satisfy all applicable objectives.”
087	FAAC	4,8a	Although it is generally understood that packaging of data is left to the discretion of the Applicant, the use of multiple supplements has the potential to greatly complicate the review and approval of such data by the FAA or its designees. It would seem appropriate to include a caution on this topic.	Increase the value of the AC by proactively addressing an issue that could increase regulatory complexity.	Suggest adding something like the following as an item 8a(3): “How data items will be combined or structured to ensure all of the information required by each of the supplements is fully and consistently addressed by the data when viewed in the aggregate.”	Not accepted. Paragraph 8.a.(2) covers it adequately.
	Final Text	Paragraph 8.a	<p>a. When If you intend to use multiple software development techniques strategies are used together, more than one DO-178C supplement may apply. When using multiple supplements, your Plan for Software Aspects of Certification (PSAC) PSAC should describe:</p> <p>(1) How you will apply DO-178C and the supplements will be applied together.</p> <p>(2) How you will address the applicable DO-178C objectives and those added or modified by the supplements will be applied, which objectives apply to which software components, and how your planned activities will satisfy all applicable objectives will be satisfied.</p>			
	Original Proposed	Paragraph 8.b.	<p>b. If a software tool is implemented or verified using a technology addressed by a recognized DO-178C supplement, apply that supplement to the qualification of the tool. If multiple technologies are used, use the applicable supplements. Your PSAC should describe:</p>			

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	Text		<p>(1) How DO-330 and the supplements used will be applied together.</p> <p>(2) How the applicable DO-330 objectives and those added or modified by the supplements will be applied, which objectives apply to which components of each software tool, and how all applicable objectives will be satisfied.</p>			
088	FAAC	4,8b	We are increasingly encountering very long and complex tool chains where the output of one tool is consumed immediately by another without human intervention/review. This paragraph addresses tools individually. Would like to see at least some statement that requires applicants to document any tool chains and show how DO-330 compliance is obtained in the presence of such chains.	Reflect current industry practice.	Suggest adding something like the following as an item 8b(3): “How the DO-330 objectives will be satisfied for any tools used in sequence (e.g., tool chaining).”	Not accepted. Already covered in DO-178C, section 4.4.1.d.
089	Honeywell ODA	Page 4, 8.b	The text suggests including information in the PSAC but does not mention the Tool Qualification Plan	When supplements are applied to a tool, it would be better to describe this in the Tool Qualification Plan, unless a TQP was not generated.	Change last sentence to read: “Your PSAC or Tool Qualification Plan should describe:”	Partially accepted. Revised to: “Your Tool Qualification Plan should describe:”
090	Rockwell Collins, Inc.	8.b.	This section declares that if a software tool is implemented or verified using a technology addressed by a recognized DO-178C supplement, that supplement must be applied. This makes sense for development tools, but for verification tools (which are often COTS), applicants often do not have visibility to what design methods were applied by the developer.		Exempt verification tools from the requirements of 8.b. Alternatively, state in the AC that for verification tools, DO-330 should be used.	Accepted for TQL 5 only. Revised paragraph b. to: “If you intend to use any techniques addressed by the supplements to satisfy the DO-330 objectives, then you should use the applicable supplements for those objectives (TQL 1-4 only).”
091	THALES Avionics	8.b	DO178C supplements (DO331, 332, 333) are not suitable for DO330.	DO 178C supplements (DO331, DO332, DO333) have been built to be used only with DO 178C.	Suppress this paragraph	Not accepted. Although the supplements do not map directly to DO-330 like DO-178C, the applicant still needs to use the applicable supplement guidance when qualifying to DO-330. The applicant will need to describe how they will apply the guidance for tool qual.

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092	Airbus SAS	§8 Use of Supplement s proviso b.	Add at the end of §8B: This above applies to tools at TQL 1, 2, 3, or 4.	For tools at Tool Qualification Level TQL5 DO-330 does not require an applicant to describe the process or methods used to develop the tool. Therefore this item should mention that it applies only to tools at TQL 1, 2, 3, or 4.		Accepted. Revised paragraph b. to apply to TQL 1-4 only.
093	Airbus SAS	§8 Use of Supplement s proviso b.	Replace the sentence “Your PSAC should describe By “The TQP applicable to the tool should describe”.	For tools at TQL 1, 2, 3, or 4 DO-330 requires the Tool Qualification Plan to describe the tool qualification process including any additional consideration.		Accepted.
094	Pratt & Whitney Aircraft	8b	You have “If a software tool is implemented or verified using a technology addressed by a recognized DO-178C supplement, apply that supplement to the qualification of the tool.” The sentence is not clear.	Not Clear	Did you mean... “If a software tool is implemented or verified using a technology addressed by a recognized DO-178C supplement, apply the DO-330 supplement to the qualification of the tool.”	Accepted. Revised text to: “If you intend to use any techniques addressed by the supplements to satisfy the DO-330 objectives, then you should use the applicable supplements for those objectives (TQL 1-4 only).”
095	Garmin	Page 4, 8.b.(2)	Need to make it clear that this guidance requires the “how” in objective satisfaction via a description of the activities.	DO-178C places emphasis on the activities associated with complying with the objectives. Thus the word “activities” should be used versus “how all applicable objectives will be satisfied.”	Change to “...to which components of each software tool, and the activities used to satisfy all applicable objectives.”	Accepted. Revised text to: “...and how the planned activities will satisfy all applicable objectives.”
096	Embraer	Section 8 - items b), c) and d); page 4	The items b), c) and d) provide some considerations to the use of supplements DO-330, DO-331 and DO-332, respectively.	However, there is no reference to the Formal Methods supplement (DO-333).		As of the writing of the draft AC 20-115C, we have no concerns regarding DO-333 to address in paragraph 8.

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	Final Text	Paragraph 8.b	<p>b. If a software tool is implemented or verified using a technology addressed by a recognized DO-178C supplement, apply that supplement to the qualification of the tool. If multiple technologies are used, use the applicable supplements. If you intend to use any techniques addressed by the supplements to satisfy the DO-330 objectives, then you should use the applicable supplements for those objectives (tool qualification levels (TQLs) 1, 2, 3, and 4 only). Your PSAC Tool Qualification Plan should describe:</p> <p>(1) How <u>you will apply</u> DO-330 and the supplements <u>guidance to the tool development or verification.</u> used will be applied together</p> <p>(2) How <u>you will address</u> the applicable DO-330 objectives and those added or modified by the supplements, will be applied which objectives apply to which components of each software tool, and <u>how the planned activities will satisfy</u> all applicable objectives. will be satisfied.</p>			
	Original Proposed Text	Paragraph 8.c.	<p>c. When applying DO-331, you cannot use model simulation to satisfy review and analysis objectives as described in section MB.6.8.1, unless you show that errors detected by simulation would include all errors that could be detected by review and analysis. You should also identify which objectives you propose to satisfy using model simulation.</p>			
097	Airbus SAS	§8 Use of Supplement s proviso c.	<p>Delete this paragraph.</p>	<p>DO-331 already defines those objectives when an applicant plans to use simulation for verification of a model.</p> <p>Therefore there is no need for rewording objectives which have already been accepted by the whole DO-178C committee.</p>	Delete this paragraph.	<p>Not accepted. There is no difference between running test cases in the simulated environment or the target environment. The FAA has not allowed target testing to substitute for reviews in the core document and therefore we should not allow it to be done in DO-331. The wording was expanded to include any kind of testing not just simulation with justification. We acknowledge that testing and reviews/analysis techniques will detect a significant portion of the same errors. Likewise there are errors only detected by each of the specific techniques. During the original FAA deliberations, the guidance allowed no credit so as to be consistent with DO-178C core document. This was relaxed to allow an applicant to provide a supporting argument to establish the replacement of review/analysis credit with simulation or testing. While it now reads similar to</p>

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						wording in DO-331, there is a significant difference. The wording in the advisory circular concentrates supplying justification for errors rather than objectives.
098	Goodrich Pump & Engine Control Systems	Page 4; para 8c	Paragraph is too restrictive and does not allow to partial credit of the objective via simulation. Fully agree that complete achievement of the objective requires a complete proof that simulation covers this 100%. The most likely industry scenario is that simulation will support reviews and analysis but not replace it.	There is strong value to simulation for proving correctness of requirements even if not all aspects of correctness can be fully achieved. We do not want to discourage partial coverage via simulation. If we discourage it then it will not become a reviewable artifact and thus may be done with less rigor. We want to encourage companies to seek partial credit versus no credit since partial credit will create the desired industry behavior to use simulation to validate/verify requirements and to help assure that requirements are complete and correct (even if this needs to be supported by other analysis activity). Note that Model Coverage Analysis must be defined by the applicant and they must show that the complete set of tasks will achieve compliance with the objectives.	Change to read as follows (italic/underlined word added): c. When applying DO-331, you cannot use model simulation to <i>fully</i> satisfy review and analysis objectives as described in section MB.6.8.1, unless you show that errors detected by simulation would include all errors that could be detected by review and analysis. You should also identify which objectives you propose to satisfy using model simulation.	Accepted. The paragraph has been completely rewritten and addresses your concern.
099	Randall Fulton	Page 4-8.c.			Recommend including a note that the simulation tool(s) should be assessed for qualification as a verification tool.	Not accepted. The tool qualification criteria in DO-178C 12.2 (DO-331 MB.12 is basically the same) is sufficient to ensure that simulation tools used as part of the MBD process will have to be evaluated.

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100	Esterel Technologies	Page 4, §8, bullet c	<p>The current text is: “c. When applying DO-331, you cannot use model simulation to satisfy review and analysis objectives as described in section MB.6.8.1, unless you show that errors detected by simulation would include all errors that could be detected by review and analysis. You should also identify which objectives you propose to satisfy using model simulation.”</p> <p>The current text might be understood as only allowing simulation if it would be able to detect all errors for all requirements and all objectives. This is not possible, and was presumably not the intended meaning of that text.</p>	<p>There is general consensus that simulation cannot detect all errors and cannot eliminate the need for review. It also shown by experience that simulation is an efficient means for supporting certain aspects of verification such as algorithms accuracy or compliance to requirements including time aspects, some of which may be difficult to assess by review. If the first sentence would be understood as “show that errors detected by simulation would include ALL errors for ALL objectives and ALL requirements, then this is likely to exclude the use of simulation in practice.</p>	<p>Require the applicant to provide evidence that he planned and executed a verification strategy with a complete and consistent set of verification techniques (review, analysis, simulation) addressing all verification objectives and all requirements, detecting all errors that would be detected by review only.</p> <p>Note that different sets of requirements and/or objectives may be verified with different techniques, depending on their characteristics (e.g. logic, filtering) as far as complete and accurate verification is achieved.</p>	<p>Accepted. The original wording was in error. The wording was modified to ensure that the applicant would have to show that all the errors that would be covered by simulation and reviews/analysis would be covered by simulation and the reduced set of reviews/analysis.</p>
101	Pratt & Whitney Aircraft	8c	<p>You have “c. When applying DO-331, you cannot use model simulation to satisfy review and analysis objectives as described in section MB.6.8.1, unless you show that errors detected by simulation would include all errors that could be detected by review and analysis. You should also identify which objectives you propose to satisfy using model simulation.”</p> <p>DO-331 already handles this at the ‘objective’ level with the statement... “Justify in detail, how that simulation activity</p>	<p>The AC request for this level of error detection (all errors that could be detected by review and analysis) with simulation is not practically achievable (just as many other DO-178B activities do not achieve similar levels of error detection) The DO (section 6.8.1b) already covers the AC’s concern by the text that was specifically written by the committee to achieve the use of simulation for reviews / analysis under the condition of having to show the simulation activity satisfies the</p>	<p>Delete paragraph 8c of the AC</p>	<p>Not accepted. The tool qualification criteria in DO-178C 12.2 (DO-331 MB.12 is basically the same) is sufficient to ensure that simulation tools used as part of the MBD process will have to be evaluated.</p>

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			completely satisfies the specific review or analysis objectives”	review/analysis objectives. Satisfaction of the objectives should be all that is necessary for an acceptable means of compliance.		
102	GE Aviation Systems	Page 4, section 8.c.	Section 8.c is at odds with EASA who in the past have actively encouraged us to use simulation as one of the techniques (in addition to review of the model) to satisfy objective A-4.1 (Low-level requirements comply with high-level requirements).	In fact EASA refused to approve the SWA display SDP/SVP/PSAC unless we added in Simulation. The FAA position seems to be that we can only use simulation if we can satisfy that it is at least as good as review.	It would be good to get harmonization of the two positions.	Partially accepted. We agree that it would be good for all certification authorities to agree on a coordinated position. However there are some technical difficulties with approach as worded in DO-331. Some changes were made to the wording that will put us closer to harmonization.
103	TCCA	Page 4 para 8 c	<p>COMMENT: The text appears to ignore the content of section 6.8.1 of DO-331, and to discourage the use of simulation, while simulation, if used with a structured approach, may provide model validation against the (dynamic) aspects of the design intent in a way that static reviews and analysis may not achieved sufficiently.</p> <p>Section 6.8.1 of the supplement addresses potential concerns that the use of simulation may be used in lieu of reviews and analysis in an inappropriate way: section 6.8.1 of DO-331 makes it clear that if simulation is use for credit, the applicant should “determine what review and analyses objective are planned to be better achieved by simulation; all other objectives should be satisfied by reviews and analyses as described in section MB 6.3” [which essentially the same as DO-178C 6.3].</p>	<p>REASON: Simulation is very widespread and is an intrinsic and value-added part of MBD life-cycles. DO-331 provides a structured approach when simulation is justified as a means to contribute to design assurance.</p>	Remove the first sentence of para 8 c.	Not accepted. The tool qualification criteria in DO-178C 12.2 (DO-331 MB.12 is basically the same) is sufficient to ensure that simulation tools used as part of the MBD process will have to be evaluated.

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			Equally important, section MB 6.8.1 goes on to say the applicant should “justify, in detail, how that simulation activity completely satisfies the specific review or analysis objectives”. DO-331 encourages disciplined use of simulation (e.g. use of requirement based test cases and procedures).			
104	EASA	§8.c	Understanding of the applicability of sentence “... You should also identify which objectives you propose to satisfy using model simulation.” may be not totally clear.	It might be obvious, but it is not totally certain if the sentence is solely applicable to §6.8.1 or if the applicability is wider.	Could you please clarify whether this sentence is only applicable to the §6.8.1 objectives?	Accepted. The paragraph has been completely rewritten and addresses your concern.
105	Honeywell ODA	Page 4, 8. c.	AC does not clarify ambiguity of what models DO-331 “addresses”	MB.1.0. Exactly what “this supplement addresses” is ambiguous due to the unclear meaning of “used for direct analysis or behavioral evaluation”. Without clarification, supplement could be interpreted such that SRATS artifacts manually drawn on a drafting board could be considered models “this supplement addresses”.	AC should clarify ambiguity of what models DO-331 “addresses” For example: A Software Process artifact will only be classified as a DO-331 model if it is (or could be) directly used in any of the following: <ul style="list-style-type: none"> • computer automated code generation from the artifact • computer aided behavioral evaluation (simulation) of the artifact • computer aided analysis of the artifact • computer automated test generation from the artifact 	Partially accepted. In the interest of harmonization, we, in coordination with other certification authorities, clarified that it applies to models used for the development of software.

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106	Honeywell ODA	Page 4, 8. c.	AC does not clarify DO-331 MB.1.6.1 statement, “Requirements from which the model is developed should be external to the model.”	Without clarification old CRI’s and IP’s could cloud interpretations such that guidance could be interpreted such that “requirements from which the [specification] model is developed” could be required to be NOT a model	AC should clarify DO-331 MB.1.6.1 statement, “Requirements from which the model is developed should be external to the model”. For example, “External” means separate files; separate artifacts.	Not accepted. While this is a good point, the intent of DO-331 is that you cannot have a model above a specification model.
107	Honeywell ODA	Page 4, 8. c.	AC does not clarify DO-331 MB.1.6.2 statement, “It [Specification Model] should only contain detail that contributes to this understanding ...”	Without clarification MB.1.6.2 statement appears to be incongruent with objective MB.5.1.1.c which states, “In the case where high-level requirements are expressed by a Specification Model, all model elements that do not represent software requirements and are not inputs to a subsequent software development process or activity are identified, for example, a comment block.”	AC should clarify DO-331 MB.1.6.2 statement, “It should only contain detail that contributes to this understanding ...”. Recommend “contain” should be interpreted as “specify” such that details that do not contribute can be in a Specification Model as long as they are identified as elements that are not software requirements per MB.5.1.1.c.	Not accepted. Comment blocks can contribute to the understanding. The goal of this paragraph is to ensure that design details are excluded from the specification model.
108	Honeywell ODA	Page 4, 8. c.	AC does not address consequences of System-Software processes overlap allowed by DO-331	DO-331 allows for the overlap of System and Software processes (see MB.B.17.7 Example E and MB.B.17.4 Example B) Problems arise when those with only software engineering expertise are asked to review/evaluate allocations, decompositions, and/or tracings that were generated based upon systems (thermodynamics, feedback control theory) expertise. Software processes are familiar with input requirements (SRATS) that are for	AC should address the consequences of DO-331 allowing for System-Software processes overlap.	Not accepted. The commenter is correct. However the scope is too large and will have to be dealt with an update to the AC or in some other way as this attacks one of the core principles of DO-331.

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				the software item and only the software item. System processes are familiar with System Requirements which are satisfied/implemented by multiple Items, many of which are not software. Implication: If the Software processes move into and overlap with the system processes there would likely be cases where software processes would have to deal with input requirements which are not wholly satisfied/implemented by only software items.		
109	Honeywell ODA	Page 4, 8 c.	DO-331 does not make it clear if a specification model is developed within the systems process that the objectives MbA-3 objectives 1 and 6, and MbC-3 objectives 1 and 6 are implicitly satisfied but it does make it clear for a design model	If it is implicitly satisfied for a design model it should also be implicitly satisfied for a specification model	Add: "When applying DO-331, if a specification model is developed within the systems process the objectives MbA-3 objectives 1 and 6, and MbC-3 objectives 1 and 6 are implicitly satisfied."	Not accepted. While we agree that this is a problem, it is at a too detailed level for this AC. We will take this under advisement for other guidance vehicles or training.
110	Garmin	Page 4, 8.c. and 8.d.	Do these paragraphs apply to tools also?	Paragraph 8 b. is directed specifically at the use of supplements in tool development. If this is the only paragraph of 8. that applies to tools then perhaps it should be the last paragraph.	Either include tools in the text of 8.c. and 8.d. or move paragraph 8.b. to the end of paragraph 8.	Not accepted. Whatever guidance applies to a particular supplement would also apply to the supplement within the context of tools, regardless of where it is located in the AC.

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	Final Text	Paragraph 8.c	<p>e. When applying DO-331, you cannot use model simulation to satisfy review and analysis objectives as described in section MB.6.8.1, unless you show that errors detected by simulation would include all errors that could be detected by review and analysis. You should also identify which objectives you propose to satisfy using model simulation.</p> <p><u>c. If you are using models as defined in DO-331, section MB.1.0, as the basis for developing software, you should apply the guidance in DO-331.</u></p> <p><u>(1) Section MB.6.8.1 identifies certain objectives and describes the activities for using model simulation to satisfy those objectives. When applying section MB.6.8.1:</u></p> <p><u>(a) You should identify which of the objectives you propose to satisfy using model simulation.</u></p> <p><u>(b) If you propose to use model simulation in combination with reviews and analysis to satisfy the objectives in MB.6.8.1, you should show that the errors detected include all errors that could be detected by reviews and analysis alone.</u></p> <p><u>(2) Section MB.6.8.2 identifies certain objectives relating to verification of the Executable Object Code and describes the activities for using model simulation to satisfy those objectives. When applying section MB.6.8.2:</u></p> <p><u>(a) You should identify which of the objectives you propose to satisfy using model simulation.</u></p> <p><u>(b) If you propose to use model simulation in combination with testing to satisfy the objectives in MB.6.8.2, you should show that the errors detected include all errors that could be detected by testing on the target platform alone.</u></p>			
	New paragraph added	New paragraph 8.d.	<p><u>d. The same approach to obtaining credit described in paragraph 8.c. can also be applied to simulation or testing used in non-model based development environments.</u></p>			
	Original Proposed Text	Paragraph 8.d.	<p>d. DO-332, Annex OO.D.2, identifies and provides recommendations for related techniques that may apply to any software development, even when object oriented technology is not used. Determine if any of the related techniques are used in your project and implement the recommendations as applicable.</p>			
111	Greg Millican	Page 4-8.d	<p>The paragraph states “Annex OO.D.2, identifies and provides recommendations for related techniques...”</p>	<p>Problem: Section OO.1.4.c states “Annex OO.D of this supplement describes vulnerabilities associated with OOT&RT, as well as supporting information for activities of sections OO.4 through OO.12.” The guidance is in sections OO.4 through OO.12 for OOT&RT, not Annex OO.D. Annex OO.D is a vulnerabilities discussion to be used when working on the guidance section OO.11.1.i “Consideration of</p>	<p>Solution, rewrite 8.d: DO-332, Section OO.11.1.i provides guidance for consideration of OOT&RT in the PSAC for related techniques that may apply to any software development, even when object oriented technology is not used. Determine if any of the related techniques are used in your</p>	<p>Not accepted. Section OO.11.1.i addresses considerations in the PSAC. Our intent is to bring attention to the information in OO.D on related techniques and not impose additional requirements. The referenced section has been changed to OO.D.1.2-OO.D.1.7.</p>

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				OOT&RT features”, specifically the PSAC.	project and implement the recommendations as applicable.	
112	Green Hills Software	Page 4, 8.d	Potential typo.	Should reference to Appendix “OO.D.2” be “OO.D.1” (Key Features and Related Techniques). The AC text discusses related techniques, but the referenced section does not.	If it is a typo, fix it.	Accepted. The referenced section has been changed to OO.D.1.2-OO.D.1.7 since OO.D.1.1, Inheritance, is not included in the list of related techniques referenced in OO.1.2, Scope.
113	Garmin	Page 4, 8.d	The paragraph states: “DO-332, Annex OO.D.2, identifies and provides recommendations for related techniques that may apply to any software development, even when object oriented technology is not used. Determine if any of the related techniques are used in your project and implement the recommendations as applicable.”	DO-332, Annex OO.D.2 includes “related techniques” like Type Conversion and Dynamic Memory Management, which are common techniques predating even DO-178B. Garmin is not aware of any issue papers applied to use of such techniques for languages such as C but only when used with Object-Oriented languages such as C++ and Ada. Consequently, it seems unnecessary to require projects that do not use OOT to be required to add overhead to their projects to address DO-332 for techniques that have not been shown to be “inadequate” per paragraph 5 even in the context of the paragraph 8 limitation that “The supplements are not to be used separately or with versions prior to DO-178C.”	Exclude Type Conversion and Dynamic Memory Management unless the project also uses OOT.	Partially accepted. Paragraph 8.d. has been revised to bring attention to the related techniques addressed in OO.D.1.2-OO.D.1.7. without imposing additional requirements outside of OOT. The paragraph states “...you may benefit from design practices identified in the related techniques sections of DO-332.”
114	Pratt & Whitney Aircraft	8d	You have “DO-332, Annex OO.D.2, identifies and provides recommendations for related techniques that may apply to any software	‘Related techniques may not be effectively applied to non-OO applications. It will be subjective and	Delete paragraph 8d of the AC	Not accepted. Paragraph 8.d. has been revised to bring attention to the related techniques addressed in OO.D.1.2-

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			<p>development, even when object oriented technology is not used. Determine if any of the related techniques are used in your project and implement the recommendations as applicable.”</p> <p>The use of ‘related techniques’ to non-OO is beyond the scope of DO-332’s intent and the intent of the SC205/WG71 committee</p>	<p>will vary depending upon the expertise of the ACO and applicant.</p> <p>SC205/WG71 tried to take the DO-332 related techniques and move them into DO-178C to gain consensus. We discovered by a large margin that these techniques could not gain consensus in the SCWG membership, due to interpretation problems and other factors that could possible contradict other portions of DO-178C. We agreed that these items could be called out separately in DO-332 only because they can be generic in nature.</p> <p>I believe calling out the use of these related techniques in this AC will cause inconsistent application of these techniques and confusion as to what should be done to handle these techniques in non-OO approaches.</p>		<p>OO.D.1.7. without imposing additional requirements outside of OOT. The paragraph states “...you may benefit from design practices identified in the related techniques sections of DO-332.” This treats it more like an FAQ.</p>
115	Boeing	Page 4 para 8d	The current wording basically turns related techniques into objectives.	<ol style="list-style-type: none"> 1. OOT SG proposed making these part of the core document but plenary sound defeated the proposal. This paragraphs wording effectively ignores this. 2. These are good practices. But there are hundreds of others further removed from OOT that should receive equal footing in the Core document. 	<p>1st recommendation. Remove the paragraph.</p> <p>2nd recommendation Change the paragraph as follows d. DO-332, Annex OO.D.2, identifies <i>some good design practices that may have some benefit outside of DO-332.</i></p>	Accepted. Paragraph 8.d. has been revised to bring attention to the related techniques addressed in OO.D.1.2-OO.D.1.7. without imposing additional requirements outside of OOT. The paragraph states “...you may benefit from design practices identified in the related techniques sections of DO-332.”

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116	Sikorsky Aircraft ODA	Pg 4, para 8d	Wording in this paragraph seems to mandate DO-332 regardless of use of object oriented technology	DO-332 section OO.1.1 defines the 'related techniques' this para is referring to. So I don't think it's as broad a requirement as it appears. It seems that if the developer uses any of the techniques listed in DO-332 (non-OOT specific techniques included) this supplement is required. The supplement itself as written may be adding to the confusion.	Please clarify if that is the intent, if not, delete	Accepted. Clarified. Paragraph 8.d. has been revised to bring attention to the related techniques addressed in OO.D.1.2-OO.D.1.7. without imposing additional requirements outside of OOT. The paragraph states "...you may benefit from design practices identified in the related techniques sections of DO-332." This treats it more like an FAQ.
117	Avidyne Corporation	Page 4 Paragraph 8.d	DO-332 Annex OO.D.2 is not intended to expand the scope of the Supplement to apply to all software development, irrespective of the development techniques employed. As written, Paragraph 8.d has the effect of doing exactly that. Reliance should be placed on the applicant's use of the Purpose and Scope statements in DO-332 as well as a holistic review of its content for a determination of its applicability. Annex OO.D.2 is really no different from the rest of the document in this regard and does not merit special emphasis.	DO-332 Annex OO.D.2 is no different from any other part of the document. The applicant's determination of its applicability can be trusted without special emphasis.	Remove Paragraph 8.d	Not accepted. Paragraph 8.d. has been revised to bring attention to the related techniques addressed in OO.D.1.2-OO.D.1.7. without imposing additional requirements outside of OOT. The paragraph states "...you may benefit from design practices identified in the related techniques sections of DO-332." This treats it more like an FAQ.
118	Honeywell ODA	Page 4, Paragraph 8.d.	Not clear if this applies to only DO178C projects or all projects.	Not clear if the overhead required to ferret through an entire supplement warrants finding those development considerations that may already be a part of the initial certification.	Point specifically to the non-OOTIA sections that should be up for consideration for Non-OOTIA SW.	Accepted. Paragraph 8.d. has been revised to bring attention to the related techniques addressed in OO.D.1.2-OO.D.1.7. without imposing additional requirements outside of OOT. The paragraph states "...you may benefit from design practices identified in the related techniques sections of DO-332."
119	Williams International	Page 4 Paragraph 8.d	As currently written, the AC requires any DO-178C program to purchase and consult the DO-332 supplement for determining if that specific supplement applies.	By providing clarity in the AC for when DO-332 should be employed, an applicant that is not using any of these techniques would not be required to	Modify 8.d(4) with either of the following two options: 1) Restrict the use of the DO-	Not accepted. Paragraph 8.d. has been revised to bring attention to the related techniques addressed in OO.D.1.2-OO.D.1.7. without imposing additional

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				purchase or review the supplement only to find that it does not apply.	332 supplement to only those software development projects when object oriented technology is used. 2) Update the statement specifying what techniques in non-object oriented software development would require the use of DO-332.	requirements outside of OOT.
120	Eurocopter	Page 4 (§ 8.d)	The text states about recommendations in annex OO.D.2 which may apply to any software development, even when object oriented technology is not used.	DO-178C is already considering the subjects addressed in OO.D.2 (traceability, structural coverage, resource analysis ...). If there is a need for complements, this should be explicit, otherwise it may lead to all possible interpretations, including systematic use of DO-332.	<ul style="list-style-type: none"> - Either remove this statement, - Or precise (for example in FAA Order 8110.49, Software Approval Guidelines) which "recommendations for related techniques" should be considered. 	Accepted. Paragraph 8.d. has been revised to bring attention to the related techniques addressed in OO.D.1.2-OO.D.1.7. without imposing additional requirements outside of OOT. The paragraph states "...you may benefit from design practices identified in the related techniques sections of DO-332." This treats it more like an FAQ.
121	Rockwell Collins, Inc.	8.d.	Paragraph 8.d implies that all projects have to reference, analyze, and address the content of DO-332, even if not using OO techniques. For example, it is unclear how this would apply to dynamic memory technology in cases where not using OO techniques.		Please provide clarification, perhaps in the way of a clarifying example.	Not accepted. Paragraph 8.d. has been revised to bring attention to the related techniques addressed in OO.D.1.2-OO.D.1.7. without imposing additional requirements outside of OOT. The paragraph states "...you may benefit from design practices identified in the related techniques sections of DO-332."
122	FAAC	4, 8d	Invocation of this Appendix for general applicability which is clearly related to OO is simply wrong. This was never intended by the members of SC-205 and it is unclear why the FAA would attempt to apply any part of DO-	Invalid and inappropriate application of the industry-consensus material.	DELETE this paragraph in its entirety.	Not accepted. DO-332, OO.1.2, Scope, states "The related techniques discussed in this supplement may be used outside of OOT." "...the guidance for related techniques should be used even when

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			332 in this way.			OOT is not used. Paragraph 8.d. has been revised to bring attention to the related techniques addressed in OO.D.1.2-OO.D.1.7. without imposing additional requirements outside of OOT. This treats it more like an FAQ.
123	Sagem /SAFRAN & Snecma / SAFRAN	Page 4 Paragraph 8.d	The recommendation for the use of DO-332 Annex OO.D.2 is too prescriptive.	When Software Development does not use techniques covered by any DO-178C supplement document, only the DO-178C core document is applicable.	Proposal for rewording of §8.d : d. DO-332, Annex OO.D.2, identifies and provides recommendations for introduces related techniques that may apply to any software development, even when object oriented technology is not used in the field of Object-Oriented Technology which may need to be considered. Determine if any of the related techniques are used in your project and implement the recommendations as applicable.	Not accepted. Paragraph 8.d. has been revised to bring attention to the related techniques addressed in OO.D.1.2-OO.D.1.7. without imposing additional requirements outside of OOT. The paragraph states "...you may benefit from design practices identified in the related techniques sections of DO-332."
	Final Text	Paragraph 8.d Changed to 8.e.	e. DO-332, Annex OO.D.2 OO.D.1.2-OO.D.1.7 , identifies and provides recommendations for information regarding related techniques that may apply to any software development, even when object oriented technology is not used. If you plan to use related techniques outside of OOT, you may benefit from design practices identified in the related techniques sections of DO-332. Determine if any of the related techniques are used in your project and implement the recommendations as applicable.			

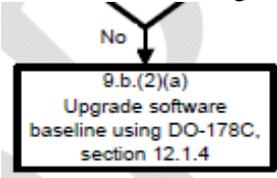
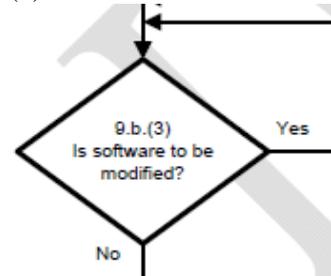
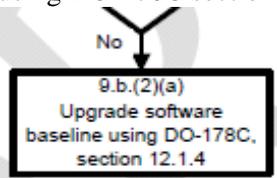
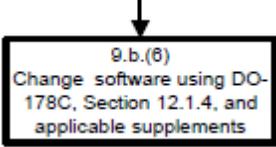
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	Original Proposed Text	Paragraph 9.a. and Paragraph 9 general comments	<p>9. Modifying and Re-using DO-178, DO 178A, or DO-178B Software.</p> <p>a. Many airborne systems were approved under type certification using DO-178, DO-178A, or DO-178B as a means of compliance. In this AC, these systems are referred to as legacy systems, and the software as legacy system software. This paragraph describes how to use the guidance of this AC to demonstrate compliance with the software aspects of certification for an application that includes modifications to legacy system software or use of unmodified legacy system software.</p>			
124	Airbus SAS	Page 4 / §9. Modifying and Re-using DO-178, DO-178A, or DO-178B Software.	<p>To spilt paragraph 9 in paragraphs 9.1 and 9.2:</p> <p>§9.1: In case of non-significant change (as per 14 CFR § 21.101(b)), the original certification baseline refers.</p> <p>§9.2: In case of significant change (as per 14 CFR § 21.101(b)), the following is to be considered by the applicant: {amended paragraph 9 starting from proviso a. }</p>	In case of non-significant change (as per 14 CFR § 21.101(b)), it must be allowed to take credit of original certification baseline when it continues to be relevant and providing same assurance.		Not accepted. Discussion of DO-178() in the context of 14 CFR 21.101 is invalid. §21.101 addresses the applicable requirements that establish the certification basis for a proposed design change. AC 20-115C recognizes DO-178C as an acceptable means of compliance. It is not a regulation and does not form part of the certification basis.
125	L-3 Communications	Page 4, paragraph 9	This section should add guidance to describe the applicability on the basis of software partitions instead of the implied nature that the guidance applies to all software in the product as one set to be analyzed.	<p>Partitioning is used to isolate software elements within a system to ensure the actions of one do not affect another. When a product is modified, it is often the case that some software partitions have no changes while others are modified. The guidance in this section should be modified so that each partition could have a different outcome in Figure 1.</p> <p>For example, assume that a legacy system has 10 software partitions that were all developed and approved to DO-178B. In a new update, 8 are unchanged, 1 has only a minor software</p>	Paragraph 9.b should be modified to indicate the analysis can be done on a partition-by-partition basis if partitioning was used in the legacy system.	Not accepted. It should be understood that Paragraph 9 applies to partitions without specifically stating so. The change impact analysis should identify any affected components, which includes affected partitions or interfaces.

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				modification, and 1 introduces a parameter data item file. Using Figure 1, It should be acceptable to have 8 partitions end up at 9.b.(3), 1 at 9.b.(5) and 1 at 9.b.(6) instead of the whole project, and thus all 10 partitions, at 9.b.(6).		
126	THALES Avionics	9 (general)	Paragraph to clarify	When is it mandatory to use DO178C? Consistency between paragraph 6 and 9?	Create a dedicated paragraph where it is clearly defined when DO178C is mandatory and when is recommended to apply it.	Not accepted. The intent of this entire paragraph is to define when an applicant needs to use DO-178C and when it is acceptable to use an earlier version. This cannot be summed in one paragraph.
127	THALES Avionics	9 (general)	Paragraph to clarify	Is this paragraph applicable when applicants decide to claim compliance to DO178C for previously developed software compliant with a previous DO178 version?	Create a dedicated paragraph where it is clearly defined when DO178C is mandatory and when is recommended to be apply it.	Not accepted. The intent of this entire paragraph is to define when an applicant needs to use DO-178C and when it is acceptable to use an earlier version. This cannot be summed in one paragraph.
128	BA EEDA	General on sections 9 and 11.	Migration to DO-178C should not be applicable for minor modification to software or to the tool.	The objective of migrating to DO-178C should be to make use of new requirements not existing in previous standards (eg DO-178B and others) to address certification issues. Thus the objective should not be to make software, using previous standards, compliance to DO-178C.	Any migration to DO-178C should be discussed and agreed with the applicant and the prime authority involved.	In most cases, applicants should be able to migrate to DO-178C without discussion and agreement with the certification authority. The intent of the AC is to provide a means for an applicant to make any change to legacy system software and, provided their processes and procedures satisfy DO-178C, declare that the software satisfies DO-178C. If the processes are established to satisfy DO-178C, then subsequent changes, and new software, will meet DO-178C. This was established to encourage applicants to convert their processes to produce software compliant with DO-178C.

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129	Honeywell ODA	Page 5	If the original DO-178B cert was done with relevant issue papers at the time, can the FAA impose newer issue papers against DO-178B or do the original issue papers at the time apply to the new SW version?	Clarification needed.	Clarify criteria for when and how issue papers will be imposed when using prior versions of DO-178.	Not accepted. If the applicant is following an established process in accordance with a previous IP, then they should be able to follow the same process. Newer IPs should not be imposed, unless there is something that they are doing that isn't covered by the previous IP.
130	Avidyne Corporation	Page 4 Paragraph 9.a	Cited approvals should include TSOA. TSOA is accepted as evidence of DO-178() compliance under FAA policy.	The AC clearly intends to treat all forms of prior approval as equivalent. TSOA must therefore be included.	Change the first sentence of Paragraph 9a to read "Many airborne systems were approved under type certification or TSOA using DO-178, DO-178A, or DO-178B as a means of compliance."	Partially accepted. The reference to type certification was removed.
131	TCCA	Page 4 para 9 a	COMMENT: Section 9.a could be interpreted as allowing almost all new applications to use previous versions of DO-178.	REASON: The allowance of the use of previous versions of DO-178 in a product should follow the certification basis and software MOC (i.e. version of 178) of the product. The expression "an application that includes modifications to legacy system software or use of unmodified legacy system software" could be interpreted very loosely as including any application that uses software data developed in previous application. This would include, with rare exceptions, all software applications in the industry. It therefore opens the doors even more to the use of previous versions of DO-178.	Remove the sentence "an application that includes modifications to legacy system software or use of unmodified legacy system software". The para should refer to software aspects of modification to a Product or Equipment certified with a previous version of DO-178.	Not accepted. If an applicant wishes to use software that was approved using a previous version of DO-178, and that software has demonstrated to be safe (i.e., no ADs, SDs, minimal OPRs), then they should be able to use that software in a new application. Software MOC is not part of the certification basis, and a MOC cannot be dictated for an entire product from a regulatory perspective.

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132	Sagem /SAFRAN & Snecma SAFRAN	Page 4 Paragraph 9.a	For Engines, the AC 21.101-1A recognizes that a software change is not significant (page A49). However this AC seems to force nevertheless a change of DO-178 version for some legacy software modifications “not significant”.	Rulemaking and advisory circular consistency.	For Engines, introduce in the paragraph, the relation with 14 CFR part 21.101 and AC 21.101-1A “not significant changes” for software.	Not accepted. Discussion of DO-178() in the context of 14 CFR 21.101 is invalid. §21.101 addresses the applicable requirements that establish the certification basis for a proposed design change. AC 20-115C recognizes DO-178C as an acceptable means of compliance. It is not a regulation and does not form part of the certification basis.
	Final Text	Paragraph 9.a	<p>a. We previously approved the software for mMany airborne systems were approved under type certification using DO-178, DO 178A, or DO-178B as a means of compliance. In this AC, we refer to these systems are referred to as legacy systems, and the software as legacy system software. In tThis paragraph, we describes how to use the guidance of this AC to demonstrate compliance with the software aspects of certification for an application that includes modifications to legacy system software or use of unmodified legacy system software.</p>			
	Original Proposed Text	Paragraph 9.b. and Figure 1	<p>b. For a project involving legacy system software, follow the procedures in this paragraph. Figure 1 presents a flow chart of the process for use of legacy system software.</p>			

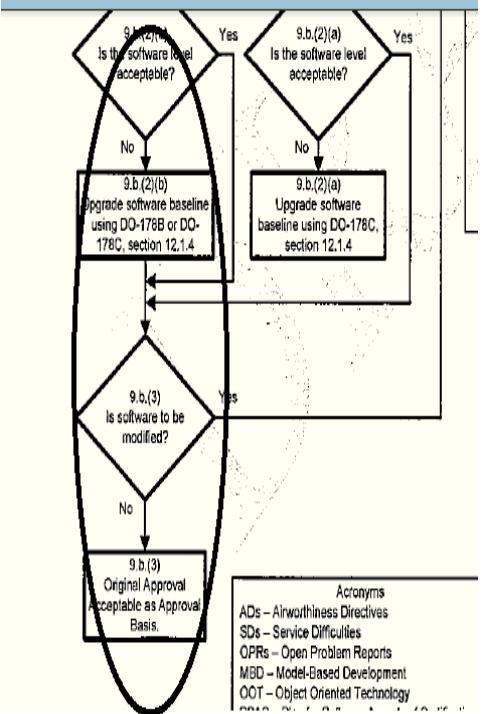
No.	Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
			<p>Intent to use software previously shown to satisfy DO-178/DO-178A, or DO-178B</p> <p>9.b.(1) Evaluate software usage history, SDs, ADs, OPRs, etc.</p> <p>9.b.(1) Is software usage history acceptable?</p> <p>No: 9.b.(1) Correct product and process deficiencies</p> <p>Yes: 9.b.(2) Is software developed using DO-178B?</p> <p>No: 9.b.(2) Establish that the DO-178/DO-178A software level satisfies the required software level</p> <p>Yes: 9.b.(2)(a) Is the software level acceptable?</p> <p>Yes: 9.b.(2)(b) Is the software level acceptable?</p> <p>No: 9.b.(2)(a) Upgrade software baseline using DO-178C, section 12.1.4</p> <p>No: 9.b.(2)(b) Upgrade software baseline using DO-178B or DO-178C, section 12.1.4</p> <p>9.b.(3) Is software to be modified?</p> <p>Yes: 9.b.(4) Conduct change impact analysis</p> <p>No: 9.b.(3) Original Approval Acceptable as Approval Basis.</p> <div data-bbox="801 1401 1142 1560"> <p>Acronyms</p> <ul style="list-style-type: none"> ADs – Airworthiness Directives SDs – Service Difficulties OPRs – Open Problem Reports MBD – Model-Based Development OOT – Object Oriented Technology PSAC – Plan for Software Aspects of Certification SCI – Software Configuration Index SAS – Software Accomplishment Summary </div>	<p>9.b.(4) Conduct change impact analysis</p> <p>9.b.(5)(a) Will MBD, OOT, or Formal Methods be introduced during the change?</p> <p>Yes: 9.b.(5)(c) Are there new development or verification tools?</p> <p>No: 9.b.(5)(b) Have the original plans and environment been maintained?</p> <p>Yes: 9.b.(5)(c) Are there new development or verification tools?</p> <p>No: 9.b.(5)(d) Are parameter data item files introduced as part of the change?</p> <p>Yes: 9.b.(5)(d) Are parameter data item files introduced as part of the change?</p> <p>No: 9.b.(5) Change software using the same DO-178 version as the original approval</p> <p>9.b.(6) Change software using DO-178C, Section 12.1.4, and applicable supplements</p>	<p>9.b.(5) Change software using the same DO-178 version as the original approval</p> <p>9.b.(6) Change software using DO-178C, Section 12.1.4, and applicable supplements</p>	

No.	Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
133	Honeywell ODA	Page 4 Paragraph 9 Page 5 Figure 1	Bullet a) text indicates this section is applicable for Type Certification projects and thus implies it is not applicable for TSO projects. Suggest the title of section 9 be clarified to indicate such. Alternately, if the intent was for section 9 and Figure 1 to apply to TCs and TSOs, the text should be clarified.	To clarify the applicability of this section.	Reword Title of paragraph 9 to read “Modifying and Re-using DO-178, DO-178A, or DO-178B software on type-certificated products.” Or change the words in paragraph 9.a to read “under type certification or TSO”	Not accepted. Removed reference to type certification to avoid confusion.
134	Snecma/Safran	Page 5 Figure 1	An arrow is missing after 9.b.(2)(a) box 	If the software is to be modified, the flow chart is not finished.	The arrow should go the 9.b.(3) condition: 	Accepted.
135	Snecma/Safran	Page 5 Figure 1	When software is developed using DO-178 or DO-178A and software level is not acceptable, if the software is to be modified, the end of the flow chart seems to be not consistent.	If software level is not acceptable, the software baseline is to be upgraded using DO-178C section 12.1.4:  But software is changed as 9.b.(5) using the same DO-178 version with an unacceptable level.	If software is to be modified and software level not acceptable, the software should be changed as 9.b.(6) using DO-178C, section 12.1.4.  In 9.b.(5)(b), page 7, a comment should be added: “when 9.b.(2)(a) is applied, the original software plans cannot	Partially accepted. Paragraph 9.b.(5)(b) (now 9.b.(7)(b)) has been rewritten to accommodate changes to the software plans resulting from 9.b.(2).

No.	Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
					still be used.”	
136	Snecma/Safran	Page 5 Figure 1	When software is not to be modified, but software baseline is upgraded due to an unacceptable level, is the original approval sufficient?	The modified data of software baseline (due to upgrade) should be submitted to approval, in the way to verify that the upgraded baseline complies with the software level.	A comment in 9.b.(3) should state that in case of upgraded software baseline (without change of the Executable Object Code), the upgraded data shall be submitted to an incremental approval.	Accepted. Changed 9.b.(3) box to reflect original approval with or without baseline upgrade.
137	L-3 Communications	Page 5, Figure 1.	The box containing “9.b.(2)(a) Upgrade software baseline using DO-178C, section 12.1.4” is missing a continuation arrow.	Flow chart does not support the text of section 9.b.	Insert a continuation arrow from the box containing “9.b.(2)(a) Upgrade software baseline using DO-178C, section 12.1.4” to the 9.b.(3) decision.	Accepted.
138	Eurocopter	Page 5 (Fig. 1)	Box 9.b.(2)(a) is a final state, which does not open the possibility to perform a software change.	Inconsistency in the flow chart.	Box 9.b.(2)(a) should have an output arrow leading to decision box “9.b.(3) Is software to be modified.”.	Accepted.
139	Sikorsky Aircraft	Pg5, fig 1	Box 9.b.(2)(a) missing an output		Add arrow	Accepted.

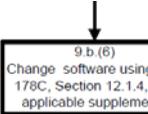
No.	Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
140	Boeing	Page 5 Figure 1. Legacy System Software Process Flow Chart <u>Box</u> 9.b.(2)(a) [on the left side of the figure]	We recommend adding one simple connector from that box to diamond “9.b.(3) – Is software to be modified?”	This legacy software can be modified, just like DO-178B software can be modified. This connector will complete the flow of upgrading the baseline of legacy DO-178/DO-178A software.	Add a simple connector from the proposed box that states: <i>“9.b.(2)(a) Upgrade software baseline using DO-178C, section 12.1.4.”</i>	Accepted.
141	Pratt & Whitney Aircraft	See text below Figure 1	See diagram below	See text below If an existing 178A project were to add a target code loader tool, then by this AC’s change analysis, one would be required to do all software updates to 178C... which we don’t think that this was what was meant... If you use MBD, OO or Formal methods in the change – then yes, one would expect to use 178C for the change... but introducing a new tool – that one would probably tool qual anyway, should not drive the software change basis up to 178C	See text below Amend the figure to permit tool additions to an existing product without bring the entire application up to DO-178C.	Accepted. The flow chart and respective paragraphs have been revised. The flow chart now refers to paragraph 10 (Tool Qualification) for all tools (new/changes) for process to follow. While we revised the process so as not to require DO-178/DO-178A software upgrade to DO-178C, a new tool would require DO-178C/DO-330 qualification.

No.	Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition

No.	Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
142	Pratt & Whitney Aircraft	Figure 1	<p>Flow path for original & upgraded approval conflict</p>  <pre> graph TD D1{9.b.(2)(a) Is the software level acceptable?} D2{9.b.(2)(a) Is the software level acceptable?} D3{9.b.(3) Is software to be modified?} B1[9.b.(2)(b) Upgrade software baseline using DO-178B or DO-178C, section 12.1.4] B2[9.b.(2)(a) Upgrade software baseline using DO-178C, section 12.1.4] B3[9.b.(3) Original Approval Acceptable as Approval Basis] D1 -- No --> B1 D1 -- Yes --> D3 D2 -- No --> B2 D2 -- Yes --> D3 B1 --> D3 B2 --> D3 D3 -- No --> B3 D3 -- Yes --> B1 D3 -- Yes --> B2 </pre> <p>Acronyms ADs – Airworthiness Directives SDs – Service Difficulties OPRs – Open Problem Reports MBD – Model-Based Development OOT – Object Oriented Technology</p>	The flow chart shows a conflicted path to both upgrade the baseline or original approval,	Note the path in Figure 1 that has the circled path... when you determine that you must upgrade your baseline to B or C – then if you’re NOT modifying the software, then “original approval accepted as approval basis” should really say “original or identified upgraded approval accepted as approval basis”	Accepted. Modified flow chart and paragraph 9.b.(3) text accordingly.
143	Eurocopter	Page 5 (Fig. 1)	<p>Decision 9.b.(3) "Is software to be modified?" leads, if no software change is required, to a box "Original Approval Acceptable as Approval Basis".</p> <p>However, one way of reaching this decision is through case 9.b.(2).(b) (upgrade of the DO-178B or DO-178C baseline, if the level is not sufficient for the new installation).</p>	Inconsistency in the flow chart.	<ul style="list-style-type: none"> - Box "9.b.(3) Original Approval Acceptable as Approval Basis" should be the result of decisions "yes" in decision boxes "9.b.(2)(a)" and "9.b.(2)(b)", - This box should also have an output arrow leading to decision box "9.b.(3) Is software to be modified?". 	<ul style="list-style-type: none"> - Partially accepted. Changed 9.b.(3) box to reflect original approval with or without baseline upgrade. - Accepted.

No.	Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
144	THALES Avionics	Figure 1	Inconsistency	There is an inconsistency when a DO178B SW needs to be upgraded to have an acceptable level (9.b.(2).(b)) because when the software is not modified the conclusion is that the original approval is acceptable as approval basis.	Modify figure 1 to solve inconsistency	Accepted. Changed 9.b.(3) box to reflect original approval with or without baseline upgrade.
145	Honeywell ODA	Page 5, Figure 1	This figure has two decision blocks related to para. 9.b.(5)(c). The first decision block can be stated more simply.	Text can be simplified.	1) Change the decision block text to: "Is legacy software developed to DO-178B?" 2) Swap the "Yes" and "No" outputs	Not accepted. Comment not applicable due to revised flow chart.
146	Honeywell ODA	Page 5, Figure 1	This figure has two decision blocks related to para. 9.b.(5)(c). The second decision block uses the 178B terminology for tools and is inconsistent with the text in para. 9.b.(5)(c).	Text is inconsistent.	Change the decision block text to: "Are there new software tools?"	Partially accepted. The flow chart has been revised and recommendation incorporated.
147	Elbit Systems Ltd.	Page 5 Figure 1	Removal of DO-178 & DO-178A related software question	The DO-178 & DO-178A previous developed SW is not relevant here, It can be removed.	this question should be removed from the Figure 1 - Legacy System Software Process Flow Chart	Not accepted. Comment not applicable due to revised flow chart.
148	Randall Fulton	Page 5- Figure 1	Box in lower right hand corner (9.b.(6) Change software using DO-178C, Section 12.1.4, and applicable supplements)	"Change software" could be interpreted as only doing source code changes with DO-178C, when this really means requirements, design, code, verification, SQA, SCM, etc.	Suggest replacing "Change software" with more generic terms such as "Perform activities."	Accepted. Modified in accordance with another recommendation "Change software and associated life cycle data..."
149	EASA	§9.b - Figure1	It is unclear why the activities "Correct product and process deficiencies" as well as "Upgrade software baseline..." are not linked/ followed by the "Change impact analysis" and the following activities on the right path of the figure.	Any change from legacy software should lead to identifying the need to apply DO-178C and its supplements, even for instance to "Correct product and process deficiencies".	Could you please consider the need to link any changes to the Change Impact Analysis and the subsequent evaluations?	Paragraph 9.b.(1) is intended for legacy software that has had issues throughout its life cycle. Problematic software is an indication of processes that are deficient. These processes, as well as the software produced by them, need to be corrected

No.	Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
						before proceeding to use the legacy software in a new project.
150	Sikorsky Aircraft ODA	Pg5, fig 1	Determination should be made early in the process flow as to whether the legacy application is intended to be used in a similar installation.	Conduct CIA in the middle of the process seems late to make this determination.	Determine applicability of software to installation up front, or conduct CIA closer to beginning	Not accepted. The paragraph on CIA is located appropriately in the flow chart, after decision to make software changes.
151	Sikorsky Aircraft ODA	Pg5, fig 1	Decision 9.b.(5)(c) - if the answer is 'yes', is there an option to invoke DO-330 as stand-alone guidance without invoking DO-178C in its entirety	Seems that DO-330 is treated independently from the supplements (see wording in para 8)	Please clarify if it is feasible to use DO-330 w/o the supplements or DO-178C	Not accepted. However, an applicant can propose to use DO-330 as an alternative for tool qualification on a DO-178B project. It does not need to be stated specifically in the AC.
152	TCCA	Page 5 Figure 1	Box 9.b.(5)(c) Is legacy sw developed to 178 or 178 A? should be removed. The question below needs to be expanded to DO-178 B if criteria 1 or 2 of DO-178 C to new tools apply.	DO-178B new tools that are not Criteria 3 tools need to be qualified by using DO-178C and DO-330.	Delete the top-level box 9.b.(5)(c) and expand the question to add a condition of having under DO-178 B new tools that would belong to criteria 1 or criteria 2 under DO-178 C.	Not accepted. If an applicant is modifying legacy DO-178B software, they may continue to use their DO-178B tool qualification processes. If they are introducing a new tool while modifying DO-178/DO-178A software, they would need to qualify the new tool using DO-178C/DO-330.
153	Eurocopter	Page 5 (Fig. 1)	The flow chart listed in Figure 1 seems to have a numbering system applied to the boxes and decision diamonds that are actually references to sub-section paragraphs of Chapter 9. Having the sub-section numbers at the top of the boxes may be misleading, especially when the same number is attributed to several boxes.	Information is not presented in a clear, concise, manner. When attempting to assess the re-use of Legacy System Software the applicant should not be left with questions as to how to proceed with a project application. The flow chart should be self-understandable and only refer to the text for further details.	The sub-section numbers should not be at the top of the boxes, but listed at the bottom, for reference to additional information in the text of paragraph 9.	Accepted. The subparagraph numbers have been relocated to the bottom of the boxes. Additionally, paragraph 9.b states to follow the procedures in paragraph 9.b, and to use the flow chart along with the text. This means that the reader should not rely on the flow chart alone.

No.	Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
154	GE Aviation Systems	Page 5, Figure 1, and section 9.b.(5)(a)	The key word is “introduced”	Had several conversation with fellow DERs and their interpretation is even modification to MDB or OO could invoke this clause.	Provide clarification that modifications to MBD or OO program by itself does not necessitate the move to RTCA/DO-178C.	Accepted. Modified 9.b.(5)(a) to state that MBD, OO, or FM are not introduced <u>for the first time</u> during the modification.
155	Airbus SAS	Page 5 / Figure 1 - Legacy System Software Process Flow Chart / Box 9.b.(6) 	Modify box content by: 9.b.(6) Change software using DO178C, Section 12.1.4, and applicable supplements for changes developed using MBD, OOT or FM, or PDI files development.	It might be clear to the reader that reference DO178C is made to parts that cover those techniques when used. When they are not used, it is not relevant to refer DO178C.	9.b.(6) Change software using DO178C, Section 12.1.4, and applicable supplements for changes developed using MBD, OOT or FM, or PDI files development.	Not accepted. There are other conditions that may require using DO-178C, not just changes involving supplements.
156	Boeing	Page 5 Figure 1. Legacy System Software Process Flow Chart Box 9.b.(5) [at the lower-right of the	We recommend revising this text to read as follows: <i>“9.b.(5): “Change software <u>and associated or applicable lifecycle data</u> using the same DO-178 version as the original approval.”</i>	The DO-178 standards dictate the control over lifecycle data, the same as they dictate control over the software.	Revise text per our recommendation,	Accepted.

No.	Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
		figure]				
157	Boeing	Page 5 Figure 1. Legacy System Software Process Flow Chart Top Diamond 9.b.(5)(c) [on the right-hand side of the figure]	We recommend revising the text to read as follows: <i>“9.b.(5)(c) Is legacy software developed to DO-178 or DO-178A <u>or DO-178B?</u>”</i>	Working the flowchart backwards, if Parameter Data Items are added to a (current) AC 120-76B product, for example, those elements of the product would need to take into account DO-178C. This may possibly be taken care of, however, by the top Diamond's 9.b.(5)(c) [that is – the 178/178A diamond] "No" flow to Diamond's 9.b.(5)(d) "Yes" flow to Box 9.b.(6), because that flow accounts for Parameter Data Items being introduced as part of the change. Please clarify.	Revise / clarify text per our recommendation,	Not accepted. Not sure of question asked in rationale, but the flow chart has been modified such that decision diamond that the comment refers to has been removed. We hope this change helps to resolve your concerns.
158	Boeing	Page 5 Figure 1. Legacy System Software Process Flow Chart Box 9.b.(6) [at the lower-right	We recommend revising the text to read as follows: <i>“9.b.(6) Change software <u>and associated or applicable lifecycle data</u> using DO-178C, Section 12.1.4 and applicable supplements.”</i>	The DO-178 standards dictate the control over lifecycle data, the same as they dictate control over the software.	Revise text per our recommendation,	Accepted.

No.	Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
		of the figure]				
159	Paul Dunlap, Consultant DER	Pages 4-7, Paragraph 9. Modifying and Re-using DO-178, DO-178A, or DO-178B Software.	<p>Information is presented in both a flow chart and written paragraphs. Because is somewhat different, it leads to confusion. If the intent is to display the decision making process, yet have more words than fit in the boxes, then maybe just a reference to the applicable sub-section.</p> <p>The flow chart listed in Figure 1 - Legacy System Software Process Flow Chart, seems to have a numbering system applied to the boxes and decision diamonds that are actually references to sub-section paragraphs of Chapter 9. The sub-section numbers should not be at the top of the boxes, but listed at the bottom, and say “See 9.b.(x)(x) for additional information” to describe the usage of the flow chart and the text.</p>	<p>Information is not presented in a clear, concise, manner.</p> <p>When attempting to assess the re-use of Legacy System Software the applicant should not be left with questions as to how to proceed with a project application.</p>	<p>Do not put partial information in multiple locations and expect the applicant to understand how to meld the guidance together.</p> <p>Pick a methodology: Use a flow diagram that contains all of the information or use descriptive paragraphs that contain complete descriptions and the decision making criteria.</p> <p>If both a diagram and separate descriptive paragraphs are truly necessary, then reduce the flow diagram to paragraph reference numbers only, without the partial descriptions.</p>	Accepted. The subparagraph numbers have been relocated to the bottom of the boxes. Additionally, paragraph 9.b states to follow the procedures in paragraph 9.b, and to use the flow chart along with the text.
160	FAAC	5, Figure 1	In general, the flow presented here appears to be straightforward. However, one can postulate various scenarios not well represented. For example, what precludes the imposition of additional issue papers that modify this flow, especially for legacy developments for which the OO or MBD papers deviate from the new guidance in DO-	Presenting a flow is good and helpful. It should, however, come with a caveat that specific situations may dictate deviation from this flow. Legacy software reuse or upgrades should always be coordinated with the FAA in advance.	As noted.	Accepted. Added the following sentences to 9.b.: “Although these procedures will apply to the majority of projects, there may be situations that do not follow this flow. You should coordinate these situations with the certification office.

No.	Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
			332 or DO-331?			
	Final Text	Paragraph 9.b and Figure 1	<p>b. For a project involving legacy system software, follow the procedures in this paragraph. Figure 1 presents a flow chart of the process for use of legacy system software. <u>Figure 1 presents a flow chart for using legacy system software. Use the flow chart while following the procedures in this paragraph if you are modifying or re-using legacy system software. Although these procedures will apply to the majority of projects, there may be situations that require deviation from this flow. You should coordinate these situations with the certification office.</u></p>			

No.	Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition	
			<p>Acronyms ADs – Airworthiness Directives FM – Formal Methods IAW – In Accordance With MBD – Model-Based Development OOT – Object Oriented Technology OPRs – Open Problem Reports SDs – Service Difficulties</p>				

No.	Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
	Original Proposed Text	Paragraph 9.b.(1)	(1) Assess the legacy system software to be modified, or re-used in a different product, for its usage history from previous installations. If the software has safety-related service difficulties, airworthiness directives, or open problem reports that have a safety impact on the proposed installation, it should not be modified or re-used in a different product without correcting the known software and development process deficiencies.			
161	Green Hills Software	Page 6 9.b.(1)	Scope of “legacy system” and “product” not clear.	<p>I reviewed this section from 3 perspectives:</p> <ol style="list-style-type: none"> 1. Legacy system (i.e., submitted by an applicant) which did not use COTS software. 2. Legacy system which did use COTS software. 3. New system which is using COTS software that was approved as part of some legacy system (same or different applicant). <p>Perspectives 1 and 2 are clearly in the scope of a legacy system (and based on the AC, could potentially continue development using a previous DO-178() version, including updates to the COTS products within them).</p> <p>Perspective 3 is not so clear. The COTS software would have a legacy heritage, but COTS software is generally not considered a “system” (i.e., not approved by itself). A COTS supplier may prefer to delivery (and make minor updates) of a COTS product under DO-178B, if feasible. If not feasible, some may interpret the AC as applying to standalone COTS while others interpreting the AC as not applying to standalone COTS, resulting in inconsistent enforcement.</p>	Explicitly clarify whether the AC applies / does not apply to standalone COTS products as a “legacy system”. If not, state applicability is dependent upon whether previously used as part of legacy system and that for new systems, even when the COTS was part of some legacy system, the COTS needs to be upgraded to DO-178C (perhaps based on Section 9.b.(6) in the AC).	Not accepted. DO-178C, section 2.5.3 addresses COTS software. Additionally, means to address previously developed software, including COTS, is covered in DO-178C, section 12.1.4, and paragraph 9 of the AC addresses use of legacy software.

No.	Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
162	UASC	Page 6 9.b.(1)	Does this paragraph mean that, for TSO product, any open problem reports that have a safety impact, including minor safety impacts, need to be fixed?	Clarification	Add wording to clarify whether, for TSO product, any open problem reports that have a safety impact, including minor safety impacts, need to be fixed?	Not accepted. Airborne software, including that developed for a TSO authorized article, may have OPRs with minor safety impact. That is why all OPRs should be reviewed at the installation level for safety impact on a particular product.
163	Honeywell ODA	Page 5 Figure 1 (box 9.b.1 “Correct product and process deficiencies”) Page 6 Bullet (1)	“Correct product and process deficiencies” implies the software process or artifact changes occur in this step, but it appears what is intended is that those changes are identified here and implemented in later steps, which then determine whether those changes can be done by a previous version of DO-178 or must be done via DO-178C.	Clarification of figure and corresponding text	Rename associated step in Figure to be: “Identify changes to address product and process deficiencies” Add sentence to bullet (1) on page 6: “Identify required changes to process or life cycle artifacts and assess DO-178C applicability per Figure 1.”	Not accepted. The purpose of implementing this step is to address software that has a history of issues and problems. The intent is to correct the known problems in the software and processes before proceeding down the flow chart.
	Final Text	Paragraph 9.b.(1)	(1) Assess the legacy system software to be modified, or re-used in a different product, for its usage history from previous installations. If the software has safety-related service difficulties, airworthiness directives, or open problem reports that <u>may</u> have a safety impact on the proposed installation, it should not be modified or re-used in a different product without correcting the known software and development process deficiencies <u>correct the known software and development process deficiencies prior to modifying or re-using it in a different product.</u>			

No.	Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition																																															
	Original Proposed Text	Paragraph 9.b.(2) and Table 1	<p>(2) DO-178B recognized five levels of software assurance, whereas previous versions only recognized three levels. DO-178C retained the DO-178B software levels. Use table 2 to determine if your legacy system software level satisfies the software level required in the proposed installation. A “✓” in the intersection of the row and column indicates that the software level is acceptable. For example, legacy system software with assurance to DO-178A software level 2 can be considered to satisfy DO-178B or DO-178C software levels C and D. A blank indicates that the software level is not acceptable.</p> <p>(a) For legacy system software developed using DO-178 or DO-178A, if the software level is not acceptable, upgrade the software development baseline using DO-178C, section 12.1.4.</p> <p>(b) For legacy system software developed using DO-178B, if the software level is not acceptable, upgrade the software development baseline using DO-178B or DO-178C, section 12.1.4.</p>	<p style="text-align: center;">Table 2 - Assurance Level Relationships</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th rowspan="2" style="text-align: center;">Software Level Required by the Safety Assessment</th> <th colspan="3" style="text-align: center;">Legacy System Software Level per DO-178/DO-178A</th> <th colspan="4" style="text-align: center;">Legacy System Software Level per DO-178B</th> </tr> <tr> <th style="text-align: center;"><i>Critical/ Level 1</i></th> <th style="text-align: center;"><i>Essential/ Level 2</i></th> <th style="text-align: center;"><i>Non-Essential/ Level 3</i></th> <th style="text-align: center;">A</th> <th style="text-align: center;">B</th> <th style="text-align: center;">C</th> <th style="text-align: center;">D</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">A</td> <td style="text-align: center;">✓</td> <td></td> <td></td> <td style="text-align: center;">✓</td> <td></td> <td></td> <td></td> </tr> <tr> <td style="text-align: center;">B</td> <td style="text-align: center;">✓</td> <td></td> <td></td> <td style="text-align: center;">✓</td> <td style="text-align: center;">✓</td> <td></td> <td></td> </tr> <tr> <td style="text-align: center;">C</td> <td style="text-align: center;">✓</td> <td style="text-align: center;">✓</td> <td></td> <td style="text-align: center;">✓</td> <td style="text-align: center;">✓</td> <td style="text-align: center;">✓</td> <td></td> </tr> <tr> <td style="text-align: center;">D</td> <td style="text-align: center;">✓</td> <td style="text-align: center;">✓</td> <td></td> <td style="text-align: center;">✓</td> <td style="text-align: center;">✓</td> <td style="text-align: center;">✓</td> <td style="text-align: center;">✓</td> </tr> </tbody> </table>	Software Level Required by the Safety Assessment	Legacy System Software Level per DO-178/DO-178A			Legacy System Software Level per DO-178B				<i>Critical/ Level 1</i>	<i>Essential/ Level 2</i>	<i>Non-Essential/ Level 3</i>	A	B	C	D	A	✓			✓				B	✓			✓	✓			C	✓	✓		✓	✓	✓		D	✓	✓		✓	✓	✓	✓		
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164	Boeing	Page 6, Paragraph 9.b.(2)	<p>We recommend revising the text to read as follows:</p> <p>“(2) ... Use table 2 to determine if your legacy system software level satisfies the software level required in <u>by the system safety assessment for</u> the proposed installation. ...”</p>	Our recommended revision will better align the text with DO-178B and DO-178C terminology.	Revise text per our recommendation,	Accepted.																																															

No.	Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
165	Boeing	Page 6 Table 2 - Assurance Level Relationships First (left-hand) column.	We recommend revising the header to read as follows: <i>"DO-178B/C Software Level Required by the System <u>Safety</u> Assessment"</i>	This table accounts for relationships between legacy levels and DO-178C levels, yet nowhere does "DO-178C" appear in this table. Our revisions will help the table to be better aligned with DO-178B/C.	Revise text per our recommendation,	Accepted.
166	Rockwell Collins, Inc.	9.b.(2)(b)	It is unclear how legacy system software could be upgraded to a new DAL level under DO-178B, since this type of change would require an update to planning documents, which would in turn violate 9.b.(5)(b) of this draft AC.	Please provide clarification that would preempt this potential conflict between 9.b.(2)(b) and 9.b.(5)(b)		Accepted. Changed paragraph 9.b.(5)(b) (now 9.b.(7)(b)) to: "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); and ..."
167	TCCA	Page 6 para 9 b 2 b	COMMENT: DO-178C should be used, not DO-178B.	REASON: DO-178C should be used, not DO-178B.		Not accepted. The FAA position is that safe software has been produced using the guidance of DO-178B for many years. We feel we cannot justify forcing developers who have been successfully producing software under existing DO-178B processes to update their processes for no safety benefit (within certain constraints).
168	UASC	Page 6 Table 2 (and related text)	Should "Development Assurance Level be used instead of "Software Level"	ARP4754A uses Development Assurance Level	Change from "Software Level" to "Development Assurance Level"	Not accepted. In the context of DO-178C, "software level" is the appropriate term.
169	Randall Fulton	Page 6-9.b.(2)	Reference to Table 2 should be Capitalized.	Reference to table 2 should be Table 2 to match the table label.	Capitalize "Table 2"	Accepted.

No.	Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
170	Greg Millican	Page 6-9.b.(2)	The paragraph states “DO-178B recognized five levels...”, but Table 2 shows DO-178B with “ABCD”, four levels	Table 2 is inconsistent with the paragraph.	Table 2 should show DO-178B having “ABCDE”, five levels	Partially accepted. Since DO-178B guidance applies to four software levels, the paragraph was rewritten as: “The guidance of DO-178B applies to four levels of software assurance, whereas the guidance of DO-178 and DO-178A applies to three levels.”
171	Honeywell ODA	Page 6 Table 2 Page 6 Bullets 2a and 2b	Table 2 is confusing and instructions do not provide clarity. It appears that what is meant is to find the entry in the first column “SW Level Required by the Safety Assessment” appropriate for the SW level/IDAL indicated by the Safety Assessment, and read across that row to determine the minimum SW level required by DO-178, DO-178A, or DO-178B.	Table and associated text is confusing	Reword text and modify table as needed to clarify.	Partially accepted. As explained in the example, start with what you have and use the table to determine if it is acceptable for what you need, not vice-versa. The example has been clarified with the following additional sentence: “Therefore, the DO-178A software developed to Essential/Level 2 would not be acceptable where DO-178B or DO-178C software levels A or B are required.”
172	EASA	§9.b (2)(b) - Table 2	The table of correspondence between DO-178B and DO-178/DO-178A does not introduce the need for an analysis when dealing with the Level 1/DAL A and Level 2/DAL B relationships. FAA Order 8110.49 section 10.3 did introduce the need for specific analysis in those most critical cases.	As previously identified, DAL equivalence between legacy software may be not so straightforward. Analysis should still be performed to support the correspondence between the most critical cases.	Could you please consider the addition of a note for the Level1/DAL A and Level2/DALB relationships that introduces the need for specific analyses?	Partially accepted. A provision was added for equivalency at level 2: “For legacy system software developed using DO-178 or DO-178A at level 2 that was previously shown to be equivalent to DO-178B level B per Order 8110.49, paragraph 10-3.a.(1), equivalency remains valid for the new project.”
173	Airbus SAS	Page 6 / Table 2 – Assurance Levels Relationships	For the case {Software level required by the Safety Assessment “B”; DO178/DO178A Essential/Level 2}, this table should allow acceptance of software level provided the analysis confirms that the software development and verification methods are still	For the case {Software level required by the Safety Assessment; DO178/DO178A Essential/Level2}, the table rejects the acceptance of software level.		Accepted. A provision was added for equivalency at level 2: “For legacy system software developed using DO-178 or DO-178A at level 2 that was previously shown to be equivalent to DO-178B level B per Order 8110.49, paragraph 10-

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			appropriate.	This is not relevant when the software is modified to adapt or improve an existing function of same safety classification level. Based on good In Service Experience, current practice in such a case is to keep the software certification baseline, including CRI's/IP's of this baseline as guidance material.		3.a.(1), equivalency remains valid for the new project.”
174	Airbus SAS	Page 6 / Table 2 – Assurance Levels Relationships	For the case {Software level required by the Safety Assessment “D”; DO178/DO178A Essential/Level 3}, this table should allow acceptance of software level provided the analysis confirms that the software development and verification methods are still appropriate.	For the case {Software level required by the Safety Assessment; DO178/DO178A Essential/Level2}, the table rejects the acceptance of software level. This is not relevant when the software is modified to adapt or improve an existing function of same safety classification level. Based on good In Service Experience, current practice in such a case is to keep the software certification baseline, including CRI's/IP's of this baseline as guidance material.		Not accepted. The comment is in regard to allowing level 3 to be acceptable for level D applications. This is inconsistent with previous policy (Order 8110.49, Figure 10-1, which only allows level 3 for level E applications.)
175	Eurocopter	Page 6 (Table 2)	FAA Order 8110.49 was opening the door for possibly accepting, after analysis, a DO-178/DO-178A level 2 software for level B. This possibility is no more considered.	There might be cases where the development process has encompassed the guidance of DO-178 or DO-178A.	We suggest stating that: - Table 2 gives the de facto accepted equivalences, - The initial development process may also be accepted if it can be shown that this process was close to the guidance of DO-	Accepted. A provision was added for equivalency at level 2: “For legacy system software developed using DO-178 or DO-178A at level 2 that was previously shown to be equivalent to DO-178B level B per Order 8110.49, paragraph 10-3.a.(1), equivalency remains valid for the new project.”

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					178B or DO-178C for the required level and brings an equivalent level of design assurance.																																																
	Final Text	Paragraph 9.b.(2)	<p>(2) <u>The guidance of DO-178B</u> recognized five <u>applies to four</u> levels of software assurance, whereas previous versions <u>the guidance of DO-178 and DO-178A</u> only recognized applies <u>three levels</u>. DO-178C <u>has</u> retained the DO-178B software levels. Use <u>Table 2</u> to determine if your legacy system software level satisfies the software level required in <u>assigned by the system safety assessment for</u> the proposed installation. A “✓” in the intersection of the row and column indicates that the <u>legacy system</u> software level is acceptable. For example, legacy system software with assurance to DO-178A software level <u>Essential/Level 2</u> can be considered to satisfy DO-178B or DO-178C software levels C and D. A blank indicates that the software level is not acceptable. <u>Therefore, the DO-178A software developed to Essential/Level 2 would not be acceptable where DO-178B or DO-178C software levels A or B are required.</u></p> <p style="text-align: center;">Table 2₁ - Assurance Level Relationships</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th rowspan="2"><u>DO-178B/C</u> Software Level Required <u>Assigned</u> by the <u>System</u> Safety Assessment</th> <th colspan="3">Legacy System Software Level per DO-178/DO-178A</th> <th colspan="4">Legacy System Software Level per DO-178B</th> </tr> <tr> <th><i>Critical/ Level 1</i></th> <th><i>Essential/ Level 2</i></th> <th><i>Non- Essential/ Level 3</i></th> <th>A</th> <th>B</th> <th>C</th> <th>D</th> </tr> </thead> <tbody> <tr> <td>A</td> <td style="text-align: center;">✓</td> <td></td> <td></td> <td style="text-align: center;">✓</td> <td></td> <td></td> <td></td> </tr> <tr> <td>B</td> <td style="text-align: center;">✓</td> <td style="text-align: center;">*</td> <td></td> <td style="text-align: center;">✓</td> <td style="text-align: center;">✓</td> <td></td> <td></td> </tr> <tr> <td>C</td> <td style="text-align: center;">✓</td> <td style="text-align: center;">✓</td> <td></td> <td style="text-align: center;">✓</td> <td style="text-align: center;">✓</td> <td style="text-align: center;">✓</td> <td></td> </tr> <tr> <td>D</td> <td style="text-align: center;">✓</td> <td style="text-align: center;">✓</td> <td></td> <td style="text-align: center;">✓</td> <td style="text-align: center;">✓</td> <td style="text-align: center;">✓</td> <td style="text-align: center;">✓</td> </tr> </tbody> </table> <p style="text-align: center;"><u>* For legacy system software developed using DO-178 or DO-178A at level 2 that was previously shown to be equivalent to DO-178B level B per Order 8110.49, paragraph 10-3.a.(1), equivalency remains valid for the new project.</u></p> <p>(a) For <u>If your</u> legacy system software <u>was</u> developed using DO-178 or DO-178A, if <u>and</u> the software level is not acceptable, upgrade the software development baseline using DO-178C, section 12.1.4.</p> <p>(b) For <u>If your</u> legacy system software <u>was</u> developed using DO-178B, if the software level is not acceptable, upgrade the software development baseline using DO-178B or DO-178C, section 12.1.4.</p>	<u>DO-178B/C</u> Software Level Required <u>Assigned</u> by the <u>System</u> Safety Assessment	Legacy System Software Level per DO-178/DO-178A			Legacy System Software Level per DO-178B				<i>Critical/ Level 1</i>	<i>Essential/ Level 2</i>	<i>Non- Essential/ Level 3</i>	A	B	C	D	A	✓			✓				B	✓	*		✓	✓			C	✓	✓		✓	✓	✓		D	✓	✓		✓	✓	✓	✓			
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	Original Proposed Text	Paragraph 9.b.(3)	(3) If modifications to the software are not required, the usage history is acceptable, and the software level has a “✓” entry in table 2, then the original approval may serve as the basis for the software in the installation approval of the proposed system.			
176	L-3 Communications	Page 6, paragraphs 9.b.3 and 9.b.5	The guidance is not clear what declarations may be made if the analysis in 9.b.(2) results in 9.b.(3) or 9.b.(5). Can they be declared DO-178C or do they retain their previous compliance claim?	Suppose that a new TSO is issued that requires DO-178C, especially one that is a new revision to an existing TSO. The legacy system software that implemented the prior revision to DO-178B now needs some changes to comply with the functionality defined in the new version of the TSO. The guidance in 9.b could result in the legacy software being acceptable per 9.b.(5). Could the TSO applicant claim compliance with DO-178C per the guidance in this AC or would the applicant have to get a TSO deviation since the continued DO-178B development is acceptable but is not what the TSO specified?	In 9.b.(3) and 9.b.(5), state whether legacy software developed to prior standards could claim to be DO-178C compliant or not.	Accepted. (New) subparagraphs 9.b.(3), 9.b.(6) and 9.b.(9), state that the software may be declared as having satisfied DO-178C if all software changes and your processes and procedures, including tool qualification, satisfy DO-178C, DO-330, and supplements, as applicable. If these conditions are not met, then the software cannot be declared as DO-178C compliant, and a deviation to the TSO requirement would be required.
177	Garmin	Page 6, 9.b.(3)	The predicates in the “if” are not in the same order as the decision flow in the flowchart.	Consistency of text order with flowchart.	“If the usage history is acceptable, the software level has a “✓” entry in table 2, and modifications to the software are not required, then the”	Accepted.
178	Sikorsky Aircraft ODA	Pg 6, para 9.b.(3)	Criteria should also include assurance the installation is similar	This may be part of verifying ‘usage history is acceptable’, but could be made more obvious		Not accepted.
	Final Text	Paragraph 9.b.(3)	(3) If modifications to the software are not required , the usage history <u>of your legacy system software</u> is acceptable, and the software level has a “✓” entry in <u>Ttable 2 (or the baseline has been upgraded appropriately)</u> , and <u>modifications to the software are not required</u> , then the original approval may serve as the basis for the software in the installation approval of the proposed system. <u>If you upgraded the software development baseline using DO-178C and you want to declare your software as having satisfied DO-178C, you should update your processes and procedures, including tool qualification processes, to DO-178C. However, you cannot declare your unmodified tools as having satisfied DO-178C. All subsequent modifications are to be made using your processes and procedures that satisfy DO-178C.</u>			

No.	Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
	Original Proposed Text	Paragraph 9.b.(4)	(4) If modifications to the software are required, conduct a change impact analysis for the modification in accordance with paragraph 10 of this AC.			
179	Williams International	Page 6 Paragraph 9.b(4)	As currently written the AC requires the use of CIA and prohibits the use of PSAC	A PSAC should be an acceptable means of documenting the planning phase of a software change as well as a CIA.	Modify 9.b(4) to read as follows “If modifications to the software are required, conduct a change impact analysis <i>or Plans for Software Aspects of Certification...</i> ”	Not accepted. Order 8110.49, paragraph 11-3.c, states that the CIA should be documented in the SAS, and paragraph 11-3.d states that the PSAC should contain a summary of the CIA data and the applicant’s strategy for addressing the change issues. Paragraph 10-Change Impact Analysis has been revised and moved to 9.b.(4). 9.b.(4)(c) states “Summarize the results of the analysis in the Software Accomplishment Summary (SAS).”
180	Boeing	Page 6, Paragraph 9.b.(4)	We recommend revising the text to read as follows: <i>“(4) If modifications to the software are required, conduct a <u>software</u> change impact analysis for the modification in accordance with paragraph 10 of this AC.”</i>	Our recommended revision will provide better alignment with DO-178C, Section 12.1.	Revise text per our recommendation,	Accepted.
181	Green Hills Software	Page 6 9.b.(4)	Missing guidance on what to do with outcome of CIA.	Would expect potentially some CIA changes to be major even if the software did not change. Did not see any reference to upgrading a baseline as a result of the CIA.	Add guidance (or clarify that this is always a minor change that does not require an upgrade in the baseline).	Partially accepted. Paragraph 10-Change Impact Analysis has been revised and moved to 9.b.(4). Order 8110.49 Chg 1, paragraph 11-2, provides more detail about outcomes of the CIA.

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182	Honeywell ODA	Pages 6-7, 9.b.(4), 10	It is unclear how the discussion of a change impact analysis in this AC relates to the change impact analysis contained in Order 8110.49 Chg 1 chapter 11. Are these two discussions of CIA intended to be the same?	Possible conflict across FAA policy documents. Figure 1 states that the primary decision for DO178C is MBD, Tools, OOT, parameter data files, new development environment etc. None of these are part of the CIA and there is no criteria as to what parts of the CIA at what levels would require DO-178C. The CIA is used as a basis for LOFI and Major/Minor determination. In addition, the majority of this data is unknown in the planning stages.	The CIA as written is irrelevant and should be removed. Sections 9.b(4) and 9.b(5) provides the relevant criteria for DO178C determination. Clarify whether the CIA discussion in this AC is intended to be the same CIA as in Order 8110.49. If they are the same, the AC should reference the CIA discussion in the Order. If they are different, the AC should clarify that they are different. If the intent is to repeat information from 8110.49, then that information should be identical to the Order.	Not accepted. The paragraph has been rewritten to reference DO-178C, section 12.1, and does not contain the detail that is used in the order. The CIA is a critical part of any software change and to ignore it in the context of this AC may result in non-compliance. We cannot refer to the order in the AC because orders are policy intended for ACOs and designees.
	Final Text	Paragraph 9.b.(4)	<p>(4) If modifications to the software are required, conduct a change impact analysis for the modification in accordance with paragraph 10 of this AC.</p> <p><u>(4) If modifications to the software are required, conduct a software change impact analysis (CIA) to determine the potential impact of the modifications on continued operational safety of the aircraft on which the system and software components are to be installed. The CIA should determine the extent of the modifications, the impact of those modifications, and what verification is required to ensure that the modified software performs its intended function and continues to comply with the identified means of compliance.</u></p> <p><u>(a) Identify the software changes to be incorporated and perform a CIA consisting of one or more analyses associated with the software change as identified in DO-178C, section 12.1. Analyses of the change should be made as applicable.</u></p> <p><u>(b) Conduct the verification as indicated by the CIA.</u></p> <p><u>(c) Summarize the results of the analysis in the Software Accomplishment Summary (SAS).</u></p>			
	New	New	<p><u>(5) If new software tools or modifications to tools are needed, refer to paragraph 10 of this AC to determine tool qualification requirements.</u></p>			

No.	Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
	paragraph added	Paragraph 9.b.(5)				
	New paragraph added	New Paragraph 9.b.(6)	<p>(6) If you upgraded the software baseline to DO-178C, or as an alternative to modifying your legacy system software using DO-178, DO-178A, or DO-178B, make all modifications to the software using DO-178C, section 12.1. If you want to declare all software as having satisfied DO-178C, you should accomplish all software modifications using DO-178C and update your processes and procedures, including tool qualification processes, to DO-178C. Your declaration applies to both modified and unmodified software and is valid even if you use unmodified tools that have not been qualified using DO-178C. However, you cannot declare your unmodified tools as having satisfied DO-178C. All subsequent modifications are to be made using your processes and procedures that satisfy DO-178C.</p>			
	Original Proposed Text	Paragraph 9.b.(5)	<p>(5) Modifications may be made to legacy software using the version of DO-178 (e.g. DO-178, DO-178A, or DO-178B) that was used for the original software approval, provided the following conditions are met:</p> <ul style="list-style-type: none"> (a) The techniques described in the DO-331, DO-332 (except those in Appendix OO.D.1), and DO-333 are not introduced during the modification; (b) The original software plans, processes, and life cycle environment have been maintained and can still be used; (c) For legacy system software developed using DO-178 or DO-178A, no new software tools are used; and (d) Parameter data item files (as defined in DO-178C) are not introduced during modification. 			
183	Garmin	Page 6, 9.b.(5)	The flow chart, and text in paragraph 9.b.(5) imply that DO-178B can't be used for modifications under some conditions.	Per paragraph 5, DO-178B can be used for new development. DO-178B should be usable for modifications to DO-178B-legacy systems, too.	Remove DO-178B from the flow chart and paragraph 9.b.(5).	Not accepted. Paragraph 9 "Modifying and Re-using DO-178, DO-178A, or DO-178B Software" is about modifying and re-using legacy software, including DO-178B. Therefore, it is appropriate to address DO-178B in (new) paragraph 9.b.(7).
184	BA EEDA	Sect 9b(5)	Is this section applied to any scope of software modification? Should a minor change due to coding error such as modifying one constant in the code be considered a modification as defined in this section 9b(5)?	Vagueness of language could lead to misinterpretation.	Clarify by specifying any software modification or major software modification in which major definition is agreed with the prime authority.	Not accepted. Major/minor determination is outside the scope of the AC. According to the AC, small changes as you describe should be allowed using the same DO-178 version as the original approval (see paragraph 9.b.(7)).

No.	Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
185	Boeing	Page 6, Paragraph 9.b.(5)	We recommend the text be revised to read as follows: “(5) Modifications may be made to legacy software using the version of DO-178 (e.g. DO-178, DO-178A, or DO-178B) that was used for the original software approval, provided the following conditions, in conjunction with a software change impact analysis, are met: ...”	Figure 1 appears to have this step occur after an applicant conducts a software change impact analysis; however, the standalone text does not include this assumption. Our suggested revision would update the sentence to better correlate the FAA’s intent as shown in Figure 1	Revise text per our recommendation,	Not accepted. The change impact analysis is required for any change, and this paragraph is not conditional on the CIA.
186	THALES Avionics	9.b.(5)(a),(c), (d)	When modifying a previously developed SW, the previous certification baseline has to be considered regarding new techniques described in DO178C supplements.	If previous baseline covered the techniques described in DO178C supplements (through FAA order, IP, CRI, Memo, ...) it could be acceptable to ask to show compliance to the previous certification baseline and not necessary to DO178C and its supplements.	Add in §9.b.(5)(a),(c), (d) and in figure 1 that DO178C is applied when previous baseline doesn’t already cover the techniques defined in DO178C supplements.	Accepted. (New) paragraph 9.b.(7)(a) states to use DO-178C if any of the supplement techniques are introduced <u>for the first time</u> during the modification. If one of the techniques are already used in the baseline, then there should be an existing issue paper that the applicant may continue to use for the modification.
187	BA EEDA	Sect 9b(5)(a)	Statement “...not introduced during the modification...”. What is the exact meaning of introduction? Completely new? Is the case where the techniques were used but modified, applicable?	Vagueness of language could lead to misinterpretation.	Clarify by adding specific cases of technique introduction where the supplements identified should apply.	Accepted. (New) paragraph 9.b.(7)(a) has been restated to be more specific: “You do not introduce model based development, object oriented technology, or formal methods <u>for the first time</u> during the modification.”
188	Eurocopter	Page 5 (Fig. 1) and Page 7 (§ 9.b.(5)(a))	A software change implying the introduction of specific methods (MBD, OOT, FM) would lead to moving to DO-178C and applicable supplement(s). However, these methods might be already addressed by Issue Papers in the target certification project. In such a case, there should be an opportunity to use these Issue	Keep a uniform approach inside a given certification project (avoid mixing several guidelines depending on software).	Open the possibility that existing Issue Papers addressing these specific methods be used instead of DO-178C and applicable supplement(s).	Accepted. (New) paragraph 9.b.(7)(a) states to use DO-178C if any of the supplement techniques are introduced <u>for the first time</u> during the modification. For projects where modifications are done to software where a technique was previously addressed by issue paper, then the previous version (e.g., DO-178B) may still be used in compliance with the

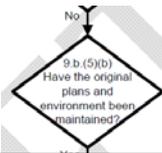
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			Papers, instead of DO-178C and its supplements.			previously agreed IP.
189	GE Aviation	Figure 1, 9.b.(5)(a)	Figure 1 contains the following “Will MBD, OOT, or Formal Methods be introduced during the change?” 9.b(5)(a) says “The techniques described in the DO-331, DO-332 (except those in Appendix OO.D.1), and DO-333 are not introduced during the modification”. What if the SW was previously developed using DO-178B or DO-178A with MBD techniques, but not necessarily in full compliance with DO-331?	GE/CFM have been using a MBD approach for development of engine controls to DO-178A level 1 and DO-178B level A SW since 1991. While the related products have good safety history, the MBD techniques may not fully comply with the guidance in DO-331. Re-use of legacy software into new systems may result in additional activities to comply with the guidance in AC 20-115C.	Provide clarification on the use of DO-178C/DO-331 as a means of compliance for legacy software that used MBD techniques before DO-331 was issued.	Partially accepted. (New) paragraph 9.b.(7)(a) states to use DO-178C if any of the supplement techniques are introduced <u>for the first time</u> during the modification. For projects where modifications are done to software where a technique was previously addressed by issue paper, then the previous version (e.g., DO-178B) may still be used in compliance with the previously agreed IP.
190	Avidyne Corporation	Page 7 Paragraph 9.b.(5)(a)	The Annexes in DO-332 contain supplementary information related to the development techniques described in the document. As they fall within the scope of DO-332, they are intended for use only in the presence of OOD&RT. None provide independent requirements in support of the Objectives. All of the issues identified in the Annexes are adequately covered in DO-178C or the other Supplements for development that falls within their scope. None of this content should be used as the basis for determination that a change from a legacy version of DO-178() to DO-178C is required. To do so would represent a massive and unintended expansion of the scope of the document.	The Annexes of DO-332 are intended for use only with respect to OOD&RT and should not be used in any other context.	Modify Paragraph 9.b.(5)(a) to read “The techniques described in DO-331, DO-332 (exclusive of the Annexes), and DO-333 are not introduced during the modification;” A similar analysis of DO-331 and DO-333 should be conducted to determine whether similar exclusions are appropriate.	Partially accepted. DO-332, section OO.1.2, <i>Scope</i> , states “The related techniques discussed in this supplement may be used outside of OOT.” “...the guidance for related techniques should be used even when OOT is not used.” Regardless, (new) paragraph 8.e has been revised to bring attention to the related techniques addressed in OO.D.1.2-OO.D.1.7. without imposing additional requirements outside of OOT. (New) paragraph 9.b.(7)(a) has been restated to be more specific: “You do not introduce model based development, object oriented technology, or formal methods for the first time during the modification.”

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191	Garmin	Page 7, 9.b.(5).(a)	<p>If Garmin’s 9.b recommendation to recognize DO-178B as an acceptable means of compliance is not accepted, then the following comment should be considered for the 9.b.(5).(a) condition for continued use of previous DO-178 versions:</p> <p>The exception identified for DO-332 should be removed.</p>	<p>The 9.b.(5).(a) condition implies that if any techniques of DO-332 Appendix OO.D.1 are already used by the software to be modified, then DO-332 and DO-178C need to be applied. DO-332 Appendix OO.D.1 includes every technique identified in DO-332 section OO.1.6.2. Thus, it would appear that DO-332, and hence DO-178C, needs to be applied to any change to software that already includes any technique defined in DO-332.</p> <p>Paragraph 5 of the draft AC acknowledges that, even when “DO-178B was found to be inadequate”, it could be “supplemented with project-specific issue paper to achieve an acceptable means of compliance.” (emphasis added). For existing software using the referenced techniques, acceptable means of compliance has been established, and should continue to be recognized for software changes.</p>	<p>Change 9.b.(5).(a) to:</p> <p>“The techniques described in DO-331, DO-332, and DO-333 are not introduced during the modification.”</p>	<p>Not accepted. (New) paragraph 9.b.(7)(a) has been restated to be more specific: “You do not introduce model based development, object oriented technology, or formal methods for the first time during the modification.” For projects where modifications are done to software where a technique was previously addressed by issue paper, then the previous version (e.g., DO-178B) may still be used in compliance with the previously agreed IP.</p>
192	Greg Millican	Page 7-9.b.(5)(a)	<p>Related to previous comment regarding RT. The paragraph states: “...(except those in Appendix OO.D.1)...”</p>	<p>Problem: Make a reference to guidance material, not vulnerabilities discussion material.</p>	<p>Solution, reference guidance material: “...(except those in Section OO.1.6.2)...”</p>	<p>Not accepted. (New) paragraph 9.b.(7)(a) has been restated to be more specific: “You do not introduce model based development, object oriented technology, or formal methods for the first time during the modification.”</p>

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193	Honeywell ODA	Page 7, 9.b.(5)(a)	This paragraph is unclear with respect to DO-332 Annex OO.D.1. [Also, the text incorrectly refers to OO.D.1 as an Appendix.]	Text is unclear	Change text to read: “The techniques described in the DO-331, DO-332 (other than those in Annex OO.D.1), and DO-333 are not introduced during the modification; [Note: DO-332 Annex OO.D.1 is to be applied per paragraph 8.d of this AC.]”	Not accepted. (New) paragraph 9.b.(7)(a) has been restated to be more specific: “You do not introduce model based development, object oriented technology, or formal methods for the first time during the modification.”
194	Honeywell ODA	Page 7 Para 9.b.5.a	If no new DO-331 (MBD) techniques are being introduced, but there were existing techniques in the original approved plans, can DO178B apply?	If field experience demonstrates no safety related issues using the processes approved to DO178B, should be sufficient.	Clarify that existing approved techniques with service history would not require adoption of DO178C.	Partially accepted. (New) paragraph 9.b.(7)(a) has been restated to be more specific: “You do not introduce model based development, object oriented technology, or formal methods for the first time during the modification.” For projects where modifications are done to software where a technique was previously addressed by issue paper, then the previous version (e.g., DO-178B) may still be used in compliance with the previously agreed IP.
195	Honeywell ODA	Page 5, Figure 1 Page 7, 9.b.(5)(a) and 9.b.(5)(d)	The use of the word “introduced” is not clear.	The assumption is that the FAA chose the word “introduced” instead of “used”. This was to cover the scenario where a prior certification and dev/verf of s/w already had introduced and was using those techniques (MBD, Formal Methods, OOT, PDI, etc.). Therefore the prior certification’s planning documents/processes/SOI audits previously the use of those techniques so there is no need to upgrade to the new supplements. However, if the prior certification did NOT use those	If this assumption is correct, in 9.b.(5)(a) and 9.b.(5)(d), change “introduced” to “introduced for the first time”.	Accepted. (New) paragraph 9.b.(7)(a) has been restated to be more specific: “You do not introduce model based development, object oriented technology, or formal methods for the first time during the modification.” For projects where modifications are done to software where a technique was previously addressed by issue paper, then the previous version (e.g., DO-178B) may still be used in compliance with the previously agreed IP.

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				<p>techniques and the change to the pre-DO-178C software is “introducing” for the first-time to that program these new technologies (to that program) then the appropriate supplement(s) must be applied.</p> <p>If all concepts were previously introduced and followed DO178B and IP guidance, is DO178C required (assuming acceptable service history)?</p>		
196	Avidyne Corporation	Pages 5 & 7 Figure 1 and Paragraph 9.b.(5)(b)	<p>Paragraph 9.b.(5)(b) and the associated decision block in Figure 1 is unnecessarily restrictive and is likely to have undesirable effects. If a fully compliant system is further developed using a legacy version of DO-178(), there is no harm and there are many benefits from incremental improvement to the plans and development environment. Prohibiting such improvements will encourage applicants to freeze their plans and to avoid making potentially beneficial improvements to their development environment (new tool versions, new tools). (Note that the presence of this decision in the flowchart renders the following decision moot. If the development environment changes, 9.b.(5)(b) kicks you to DO-178C regardless of the version of DO-178() that was previously used.) The other decision blocks in the flowchart adequately address introduction of new software technology or features that would motivate adoption of DO-178C. Under a strict interpretation of Paragraph 9.b.(5)(b), any</p>	<p>Introduction of incremental changes to process plans and development environment found to be compliant under a legacy version of DO-178() does not invalidate compliance of the software itself and is generally a positive, not a negative. It must be encouraged, not discouraged.</p>	<p>Delete Paragraph 9.b.(5)(b) and the associated decision block in Figure 1.</p>	<p>Partially accepted. Changed (new) paragraph 9.b.(7)(b) to state more clearly: “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);”</p>

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			project that requires a PSAC would, in fact, require DO-178C compliance.			
197	BA EEDA	Sect 9b(5)(b)	Statement "...have been maintained and can still be used...". What is the exact meaning of maintained? Is a minor modification to a working instruction of a process applicable?	Vagueness of language could lead to misinterpretation.	Clarify by adding specific criteria where plans, processes, and life cycle environment are considered maintained.	Accepted. Changed (new) paragraph 9.b.(7)(b) to state more clearly: "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);"
198	Rockwell Collins, Inc.	9.b.(5)(b)	This paragraph says that "the original software plans, processes, and life cycle environment" must be maintained in order to stay with DO-178B. This will put pressure on engineering teams to NOT make minor updates to their plans, even when it is highly advisable to do so, since that would trigger the mandatory update to DO-178C. We want our software teams to be able to smartly update their legacy plans to support minor changes.		Please consider changing (b) to say that The original PSAC can still be used. This would allow for working-level changes to the software development and verification plans, while ensuring that legacy software requiring major changes would have to comply to DO-178C.	Partially accepted. Changed (new) paragraph 9.b.(7)(b) to state more clearly: "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);"
199	Eurocopter	Page 7 (§ 9.b.(5)(b))	"(b) <i>The original software plans, processes, and life cycle environment have been maintained and can still be used;</i> " One can understand that any change in the life cycle environment (e.g. development platforms, compiler, linker ...) would lead to upgrade the approval baseline to DO-178C.	Resolution of tool or platform obsolescence should not lead to an upgrade of the software development process.	Clarify that " <i>have been maintained and can still be used</i> " does not necessary mean that the complete life cycle environment is unchanged.	Partially accepted. Changed (new) paragraph 9.b.(7)(b) to state more clearly: "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);"
200	TCCA	Page 7 para 9 b (5) b	COMMENT: "have been maintained" is unacceptable	REASON: Ambiguous and open ended.	Replace with "are still fully applicable and do not require updates"	Not accepted. The recommendation is too restrictive.

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201	Embraer	Section 9 - Figure 1, 9.b(5)(b) and 9.b(5)(c); pages 5 and 7	Flowchart presented in Figure 1 and paragraphs 9.b(5)(b) and 9.b(5)(c) are not clear.	Embraer considers the AC does not make clear what guidance should be used if there are new tools in DO-178B legacy software. Additionally Embraer understands that if the change in the tool is related to bugs correction, there is no need to follow the new version of the standard.	Embraer suggests making it clear if software tools are considered part of the life cycle environment.	Partially accepted. Paragraph 9 and the flow chart have been modified so that any new tools or changes to tools go through paragraph 10 for tool qualification determination.
202	Airbus SAS	Page 5 / Figure 1 - Legacy System Software Process Flow Chart / Gate 9.b.(5)(b) 	Delete Gate 9.b.(5)(b).	Differences between DO178C with respect to DO178B are related to OOT, MBD, FM and PDI. There is no difference as far as plans and environment are concerned.	Delete Gate 9.b.(5)(b).	Not accepted. Changed (new) paragraph 9.b.(7)(b) to state more clearly: “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);”
203	THALES Avionics	9.b.(5)(b)	When modifying a previously developed SW, the previous certification baseline has to be considered regarding the plans and environment evolution.	If previous baseline covered plans and environment evolution (through FAA order, IP, CRI, Memo, ...) it could be acceptable to ask to show compliance to the previous certification baseline and not necessary to DO178C. For instance, DO178B handles the case where the compiler is changed (environment change).	Add in §9.b.(5)(b) and in figure 1 that DO178C is applied when previous baseline doesn't cover the plans and environment evolution.	Partially accepted. Changed (new) paragraph 9.b.(7)(b) to state more clearly: “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);”
204	Boeing	Page 7 Paragraph	A strict interpretation of this requirement would force an applicant to update to DO-178C. For example, if the software plans had	Clarification is needed to allow applicants flexibility and to prevent future misinterpretation.	Clarify the intent of the proposed text that states:	Accepted. Changed (new) paragraph 9.b.(7)(b) to state more clearly: “You have maintained, and can still use, the

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		9.b.(5)(b)	identified use of an offshore sub-team and now the activities of the sub-team were brought back to a domestic location, one could interpret the requirement to force the applicant to move to DO-178C, though no DO-178B objectives were impacted by the move. We recommend that this proposed text be revised to allow more flexibility to applicants.		“(b) The original software plans, processes, and life cycle environment have been maintained and can still be used; ...”	software plans, processes, and life cycle environment, including process improvements and changes resulting from subparagraph 9.b.(2);”
205	Airbus SAS	Page 7, 9.b.(5)(b)	Remove: (b) The original software plans, processes, and life cycle environment have been maintained and can still be used;	Differences between DO178C with respect to DO178B are related to OOT, MBD, FM and PDI. There is no difference as far as plans and environment are concerned.		Not accepted. The intent is that if the applicant has not done an adequate job of maintaining their plans and the environment, then they should upgrade their processes to DO-178C standards.
206	Honeywell ODA	Page 6, Section 9 figure 1 and paragraph 5 (b)	“The original software plans, processes, and life cycle environment have been maintained and can still be used; “This section could use more concrete criteria for “have been maintained”. Does that mean no changes at all or what level of “maintenance” is allowed and still be considered acceptable to reuse 178B? Does a new PSAC for the proposed change preclude the argument of “original software plan”? How do we assure a consistent interpretation?”	Missing definitions	Develop definitions for “maintained” and acceptable reuse of DO-178A/B	Partially accepted. Changed (new) paragraph 9.b.(7)(b) to state more clearly: “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);”

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207	Green Hills Software	Page 7 9.b.(5) Item (a) and (b)	<p>Item (a) discusses potential updates from Appendix, but (b) discusses plans being maintained.</p> <p>It is not clear whether a plan could be updated to account for the Appendix and yet still satisfy (b) (i.e., can a plan still be changed as part of maintenance).</p>	<p>There is a potential process discrepancy that may be interpreted inconsistently.</p> <p>If plans cannot be changed, than any change to a plan, standard, or process will result in upgrade to DO-178C. This would include any normal maintenance related changes.</p> <p>Also, if plans cannot be changed, then it is not clear what written document would be used to add acceptable changes from the referenced Appendix (PSAC is not the best vehicle, as this is intended for the cert authority, not the project development team).</p> <p>If plans cannot be changed without being considered for upgrade, there will be a tendency to forgo updates in order to retain the older process.</p>	<p>Clarify if changes can be made to plans, processes, and life cycle environment as part of legacy system that would prefer to not upgrade to DO-178C.</p> <p>If changes to the plans do require an upgrade to DO-178C, state this (and compliance consequence of using out of date plans).</p>	<p>Accepted. Changed (new) paragraph 9.b.(7)(b) to state more clearly: “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);”</p>
208	Garmin	Page 7, 9.b.(5).(b)	<p>If Garmin’s 9.b recommendation to recognize DO-178B as an acceptable means of compliance is not accepted, then the following comment should be considered for the 9.b.(5).(b) condition for continued use of previous DO-178 versions:</p> <p>The 9.b.(5).(b) condition should be changed to clarify that earlier versions of DO-178 continue to be applicable to software changes even when there have been changes to plans, processes or life cycle environment as documented in the Software Accomplishment</p>	<p>The 9.b.(5).(b) condition, as written, is unclear and can be interpreted to mean that DO-178C must be applied when there is any change to software plans, processes or life cycle environment. It is common for plans, processes and life cycle environment to change in minor ways such as clerical changes to standards and/or updates to commonly used SW applications such as word processors. DO-178B and DO-178C make it clear that differences from plans, processes and standards can be</p>	<p>Change 9.b.(5).(b) to:</p> <p>“The original software plans, processes, and life cycle environment have been maintained and can still be used (i.e. new Software Plans do not need to be submitted)”.</p> <p>A corresponding change should be made to the flowchart of Figure 1.</p>	<p>Partially accepted. Changed (new) paragraph 9.b.(7)(b) to state more clearly: “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);”</p>

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			Summary.	documented in the Software Accomplishment Summary and do not trigger a return to the Planning Process, which itself would imply that DO-178C should be applied.		
209	Honeywell ODA	Page 7, 9.b.(5)(b)	This paragraph is imprecise.	Text is imprecise.	Change text to read: "The original software plans, processes, and life cycle environment have been maintained and are to be reused without change."	Not accepted. The recommendation is too restrictive.
210	Embraer	Section 9 - Figure 1, 9.b(5)(b) and 9.b(5)(c); pages 5 and 7	Table 2 provides the assurance level relationship between DO-178C and previous versions of the standard. There is a similar table in the Order 8110.49 Chapter 10.	However, the Order gives the possibility of a software level 2 as per DO-178/178A be classified as level B or A. For software level 2 being proposed as equivalent to level B it is necessary an agreement with certification authorities.	Embraer understands that Table 2 in the AC 20.115C should be harmonized with Figure 10.1 in the Order 8110.49.	Partially accepted. A note was added for equivalency at level 2: "For legacy system software developed using DO-178 or DO-178A at Essential/Level 2 that was previously shown to be equivalent to DO-178B level B per Order 8110.49, paragraph 10-3.a.(1), equivalency remains valid for the new project."
211	Eurocopter	Page 7 (§ 9.b.(5)(c))	<i>"(c) For legacy system software developed using DO-178 or DO-178A, no new software tools are used;"</i> One can understand that any change in the tools would lead to upgrade the approval baseline from DO-178 or DO-178A to DO-178C.	Resolution of tool obsolescence should not lead to an upgrade of the software development process. Also, it should be allowed to add verification tools without upgrading the baseline if no verification credit is claimed.	To make more explicit the concept <i>"no new software tools are used"</i> .	Accepted. The flow chart and respective paragraphs have been revised. The flow chart now refers to paragraph 10 (Tool Qualification) for all tools (new/changes) for process to follow. While we revised the process so as not to require DO-178/DO-178A software upgrade to DO-178C, a new tool would require DO-178C/DO-330 qualification.
212	Honeywell ODA	Page 5 Figure 1 Page 7	Figure 1 and paragraph 9.b.5.c addresses new tools used on legacy DO-178 and DO-178A projects, but does not explicitly address tools qualified via DO-178B (addressed by section 11). This created confusion for many readers	Need clarification on tools qualified under DO-178B to eliminate confusion.	Suggest clarifying paragraph 9.b.5.c to read "For legacy system software developed using DO-178 or DO-178A, no new software tools are used"	Partially accepted. A new paragraph 9.b.(5) has been added (with flow chart change) so that any new tools or changes to tools will require going to paragraph 10-Tool Qualification, for determination

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		Para 9.b.5.c	and an interpretation that section 11 conflicted with Figure 1.		(see section 11 for guidance on tool qualification for tools and legacy software developed using DO-178B); and”	of whether or not qualification is required.
213	GE Aviation Systems	Page 5, Figure 1 and section 9.b.(5)(c) Same comment also applies to Page 9, section 11.b.(4)	To state that an introduction of a verification tool will now require projects to jump to RTCA/DO-178C seems extreme.	This will discourage applicants from automating tedious/error prone tasks. In addition this doesn't make sense when reading 9.b.(6). If the applicant only has to apply RTCA/DO-178C on the “changes” and does not change any software tools. By this assertion, section 9.b.(6), you are stating that all software tools used on the program meet the intent of RTCA/DO-178C. So to restate this, if a tool is developed under RTCA/DO-178B it meets the intent of RTCA/DO-178C. So why not allow a tool that is developed under RTCA/DO-178B on a legacy program?	Remove 9.b.(5)(c). -or- Provide additional clarification on how to evaluate changes to software tools	Partially accepted. Paragraph 9.b.(5)(c) has been removed. A new paragraph 9.b.(5) has been added (with flow chart change) so that any new tools or changes to tools will require going to paragraph 10-Tool Qualification, for determination of whether or not qualification is required. A change to a DO-178/DO-178A tool requires the tool to be qualified to DO-178C/DO-330, but not the software.
214	Green Hills Software	Page 5 (Figure 1) and Page 6 (9.b.(5))	Use of “DO-178” (as referring to any version of the document) overloads the use of “DO-178” to refer to the original version of DO-178.	Overloading this term results in confusion as to which usage is appropriate in each instance.	Use a different term when referring to any version of the RTCA document. At one time, I seem to recall use of “DO-178()” as a means used to refer to any version (this could be defined as part of first use of the general term).	Partially accepted. (New) paragraph 9.b.(7) already clarifies the intent by stating “...of DO-178 (i.e. DO-178, DO-178A, or DO-178B)...” The flow chart has been modified as suggested. The DO-178() nomenclature has been used in new paragraph 9.b.(8).
215	Garmin	Page 7, 9.b.(5).(c)	If Garmin’s 9.b recommendation to recognize DO-178B as an acceptable means of	The tool qualification considerations defined in DO-178C (determination of	Remove the existing 9.b.(5).(c). Add a new item	Partially accepted. Paragraph 9.b.(5)(c) has been removed. A new paragraph

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			<p>compliance is not accepted, then the following comment should be considered for the 9.b.(5).(c) condition for continued use of DO-178 previous versions:</p> <p>The addition of a software tool should be a case considered independently from 9.b.(5). If legacy system software otherwise qualifies for modification using DO-178 or DO-178A and a new software tool is used, it should be permissible to qualify the tool by itself according to DO-178C section 12.2.</p>	<p>whether qualification is needed, determination of qualification level, and the qualification process) are independent of the objectives being automated by the tool. Whether the software has been developed using DO-178, DO-178A or DO-178B, DO-178C section 12.2 can be used to qualify a tool. Therefore, DO-178C can be applied to the tool without requiring it to be applied to the software change.</p>	<p>after 9.b.(5) that states:</p> <p>“If the conditions of subparagraph 9.b.(5) are met for legacy system software developed using DO-178 or DO-178A, and a new software tool is used, qualify the tool according to DO-178C section 12.2.”</p> <p>A corresponding change should be made to the flowchart of Figure 1.</p>	<p>9.b.(5) has been added (with flow chart change) so that any new tools or changes to tools will require going to paragraph 10-Tool Qualification, for determination of whether or not qualification is required. A change to a DO-178/DO-178A tool requires the tool to be qualified to DO-178C/DO-330, but not the software.</p>
216	Sandel Avionics Inc.	Page 7-9.b.(5)(c)	<p>What if a version of the tool is changed? Just want to clarify by “new software tool” it means a new tool that is added and not an existing tool that is updated.</p>	<p>There are many instances when the version of already listed tool is changed by vendor, but the delta qualification illustrates that no functional changes are made.</p>	<p>The AC should clarify DO-178C needs to be only followed if a new tool is added not if the existing tool is modified. A provision for analysis should be provided rather than just making a statement that DO-178C needs to be followed.</p>	<p>Accepted. Paragraph 9.b.(5)(c) has been removed. A new paragraph 9.b.(5) has been added (with flow chart change) so that any new tools or changes to tools will require going to paragraph 10-<i>Tool Qualification</i>, for determination of whether or not qualification is required. Paragraph 10, <i>Tool Qualification</i>, allows for an analysis for DO-178B tools. DO-178/DO-178A tools may need to be requalified using DO-330, but the software does not need to be upgraded using DO-178C.</p>
217	Honeywell ODA	Page 7, Para 9b.(5)(c)	<p>What is the definition of “New”? New to the project? New to the company? New version of a previously qualified tool? I also assume this does not apply to DO178B systems per the text.</p>	<p>Need clarification to establish compliance.</p>	<p>Clarify if not applicable for DO178B tool qualification. Provide better definition of “New”.</p>	<p>Partially accepted. Paragraph 9.b.(5)(c) has been removed. A new paragraph 9.b.(5) has been added (with flow chart change) so that any new tools or changes to tools will require going to paragraph 10-<i>Tool Qualification</i>, for determination of whether or not qualification is required.</p>

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						Paragraph 10, <i>Tool Qualification</i> , allows for an analysis for DO-178B tools. DO-178/DO-178A tools may need to be requalified using DO-330, but the software does not need to be upgraded using DO-178C.
218	TCCA	Page 7 Paragraph 9 b (5) (c)	Expand the question to check if for changes to DO-178B developed sw new tools have been introduced that belong to criteria 1 or 2 applying DO-178C.	DO-178B new tools that are not Criteria 3 tools need to be qualified by using DO-178C and DO-330.	Expand the question.	Not accepted. If a DO-178B tool was previously qualified to a level equivalent to the required TQL, then the unchanged tool can be used for a DO-178C project. A new tool used for a DO-178B project can be qualified using a DO-178B tool qual process.
219	EASA	§9.b Fig 1, §9.b.(5)(c), §11.d	The DO-330 supplement provides clearer considerations for tool classification and qualification than DO-178B section 12.2. It seems than the use of DO-178B guidance is still deemed adequate to support tool qualification, even for new software tools.	In our opinion, regarding the use of tools, DO-178B should also be considered as “legacy” compared to DO-178C/DO-330, at least when a new criteria 1 or 2 tool is introduced.	Could you please consider the need to apply the DO-330 supplement also for DO-178B previously developed Software, at least for any new criteria 1 or 2 tool?	Not accepted. If a DO-178B tool was previously qualified to level equivalent to the required TQL, then the unchanged tool can be used for a DO-178C project. A new tool used for a DO-178B project can be qualified using a DO-178B tool qual process. However, compliance to DO-178C/DO-330 cannot be claimed.
220	EASA	§9	The conditions described within §11.b. and §11.c. under which it is acceptable to continue to use the DO-178B tool qualification process for a DO-178C project, are not depicted in §9.	Even if the scope of §9 is focused on legacy SW, it may be useful to already highlight here the concern about “legacy” software tools and the potential need to apply DO-330.	Could you please consider at least to add note §9 referring to the specific guidance for DO-178b qualified software tools described in §11.b & §11.c?	Accepted. Paragraph 9.b.(5)(c) has been removed. A new paragraph 9.b.(5) has been added (with flow chart change) so that any new tools or changes to tools will require going to paragraph 10- <i>Tool Qualification</i> , for determination of whether or not qualification is required.
221	Rockwell Collins, Inc.	9.b.(5)(d)	Introducing Parameter Data Item files are identified specifically in this criteria; however, modifications to existing PDI files isn’t addressed. Does that mean as long as an applicant doesn’t	Please provide clarification in the AC.		Accepted. Changed to: “You do not introduce parameter data item files, as defined in DO-178C, <u>for the first time</u> during the modification.”

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			<p>introduce a new “file” but rather just modifies an existing file regardless the extent of the modification (ie., complete modification of the contents of the existing PDI file), that transitioning to DO-178C is not going to be required?</p> <p>Alternatively, is it meant that if no parameter files existed before but they are introduced during the modification that we are now required to use DO-178C?</p>			
222	Sandel Avionics Inc.	Page 7-9.b.(5)(d)	<p>This needs to be clarified as DO-178C requires requirements for Parameter File items (parameter data). Parameter data in form of Parameter Data item file influences the behavior of software without modifying the executable object code that is managed as a separate configuration item (example include database and configuration tables)</p> <p>If it is being stated if new parameter items added to legacy software requires following DO-178C then it will cause inconsistency as requirements will be only updated for the delta parameters added and not for the whole parameter data file. Reference to 4.2(j) of DO-178C. States planning required for Parameter item file, many instances in a minor change to legacy software may not require changes to planning documents. The intent needs to be clarified. Is it being imposed that if existing parameter items are changed (value change or range change) then DO-178C needs to be followed.</p>	Avoid inconsistency and provide clear definition.	The AC should provide clear guidance so minor changes don’t become major because of the addition requirements imposed by DO-178C. A provision for analysis should be provided rather than just making a statement that DO-178C needs to be followed.	Partially accepted. Use of a new PDI file could have a significant impact on the operational software. Changed to: “You do not introduce parameter data item files, (as defined in DO-178C,) <u>for the first time</u> during the modification.”

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223	Garmin	Page 7, 9.b.(5).(d)	<p>If Garmin’s 9.b recommendation to recognize DO-178B as an acceptable means of compliance is not accepted, then the following comment should be considered for the 9.b.(5).(d) condition for continued use of previous version:</p> <p>The introduction of a PDI file should be a case considered independently from 9.b.(5). If legacy system software otherwise qualifies for modification using DO-178B and a new PDI file is used, it should be permissible to qualify the PDI file by itself according to DO-178C.</p>	<p>Prior to the publication of DO-178C, FAA Order 8110.49 Chg 1 Chapter 15 specified an acceptable means of providing design assurance for PDI files. (Note also that identical guidance to Order 8110.49 Chg 1 Chapter 15 was previously specified in FAA Notice 8110.110 Chapter 3.)</p> <p>Order 8110.49 Chg 1 Chapter 15 does not place additional process objectives on the executable software but specifies "... that each [airborne system] database is assured to the appropriate software level using RTCA/DO-178B or other acceptable means, <i>and that they are verified in the context of the functional software</i>, the system, and the overall aircraft use." (paragraph 15-4.b, <i>emphasis added</i>) .</p> <p>Similar to Order 8110.49 Chg 1 Chapter 15, DO-178C <i>does</i> include process objectives for PDI verification that depend on aspects of high level requirements for the executable software that were clarified in DO-178C. Although it may be necessary to enhance the requirements of the modified software to allow verification of the PDI file, it is not necessary to apply DO-178C fully to the modified software.</p>	<p>Remove the existing 9.b.(5).(d). Add a new item after 9.b.(5) that states:</p> <p>“If the conditions of subparagraph 9.b.(5) are met for legacy system software developed using DO-178B, and a new parameter data item file is introduced, qualify the PDI file according to DO-178C.”</p> <p>A corresponding change should be made to the flowchart of Figure 1.</p>	<p>Partially accepted. Use of a new PDI file could have a significant impact on the operational software. Changed to: “You do not introduce parameter data item files, (as defined in DO-178C,) <u>for the first time</u> during the modification.”</p>

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224	BA EEDA	Sect 9b(5)(d)	Statement "...Parameter data item files (as defined in DO-178C) are not introduced...". Is a modification to existing parameter data item file applicable? Is a re-organization of existing parameter data item files, without modification to the content, by introducing new files applicable.	Vagueness of language could lead to misinterpretation.	Clarify by adding specific criteria where parameter data item files are considered "Introduced".	Accepted. Changed to: "Parameter data item files, as defined in DO-178C, are not introduced <u>for the first time</u> during modification."
225	Sikorsky Aircraft ODA	Pg 7, para 9b(5)d	In the case where legacy software is being modified but already existing parameter data are not, does DO-178C need to be used?			No recommendation provided. Changed to: "Parameter data item files, as defined in DO-178C, are not introduced <u>for the first time</u> during modification."
	Final Text	Paragraph 9.b.(5) changed to 9.b.(7)	<p>(7) You may make mModifications may be made to legacy <u>system</u> software using the version of DO-178 (e.g. i.e. DO-178, DO-178A, or DO-178B) that was used for the original software approval, provided <u>all of</u> the following conditions are met:</p> <p>(a) The techniques described in the DO-331, DO-332 (except other than those in Appendix section OO.1.6.2OO.D.1), and or DO-333 are not introduced for the first time during the modification (DO-332 section OO.1.6.2 is to be applied per paragraph 8.d of this AC.); <u>You do not introduce model based development, object oriented technology, or formal methods for the first time during the modification;</u></p> <p>(b) The original software plans, processes, and life cycle environment have been maintained and can still be used; <u>You have properly maintained the original software plans, processes, and life cycle environment, including process improvements and changes resulting from subparagraph 9.b.(2); and</u></p> <p>(c) For legacy system software developed using DO-178 or DO-178A, no new software tools are used; and</p> <p>(c) <u>You do not introduce p</u>Parameter data item files, as defined in DO-178C, are not introduced <u>for the first time</u> during <u>the</u> modification.</p>			
	Original Proposed Text	Paragraph 9.b.(6)	(6) If any of the conditions in subparagraph 9.b.(5) are not met, accomplish all changes to the software using DO-178C and applicable supplements. You may declare all software (both changed and unchanged) as having satisfied DO-178C if all software changes and your processes and procedures, including tool qualification, satisfy DO-178C, DO-330, and supplements, as applicable.			
226	Avidyne Corporation	Pages 5 & 7 Figure 1 and Section 9.b.(6)	This paragraph imposes the requirement that all aspects of the software change be made in compliance with DO-178C if any single characteristic would require such a change. This seems overly restrictive. For example, Paragraph 9.b.(5)(c) responds to inadequate treatment of tool qualification under DO-178 and DO-178A. It requires that new tools	The system characteristics, software features and development methodologies that motivate adoption of DO-178C are logically separable. There's no reason to believe that it would be detrimental to safety to allow them to be treated differently in the change process.	Change the language of Paragraph 9.b.(5) and 9.b.(6) to eliminate "accomplish all changes to the software" and substitute language indicating that individual changes may be treated separately based on the CIA and application of the	Not accepted. We have added provisions for these types of situations in paragraph 9.b. "Although these procedures will apply to the majority of projects, there may be situations that do not follow this flow. You should coordinate these situations with the certification office." Using the hybrid nomenclature of DO-

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			introduced during the change process trigger compliance with DO-178C for all aspects of the change. This is likely to inhibit the adoption of new or improved methods, which is potentially antagonistic to safety. Similarly, if an applicant is an experienced user of OOD under DO-178B and has a system which is fully compliant, introduction of isolated new MBD features would compel the applicant to comply with DO-178C for all changes to the non-MBD areas of the system, potentially inhibiting the introduction of bug fixes and feature enhancements that could have a beneficial effect on safety.		flowchart in Figure 1. Indicate that such a case may require the software to be indicated as, for example, “DO-178B/C”.	178B/C would not be compatible with existing guidance and regulations.
227	Airbus SAS	Page 7, 9.b.(6)	<p>Replace: (6) If any of the conditions in subparagraph 9.b.(5) are not met, accomplish all changes to the software using DO-178C and applicable supplements.</p> <p>By: (6) If any of the conditions in subparagraph 9.b.(5) are not met, accomplish all changes to the software using DO-178C and applicable supplements as relevant regarding introduction of OOT, MBD, FM and PDI.</p>	<p>It might be clear to the reader that reference DO178C is made to parts that cover those techniques (OOT, MBD, FM and PDI) when used.</p> <p>When they are not used, it is not relevant to refer DO178C.</p>	(6) If any of the conditions in subparagraph 9.b.(5) are not met, accomplish all changes to the software using DO-178C and applicable supplements as relevant regarding introduction of OOT, MBD, FM and PDI.	Not accepted. When a change is made, and the applicant wants to declare compliance to DO-178C, then all changes need to be accomplished IAW DO-178C, not just the components affected by the supplements. There may be situations that would allow continued use of an existing DO-178B process.
228	Greg Turgeon	Page 7 Para 9.b.(6)	Declaring products meet DO-178C when only a portion is changed IAW DO-178C is a misleading description of the process assurance used for the software	Avoid future incorrect assumptions about software products. For example, if an applicant only modifies a small % of software using a new DO-178C process, it is not correct that the entire software product was developed and approved to DO-178C. This could provide a false claims and set of	<u>This software will satisfy the requirements of this AC, but you may only declare the changed software satisfies all software (both changed and unchanged) as having satisfied DO-178C.</u>	Not accepted. Rather than requiring DO-178C, we allow the applicant to declare DO-178C for the entire software as an incentive to change their processes and software modifications using DO-178C.

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				confidence for future certifications. This is a particular concern for RTOS and other software component suppliers.		
229	THALES Avionics	9.6 9.b.(6)?	Paragraph to clarify	Does it mean that DO178C is applicable on the previously developed SW modified parts only?	Precise §9.6 answering to the question.	In order to claim compliance to DO-178C, all new software and modifications to software, including processes and procedures, needs to be accomplished using DO-178C.
230	THALES Avionics	9.6	Paragraph to clarify	Does it mean that when modified part will be recognized as compliant to DO178C the whole previously developed SW will be recognized compliant to DO178C?	Precise §9.6 answering to the question.	Partially accepted. It is stated pretty clearly (new text): “accomplish all changes to the software using DO-178C, section 12.1. If you want to declare your software as having satisfied DO-178C, you should accomplish all software modifications using DO-178C and update your processes and procedures, including tool qualification processes, to DO-178C. Your declaration applies to both modified and unmodified software and is valid even if you use unmodified tools that have not been qualified using DO-178C.”
231	Green Hills Software	Page 7 9.b.(6)	Intent of what is permitted under this paragraph is not clear. The effort described here may be substantially less than what is defined in DO-178C Section 12.1.4 (Upgrading a Development Baseline).	Based on the other sections, it seems that the only time DO-178C Section 12.1.4 needs to be applied for DO-178B/A legacy software is when the software level changes. This means that what essentially is an upgrade effort can apply DO-178C (and supplement) activities just to the changes. For example, two-way traceability to test cases, test procedures, and test results. Based on	If DO-178C Section 12.1.4 is intended to be applicable, add description of when and how (in lieu of process described). There should be some written rational on why this is acceptable over applying DO-178C Section 12.1.4 (which would apply if the AC did not discuss this topic).	Partially accepted. Added reference to DO-178C, section 12.1 in the new paragraph 9.b.(9).

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				<p>this, this level of traceability would only have to be applied to the requirements and tests for the impacted changes. That is, they are implicitly satisfied for the unchanged portion.</p> <p>With a large degree of impacts being implicitly satisfied, it is not clear what the merit of applying the new / modified DO-178C objective is.</p> <p>I seem to recall the same method being proposed when DO-178B was introduced (perhaps to address the large number of existing DO-178A software projects that would probably try to argue everything as DO-178A in order to avoid the transition to the new standard).</p> <p>Seems like it is likely to be abused.</p>		
232	Green Hills Software	Page 7 9.b.(6)	Intent of what is permitted under this paragraph is not clear.	<p>Minor clarification required for cascade updates and approvals. The way it is currently phrased, after the first update, all of the software, including the unchanged portions, may be declared as satisfying DO-178C. Thus on the next update (to a different set of requirements), no changes to satisfy DO-178C would have to be made (since could already declared as complying).</p> <p>I do not believe this was the intent.</p>	Add to end “All subsequent changes are made using the processes and procedures that satisfy DO-178C.”	Accepted.
233	Garmin	Page 7,	Ensure that the cited paragraphs do not	It is preferred to remove any ambiguity	In paragraph 9.b.(6), suggest	Accepted. Changed text to say

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		9.b.(6) and Page 9, 11.b and 11.c	<p>conflict.</p> <p>Paragraph 9.b.(6) states that if any changes are completed to DO-178C, then DO-178C can be claimed for the entire software base, if changes, processes, including tool qualification, satisfy DO-178C.</p> <p>Yet paragraphs 11.b and 11.c imply that tool qualification can be continued using DO-178B tool qualification processes for a DO-178C claimed project (under stated conditions for development and verification tools).</p>	or confusion between the cited paragraph's texts.	<p>modifying the phrase "including tool qualification", to only apply to DO-178- or DO-178A-based tools. This coincides with the text in 9.b.(5)(c) that limits the tool qualification factors to those done under DO-178 or DO-178A.</p> <p>If the above conclusion is incorrect, please ensure consistency between the cited paragraphs.</p>	"...including tool qualification processes,..." Even if the tools have not changed, the processes are and the next tool qualification would require DO-178C/DO-330. Paragraph 10. <i>Tool Qualification</i> was changed extensively to make it more clear as to when tools need to be qualified using DO-330 or existing process.
234	Honeywell ODA	Page 7, 9.b.(6)	This paragraph states that "You may declare all software (both changed and unchanged) as having satisfied DO-178C if all..." This leads to some ambiguity with respect to subsequent software changes to this product. For example, what is the policy if changes are made to the previously unchanged software? Must such changes always be made per 178C (since this software is now recognized as 178C compliant) or can the applicant continue to use 178B if permitted per the Figure 1 flow chart?	Text is ambiguous.	Clarify policy to eliminate ambiguity.	Accepted. This was addressed per another comment: added "All subsequent changes are to be made using your processes and procedures that satisfy DO-178C."
235	American Eurocopter Corporation, Certification Department	Pages 4-7, Paragraph 9. Modifying and Re-using DO-178, DO-178A, or DO-178B Software.	<p>Content missing from Section 9: Although it may seem to be an obvious requirement that this guidance only applies to minor changes, Sections 9 and 10 do not discriminate as to the extent of the aggregate of changes made to a legacy software product using outdated software development processes.</p> <p>A rational person would assume that use of this</p>	Explicitly following the guidance it might be possible to use a legacy software configuration item, follow through all the decision gates of Sections 9 and 10 that lead to 9.b(5) and change software using the same DO-178 version as the original approval, over and over again.	My opinion is that a set of "Extent of Change" discrimination checks should be added to the process. If the "Extent of Changes" is less than or equal to 25% of the total legacy code, then changing the software using the same DO-178 version as	If a developer makes a change and wants to declare the software as DO-178C, all processes and procedures, including tool qualification processes, must satisfy DO-178C. Even though a small change may allow claiming DO-178C compliance, the next change will have to be in accordance with DO-178C, and so on. We added the statement "All subsequent changes are to

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		Pages 7-8, Paragraph 10. Change Impact Analysis (CIA).	<p>guidance may only apply to small changes or self-described “minor changes.” However, the guidance does not prevent a new product from being developed from a legacy software product through a sequential set of changes using an outdated DO-178 process, or by not using any process at all.</p> <p>Lastly, the extent of change evaluation process is further exacerbated by the possibility of multiple software modules and configuration items being lumped under one top-level unit certification. I think there needs to be a methodology to capture the difference between product updates and avoidance of certification compliance to more recent DO-178 version requirements.</p>	Using superseded software development processes might be possible even if eventual result of the aggregate of minor changes results in 99% or more of the original legacy software being changed.	<p>the original approval could be considered appropriate.</p> <p>And if the overall extent of the change is greater than 50% of the total legacy code then changing the software using DO-178C, Section 12.1.4, and applicable supplements should be invoked.</p> <p>The gray area between 25% and 50% should probably be negotiated between the applicant and the FAA. For a very low FAA Level of Involvement in the project, the negotiation would not be required.</p> <p>To capture multiple changes made to the same legacy product, the guidance should also take into account the aggregate of changes made since an established baseline.</p> <p>The baseline would need to be established at the last time the original legacy software became an approved product to the same DO-178 version as the original approval, while that DO-178 version was the latest version in effect.</p>	be made using your processes and procedures that satisfy DO-178C.” In the past, declaration of software compliance to a particular standard based on a percentage has been problematic and subject to abuse. Therefore, we decided to avoid that aspect and simplify.

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					All changes beyond that baseline would be evaluated for the aggregate of changes to a legacy product using superseded development processes.	
	New paragraph added	New Paragraph 9.b.(8)	(8) If all of the conditions in subparagraph 9.b.(7) are satisfied, you may accomplish all modifications to the software using the same DO-178 version as the original approval. However, you may not declare your software as having satisfied DO-178C.			
	Final Text	Paragraph 9.b.(6) changed to 9.b.(9)	(9) If any of the conditions in subparagraph 9.b.(7) are not satisfied met , accomplish all changes modifications to the software using DO-178C, section 12.1. and applicable supplements. You may declare all software (both changed and unchanged) as having satisfied DO-178C if all software changes and your processes and procedures, including tool qualification, satisfy DO-178C, DO-330, and supplements, as applicable If you want to declare your software as having satisfied DO-178C, you should accomplish all software modifications using DO-178C and update your processes and procedures, including tool qualification processes, to DO-178C. Your declaration applies to both modified and unmodified software and is valid even if you use unmodified tools that have not been qualified using DO-178C. However, you cannot declare your unmodified tools as having satisfied DO-178C. All subsequent modifications are to be made using your processes and procedures that satisfy DO-178C.			

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	Original Proposed Text	Paragraph 10.a.	<p>10. Change Impact Analysis (CIA). All changes to software must comply with the applicable airworthiness regulations.</p> <p>a. A CIA documents how modifications to software components and associated life cycle data affect the changed components and related components and life cycle data. The analysis should consist of one or more analyses identified in DO-178C, section 12.1 and other analyses as applicable:</p> <ul style="list-style-type: none"> (1) Traceability analysis; (2) Memory margin analysis; (3) Timing margin analysis; (4) Data flow analysis; (5) Control flow analysis; (6) Input/output analysis; (7) Development environment and process analyses; (8) Operational characteristics analysis; (9) Certification maintenance requirements analysis; (10) Partitioning analysis; (11) Hardware interface analysis; (12) Environmental qualification analysis (e.g., radio frequency susceptibility, and emissions of radio frequency energy); and (13) Test procedures and test cases analysis for reverification. 			
236	Embraer	Section 10 – item a); page 7	Section 10.a presents a list of possible analyses to be performed during the Change Impact Analysis.	Embraer noted that most of those analyses are also requested by Order 8110.49, but not all of them (e.g. (12) Environmental qualification analysis). AC 20.115C should be harmonized with Order 8110.49.	Embraer also suggests that additional guidance should be provided on this analysis, for instance some of the aspects should be considered (e.g. software functionalities that affects electromagnetic interference, or changes in software to address any environmental robustness characteristics, etc.).	Not accepted. Paragraph 10 (Change Impact Analysis) has been removed and replaced with paragraph 9.b.(4), which refers to DO-178C, section 12.1. for conducting the CIA. It is not appropriate to mention Order 8110.49 in the AC, since that contains policy intended for ACO engineers to follow.

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237	Garmin	Page 7, 10	This seems to be attempting to replace Order 8110.49, chapter 11, or at least parrot it.	<p>It should be made clearer that this does (or does not) replace the guidance of Order 8110.49, chapter 11, with respect to determination of a minor or major change.</p> <p>Also, the current Order specifies par. 12.1.1 of DO-178B while this new text specifies par. 12.1 of DO-178C. Is this intentional? It seems that 12.1 is correct, so this might be a correction to the original Order text? If it is a correction, it should be brought to attention as such (e.g., via a Note).</p>	Clarify how this guidance supersedes or modifies the current guidance of Order 8110.49 chapter 11. This could be done by adding a Note to paragraph 10.	Not accepted. Paragraph 10 (Change Impact Analysis) has been removed and replaced with paragraph 9.b.(4), which refers to DO-178C, section 12.1. for conducting the CIA. It is not appropriate to mention Order 8110.49 in the AC, since that contains policy intended for ACO engineers to follow.
238	Garmin	Page 7, 10.a	If this paragraph is based on Order 8110.49 chapter 11, it is lacking the explanatory text of 8110.49.	The explanatory text of Order 8110.49 chapter 11 provides for better understanding of the various types of analyses listed in paragraphs 10.a.(1) through 10.a.(13).	Include the explanatory text from FAA Order 8110.49 chapter 11 for each of the analysis types <u>or remove paragraphs 10.a.(1) through 10.a.(13)</u> and adjust 10.a accordingly.	Partially accepted. Paragraph 10 (Change Impact Analysis) has been removed and replaced with paragraph 9.b.(4), which refers to DO-178C, section 12.1. for conducting the CIA.
239	Garmin	Page 7, 10.a., First sentence	Compound sentence grammar error	Too many uses of “and”	“...data affect the changed components, related components and life cycle data.”	Not accepted. Comment no longer applicable. Paragraph 10 (Change Impact Analysis) has been removed and replaced with paragraph 9.b.(4), which refers to DO-178C, section 12.1. for conducting the CIA. The offending sentence was removed.
240	Garmin	Page 7, 10.a., Second sentence	Overloading of the word “analysis”.	The text refers to DO-178C section 12.1 as identifying types of analysis. The analysis types in that section actually refer to the aspects of Previously Developed Software (PDS) which may have changed and are thus driving the	<p>Change second sentence of 10a. to:</p> <p>“One or more analysis should be performed based on the change made to the software</p>	Accepted. Paragraph 10 (Change Impact Analysis) has been removed and replaced with paragraph 9.b.(4), which refers to DO-178C, section 12.1. for conducting the CIA. Made the change as recommended.

No.	Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
				CIA. The AC sentence then itemizes true types of analysis which may be applicable based on the aspect of the PDS driving the change.	as identified in DO-178C, section 12.1. Analyses of the change should be made as applicable; (1) Traceability analysis; (2)	
241	Sikorsky Aircraft ODA	Pg 7, para 10a	Requirement and design impact analysis should be included in list		Add them	Not accepted. Comment no longer applicable. Paragraph 10 (Change Impact Analysis) has been removed and replaced with paragraph 9.b.(4), which refers to DO-178C, section 12.1. for conducting the CIA.
242	Sikorsky Aircraft ODA	Pg 7, para 10 Pg 7, para 10.a Pg 8, para 10.a(13)d	Para 10 explains What a CIA is and how to conduct one. Then, Pg 8 says to “Document your process for conducting a CIA. Summarize the results of the analysis in the Software Accomplishment Summary (SAS).” It seems like the AC is imposing additional requirements both on the process and for the artifacts, above what is documented in 178C. This section feels like an afterthought to 178C.	178C section 12.1 talks about handling previously developed software and, while it does say to analyze the impact of the changes, it doesn’t include all the analysis items in the AC para 10.a. In addition, it isn’t clear anywhere that the SAS would be the appropriate place to document it.	Since other sections of this AC mainly provide guidance on how to use 178X based on the circumstances, determine the intent of placing additional requirements in the AC and whether it is the appropriate place.	Partially accepted. Paragraph 10 (Change Impact Analysis) has been removed and replaced with paragraph 9.b.(4), which refers to DO-178C, section 12.1. for conducting the CIA.
243	THALES Avionics	10.a.(12)	§ doesn’t handle with SW aspect	Environmental qualification analysis is not in the scope of the SW	Suppress this §	Partially accepted. Paragraph 10 (Change Impact Analysis) has been removed and replaced with paragraph 9.b.(4), which refers to DO-178C, section 12.1. for conducting the CIA.
244	L-3 Communications	Page 7, Paragraph 10.a.	The first sentence ends in a run on list.	To improve readability of list.	Change “... affect the changed components and related components and life cycle data.” to “...affect the changed components, related	Not accepted. Comment no longer applicable. Paragraph 10 (Change Impact Analysis) has been removed and replaced with paragraph 9.b.(4), which refers to DO-178C, section 12.1. for conducting

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					components, and life cycle data.”	the CIA.
245	L-3 Communications	Page 7, Paragraph 10.a.(6)	Since items (4) and (5) stated Data and Control coupling, Input/output can be mistaken for inter-software interface.	Clarification.	Suggest adding I/O acronym after Input/output.	Not accepted. Comment no longer applicable. Paragraph 10 (Change Impact Analysis) has been removed and replaced with paragraph 9.b.(4), which refers to DO-178C, section 12.1. for conducting the CIA.
246	Boeing	Page 7, Paragraph 10.a.(8)	We recommend deleting paragraph 10.a.(8).	This type of analysis is beyond the scope of a pure software change analysis. It is a systems activity that is already covered by AC 20-174 (“Development of Civil Aircraft and Systems”) when using ARP4754A, Section 6.3, “Modification Impact Analysis.”	Delete the proposed text that states <i>“(8) Operational characteristics analysis”</i>	Accepted. Paragraph 10 (Change Impact Analysis) has been removed and replaced with paragraph 9.b.(4), which refers to DO-178C, section 12.1. for conducting the CIA.
247	Boeing	Page 7, Paragraph 10.a.(9)	We recommend deleting paragraph 10.a.(9).	This type of analysis is beyond the scope of a pure software change analysis and is already addressed by other FAA material, such as AC 25-19A (“Certification Maintenance Requirements”).	Delete the proposed text that states: <i>“(9) Certification maintenance requirements analysis;”</i>	Accepted. Paragraph 10 (Change Impact Analysis) has been removed and replaced with paragraph 9.b.(4), which refers to DO-178C, section 12.1. for conducting the CIA.
248	Boeing	Page 8 Paragraph 10.a.(11)	We recommend revising the text of subparagraph (11) to read as follows: <i>“(11) Hardware/<u>Software interface integration</u> analysis;”</i>	Our recommended changes provide better alignment with DO-178C terminology.	Revise text per our recommendation,	Not accepted. Comment no longer applicable. Paragraph 10 (Change Impact Analysis) has been removed and replaced with paragraph 9.b.(4), which refers to DO-178C, section 12.1. for conducting the CIA.

No.	Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
249	Boeing	Page 8, Paragraph 10.a.(12)	We recommend deleting paragraph 10.a.(12).	This type of analysis is beyond the scope of a pure software change analysis. It is a systems activity that is already covered by other FAA material, such as AC 21-16G (“RTCA Document DO-160 versions D, E, F, and G, ‘Environmental Conditions and Test Procedures for Airborne Equipment’”).	Delete the proposed text states: “(12) <i>Environmental qualification analysis (e.g., radio frequency susceptibility and emissions of radio frequency energy); and ...</i> ”	Accepted. Paragraph 10 (Change Impact Analysis) has been removed and replaced with paragraph 9.b.(4), which refers to DO-178C, section 12.1. for conducting the CIA.
250	Green Hills Software	Page 7 10.a.(9)	Meaning of “Certification maintenance requirements” is not well known to software developers.	This term quite often has to be explained when CIA is being performed under DO-178B.	Add “(i.e., required periodic task, established during the design certification of the airplane as an operation limitation of the type certificate)” to after “requirements” to explain what this is.	Not accepted. Comment no longer applicable. Paragraph 10 (Change Impact Analysis) has been removed and replaced with paragraph 9.b.(4), which refers to DO-178C, section 12.1. for conducting the CIA.
251	Elbit Systems Ltd.	Page 8 § 10a	Additional Stack Analysis	Additional applicable analysis for CIA activity	<ul style="list-style-type: none"> • Addition of wording " (14) Stack analysis " • Maybe to re-number the possibilities per subject ? 	Not accepted. Comment no longer applicable. Paragraph 10 (Change Impact Analysis) has been removed and replaced with paragraph 9.b.(4), which refers to DO-178C, section 12.1. for conducting the CIA.
252	FAAC	7, 10a	While the list of topics given here echoes that in FAA Order 8110.49 (chg 1), it is silent on a number of other analysis areas that should be revisited. These are either directly mentioned or implied in DO-178C and include: 1. Compiler/linker warning analysis 2. Processor errata analysis 3. Derived requirements justification (for new	Make explicit the requirement to revisit these topics when changes are made.	As noted	Not accepted. Comment no longer applicable. Paragraph 10 (Change Impact Analysis) has been removed and replaced with paragraph 9.b.(4), which refers to DO-178C, section 12.1. for conducting the CIA.

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			or modified derived requirements)			
253	Randall Fulton	Page 8-10.a.(12)	(12) Environmental qualification analysis (e.g., radio frequency susceptibility and emissions of radio frequency energy); and	Environmental qual should be more generic, changes could impact more than EMI/RFI. Thermal could be impacted, etc.	Make more generic to include other environmental qualification concerns.	Not accepted. Comment no longer applicable. Paragraph 10 (Change Impact Analysis) has been removed and replaced with paragraph 9.b.(4), which refers to DO-178C, section 12.1. for conducting the CIA.
254	Garmin	Page 8, 10.a.(13)	10.a.(13) would seem to be a subset of the second sentence of 10.b.	10.b. second sentence requires the applicant to assess what verification (which includes test) is required to ensure the modified software performs its intended function and continues to comply with the identified means of compliance. It would seem that this should be necessary for any change, not just those impacting continued operational safety (COS). You don't want changes to make the software non-compliant.	Delete item 10.a.(13). Additionally, pull the second sentence of 10.b. out into its own sub-paragraph of 10 (e.g., a new paragraph 10.c).	Not accepted. Comment no longer applicable. Paragraph 10 (Change Impact Analysis) has been removed and replaced with paragraph 9.b.(4), which refers to DO-178C, section 12.1. for conducting the CIA.
255	Honeywell ODA	Paragraph 10.a	The CIA description in the AC is unnecessarily complex. Based on Figure 1, the only information the CIA needs to determine (within the context of this AC) is: <ul style="list-style-type: none"> • Will MBD, OOT, FM be used? • Have the original plans and environment been maintained? • Are there new software tools? • Are PDI files introduced? 	Unnecessary content. The CIA is not the means for determining how to apply DO-178C and Supplements.	Simplify the description of the CIA to require the determination of only that information necessary to answer the flow chart questions (Figure 1).	Not accepted. Paragraph 10 (Change Impact Analysis) has been removed and replaced with paragraph 9.b.(4), which refers to DO-178C, section 12.1. for conducting the CIA. Although the scope of a CIA is more comprehensive than determining whether or not DO-178C is required, it is still an important part of conducting a software change.

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256	Honeywell ODA	Page 5, Fig 1 Page 7, Para 10	The change impact analysis is ill-defined and not appropriate for determining if DO178C is applicable.	Figure 1 states that the primary decision for DO178C is MBD, Tools, OOT, parameter data files, new development environment etc. None of these are part of the CIA and there is no criteria as to what parts of the CIA at what levels would require DO-178C. The CIA is used as a basis for LOFI and Major/Minor determination. In addition, the majority of this data is unknown in the planning stages.	The CIA as written is irrelevant and should be removed. Sections 9.b(4) and 9.b(5) provides the relevant criteria for DO178C determination.	Partially accepted. Paragraph 10 (Change Impact Analysis) has been removed and replaced with paragraph 9.b.(4), which refers to DO-178C, section 12.1. for conducting the CIA. Although the scope of a CIA is more comprehensive than determining whether or not DO-178C is required, it is still an important part of conducting a software change.
257	Boeing	Pages 7-8, Paragraph 10	We recommend moving the entire paragraph 10 to AC 20-174 (“Development of Civil Aircraft and Systems”) or to a new AC on modification to existing systems.	The proposed paragraph does not cover a pure software change analysis and contains only some systems items that an applicant may need to do for a modification to an existing system. The paragraph should be moved to an existing AC or to a new AC to address modification(s) to existing aircraft systems. The existing AC, or new AC, could then also include additional system related items.	Move paragraph 10 per our recommendation.	Not accepted.
	Final Text	Paragraph 10.a removed	Paragraph 10 has been removed and replaced with new paragraph 9.b.(4)			
	Original Proposed Text	Paragraph 10.b., c., d.	<p>b. Conduct a CIA to determine the potential impact of the change(s) on continued operational safety of the aircraft on which the system and software components are to be installed. The CIA should determine the extent of the changes, the impact of those changes, and what verification is required to ensure that the modified software performs its intended function and continues to comply with the identified means of compliance.</p> <p>c. Conduct the verification as indicated by the CIA.</p> <p>d. Document your process for conducting a CIA. Summarize the results of the analysis in the Software Accomplishment Summary (SAS). Make any modified or regenerated software life cycle data resulting from the changes available to the FAA when requested.</p>			

No.	Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
258	Boeing	Page 8, Paragraph 10.b.	We recommend revising the text to read as follows: <i>“b. Conduct a CIA to determine the potential impact of the change(s) on continued operational safety of the aircraft on which the system and the software components <u>that</u> are to be installed. The CIA should determine the extent of the changes, the impact of those changes, and what verification is required to ensure that the modified software performs its intended function and continues to comply with the identified means of compliance.”</i>	The proposed analysis is beyond the scope of a pure software change analysis and contains systems activities.	Revise text per our recommendation.	Not accepted. Paragraph 10 (Change Impact Analysis) has been removed and replaced with paragraph 9.b.(4), which refers to DO-178C, section 12.1. for conducting the CIA.
259	Garmin	Page 8, 10.d., Second sentence	This seems unnecessary and not correct in all cases.	The FAA can request any data they need when finding compliance as noted in paragraph 6.d. Additionally, some of the modified or regenerated data from the change may, in fact, be part of the type design and thus required to be presented to the FAA upon application, not just when requested.	Delete sentence. FAA can request what they want/need and applicant provision of necessary data without request is covered by paragraph 6.d.	Accepted. Comment is with regard to third sentence, not second. Third sentence deleted.
260	Avidyne Corporation	Page 8 Paragraph 10.d.	Paragraph 10.d. establishes a requirement for a document describing the applicant’s Change Impact Analysis (CIA) process. No such requirement exists in DO-178() or any prior FAA guidance or policy. It is inappropriately burdensome for the requirement to be introduced here. Sufficient information exists in DO-178B, DO-178C and Order 8110.49 to establish the recommended elements of a CIA without the need for an applicant to	Sufficient information exists in DO-178B, DO-178C and Order 8110.49 to establish the recommended elements of a CIA without the need for an applicant to independently produce a description of his process.	Remove the first sentence of Paragraph 10.d.	Accepted.

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			independently produce a description of his process.			
261	GE Aviation	10.d.	It states that the CIA should be documented in the SAS. The SAS is one of the last data items to get submitted and approved.	Shouldn't the CIA be documented earlier than in a SAS? A PSAC or substantiation plan is a more appropriate place for this.	The CIA data should be captured in either a PSAC or a substantiation plan, or other suitable means. This should be completed well before the SAS is written.	Not accepted. Order 8110.49, paragraph 11-3.c, states that the CIA should be documented in the SAS, and paragraph 11-3.d states that the PSAC should contain a summary of the CIA data and the applicant's strategy for addressing the change issues.
262	GE Aviation Systems	Page 8, Section 10.d.	It states that the CIA should be documented in the SAS. This doesn't seem to be in alignment with FAA Order 8110.49, chapter 11	<p>FAA Order 8110.49 states that the FAA proper needs to confirm the major/minor determination. Having this documented in the SAS is too late, if the FAA disagrees with the applicant position that a change in minor.</p> <p>In addition doesn't section 12 of RTCA/DO-178C seem to imply that the contents of a CIA be included in the PSAC. I do agree that the CIA in the PSAC is a "preliminary" CIA since not all development/analysis would have been done that could change the contents in the CIA - so the final CIA should be presented in the SAS</p>	The CIA data should be captured in the PSAC/planning documents. The approval of the PSAC/planning documents will serve as concurrence of the major/minor determination.	Not accepted. Order 8110.49, paragraph 11-3.c, states that the CIA should be documented in the SAS, and paragraph 11-3.d states that the PSAC should contain a summary of the CIA data and the applicant's strategy for addressing the change issues.
	Final Text	Paragraph 10.b.,c.,d removed	Paragraph 10 has been removed and replaced with new paragraph 9.b.(4)			

No.	Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition																																
	Original Proposed Text	Paragraph 11.	<p>11. Tool Qualification. DO-178C, section 12.2, and DO-330 provide an acceptable method for tool qualification. DO-330 contains its own complete set of objectives, activities, and life cycle data for tool qualification. For legacy systems with DO-178B software involving tool qualification or use of legacy tools on current DO-178C projects, the following subparagraphs provide guidance for establishing if any additional activity or qualification is necessary for compliance with this AC.</p> <p>a. DO-178C establishes five levels of tool qualification based on the tool use and its potential impact in the software life cycle processes (see DO-178C, section 12.2.2 and table 12-1). However, DO-178C does not address the use of tools previously qualified to the DO-178B criteria. For a tool previously qualified as a DO-178B development tool or verification tool, use table 3 to determine the correlation between the DO-178B tool qualification type and DO-178C tool criteria and tool qualification levels (TQL).</p> <p style="text-align: center;">Table 3 - Correlation Between DO-178B Tool Qualification Type and DO-178C Tool Criteria/TQL</p> <table border="1" data-bbox="1131 683 2010 1130"> <thead> <tr> <th><i>DO-178B Tool Qualification Type</i></th> <th><i>Software Level</i></th> <th><i>DO-178C Tool Criteria</i></th> <th><i>DO-178C TQL</i></th> </tr> </thead> <tbody> <tr> <td>Development</td> <td>A</td> <td>1</td> <td>TQL-1</td> </tr> <tr> <td>Development</td> <td>B</td> <td>1</td> <td>TQL-2</td> </tr> <tr> <td>Development</td> <td>C</td> <td>1</td> <td>TQL-3</td> </tr> <tr> <td>Development</td> <td>D</td> <td>1</td> <td>TQL-4</td> </tr> <tr> <td>Verification</td> <td>A, B</td> <td>2</td> <td>TQL-4</td> </tr> <tr> <td>Verification</td> <td>C, D</td> <td>2</td> <td>TQL-5</td> </tr> <tr> <td>Verification</td> <td>All</td> <td>3</td> <td>TQL-5</td> </tr> </tbody> </table> <p>b. If a development tool was previously qualified using DO-178B, you may continue to use the DO-178B qualification process for a DO-178C project, provided that:</p> <ol style="list-style-type: none"> (1) The tool has not been modified; (2) The tool operational environment has not been modified; and (3) The DO-178B software level assigned to the tool correlates with or exceeds the required TQL established by DO-178C. (4) If one or more of these conditions are not met, the tool should be qualified using DO-178C and DO-330. <p>c. If a verification tool was previously qualified using DO-178B, you may continue to use the DO-178B qualification process for a DO-178C project, provided that:</p>	<i>DO-178B Tool Qualification Type</i>	<i>Software Level</i>	<i>DO-178C Tool Criteria</i>	<i>DO-178C TQL</i>	Development	A	1	TQL-1	Development	B	1	TQL-2	Development	C	1	TQL-3	Development	D	1	TQL-4	Verification	A, B	2	TQL-4	Verification	C, D	2	TQL-5	Verification	All	3	TQL-5			
<i>DO-178B Tool Qualification Type</i>	<i>Software Level</i>	<i>DO-178C Tool Criteria</i>	<i>DO-178C TQL</i>																																			
Development	A	1	TQL-1																																			
Development	B	1	TQL-2																																			
Development	C	1	TQL-3																																			
Development	D	1	TQL-4																																			
Verification	A, B	2	TQL-4																																			
Verification	C, D	2	TQL-5																																			
Verification	All	3	TQL-5																																			

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			<p>(1) The tool has not been modified;</p> <p>(2) The tool operational environment has not been modified; and</p> <p>(3) The tool qualification level required by DO-178C is TQL5.</p> <p>(4) If one or more of these conditions are not met, the tool should be qualified using DO-178C and DO-330.</p> <p>d. For a DO-178B project, DO-178B, section 12.2, can be used for qualifying new or modified tools in support of modifications to DO-178B legacy system software.</p>			
263	Honeywell ODA	Page 8, Para 11.a. and Table 3	Incorrect references to DO178C throughout the section.	DO-330 determined the requirements for TQL 1 thru 5 NOT DO178C. DO178C determined the tool criteria not the TQL requirements.	Change Paragraph 11.a. to a. DO-330 established five levels of tool qualification . . . tool criteria and DO-330 tool qualification levels (TQL). Change table 3 far right heading to read “DO-330 TQL” (Note this is incorrect in DO178C also).	Not accepted. Table 12-1 in DO-178C establishes the TQL required for any particular project based on the tool criteria and the software level. DO-330 describes the objectives, activities, guidance, and life cycle data for each TQL. Relabeled Table 3 column heading as “DO-178C/DO-330 TQL.”
264	Honeywell ODA	Page 9 Paragraph 11 b.& c.	Modification to a tool and/or environment should be evaluated for significance prior to forcing a requalification to DO-178C tool requirements	Small changes to environment or tool should be allowed if the applicant can show the change is minor and that past use of the tool for certification credit was successful following the original tool qualification process	Add after modification: “or modification can be shown to be minor.” Add definition for minor tool or tool environment changes.	Partially accepted. This paragraph has been completely rewritten and refers to DO-330 for conducting a tool change analysis to determine what activities need to be re-performed.
265	Airbus SAS	Page 9 / Table 3 - Correlation Between DO-178B Tool Qualificatio n Type and DO-178C Tool Criteria/TQ	Switch column “Software Level” and “DO-178C Tool Criteria”	The use of the table would be more meaningful in that sequence.		Not accepted. The DO-178C tool criteria column correlates more closely with the TQL column than the DO-178B tool qualification type column. Therefore, it makes more sense to locate the columns as originally established.

No.	Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
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266	GE Aviation	11	As soon as a verification tool is changed on a DO-178B program does this force the entire program to be upgraded to DO-178C? This section is confusing.	Can DO-330 be applied to an existing DO-178B program?		No recommendation provided. The commenter is asking two different questions. Paragraph 10, <i>Tool Qualification</i> , has been rewritten and only addresses tools; it does not force the software to be upgraded to DO-178C. The applicant can always propose to use DO-330 on a DO-178B project.
267	GE Aviation	11	1.	Does this apply DO-330 to DO-178B tools just used on DO-178B?		No recommendation provided. Paragraph 10, <i>Tool Qualification</i> , has been completely rewritten and should be clearer as to when DO-330 is required. The applicant can always propose to use DO-330 on a DO-178B project.
268	THALES Avionics	11	Paragraph to clarify	It is necessary to define, as for embedded SW, in which cases FAA deem it is necessary to switch from previous versions of DO178 to DO178C and DO330. Is it to the applicant to choose the DO178 version he wants to apply?	Create a dedicated paragraph where it is clearly defined when DO178C and DO 330 is mandatory and when is recommended to apply them.	Partially accepted. Paragraph 10, <i>Tool Qualification</i> , has been completely rewritten and should be clearer as to when DO-330 is required. The applicant can always propose to use DO-330 on a DO-178B project.
269	Randall Fulton	Page 8-11.a	Reference to Table 3 should be Capitalized.	Reference to <i>table 3</i> should be Table 3 to match the table label.	Capitalize "Table 3"	Accepted.
270	GE Aviation	11.a.	Table 3 seems to apply more stringent requirements to verification tools for level A and B than DO-330 categories would.	DO-330 Table D-3 shows that for criteria 3 that all levels are TQL-5. The table in the draft AC makes the levels A and B at TQL-4. Why does this override the DO-330 criteria?	Change the AC to match the Table D-3 in DO-330.	Not accepted. Table 2 in the AC is consistent with DO-330, Table D-3. Table 3 (now Table 2) in the AC shows that all DO-178B verification tools categorized as Criteria 3 tools should be qualified at TQL-5, and only verification tools categorized as Criteria 2 at Level A or B should be qualified to TQL-4.

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271	Sikorsky Aircraft ODA	Pg 8, para 11, table	Tool Criteria (1 – 3) is not obvious to those without DO-330 familiarity	Clarity	Add definition of the 3 criteria to the text	Not accepted. The definitions are located in DO-178C, section 12.2.2
272	THALES Avionics	11.b	When modifying a previously developed tool, the previous certification baseline has to be considered regarding the modification of the operational environment or the tool itself or the software level of the tool.	If a development tool has been developed according to DO178B and the applicant wants to modify the tool, the operational environment or the software level of the tool, the DO178B defines what is necessary to do to qualify the tool so it is not necessary to use DO330.	Add in §11.b that DO330 is applied when previous baseline doesn't cover the modification of the operational environment or the tool itself or the software level of the tool.	Partially accepted. Paragraph 10, <i>Tool Qualification</i> , has been completely rewritten and refers to DO-330 for conducting a change analysis to determine what activities need to be re-performed.
273	THALES Avionics	11.c	When modifying a previously developed tool, the previous certification baseline has to be considered regarding the modification of the operational environment or the tool itself.	If a verification tool has been developed according to DO178B and the applicant wants to modify the tool or the operational environment, the DO178B defines what is necessary to do to qualify the tool so it is not necessary to use DO330.	Add in §11.b that DO330 is applied when previous baseline doesn't cover the modification of the operational environment or the tool itself.	Partially accepted. Paragraph 10, <i>Tool Qualification</i> , has been completely rewritten. Since qualification of verification tools requires meeting objectives in DO-330, which is different from DO-178B for TQL 4, then the tool will need to be requalified using DO-330 when claiming DO-178C compliance unless the tool is required to meet TQL 5.
274	THALES Avionics	11.c	For criteria 2 tools previously developed according to DO178B, it has to be considered that in service history is a mean to demonstrate equivalence to TQL 4.	If a verification tool qualified according to DO178B has been successfully used for a long period to complete verification activities classified as Criteria 2 in DO178C, a criteria 2/TQL 4 based on in service history can be claim.	Add in §11.c that in service history can be used for previously developed tools to show equivalence to criteria 2 /TQL4 .	Not accepted. A qualified DO-178B verification tool that is now categorized as a criteria 2 tool has not been qualified to the required rigor for a DO-178C project and therefore needs to be qualified to the required DO-330 TQL in order to claim compliance to DO-178C.
275	Sandel Avionics Inc.	Page 8-11.b(1) and 11.c(1)	“The tool has not been modified” needs to be clarified. Every vendor updates their version and adds additional features which may not impact the original cert documents and an analysis can prove that. What does modified mean? A new revision of the tool? Minor	Adding new requirements to already qualified tool with non-significant changes proved by analysis can increase the scope and I don't think that is the intent. The intent should be clear. If the functionality of the tool changes then it	The AC should have a provision for analysis should be provided rather than just making a statement that DO-178C needs to be followed.	Partially accepted. Paragraph 10, <i>Tool Qualification</i> , has been completely rewritten and refers to DO-330 for conducting a change analysis to determine what activities need to be re-performed for “development” tools. Since

No.	Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
			revision/major revision	is okay to move to DO-178C direction but a provision of analysis should also be provided before making a direct statement that you need to follow DO-178C.		qualification of verification tools requires meeting objectives in DO-330, which is different from DO-178B for TQL 4, then the tool will need to be requalified using DO-330 when claiming DO-178C compliance unless the tool is required to meet TQL 5.
276	Airbus SAS	Page 9, 11.b(1) & 11.c.(1)	Remove those provisos B(1) & C(1)	Paragraph 9 (Modifying and Re-using DO-178, DO-178A, or DO-178B Software) allows to keep DO178B reference baseline in case of SW modification provided new technology is not introduced, whereas paragraph 11 B(1) & C(1) do not (Paragraph 11 impose to upgrade tool qualification data in case of tool modification.)		Not accepted. The comment addresses two different aspects of software development. Paragraph 9 addresses using legacy software and when you may claim DO-178C compliance, where paragraph 10 addresses the use of DO-178B legacy tools on DO-178C projects. Paragraph 10 allows the continued use of a DO-178B tool qualification process on a DO-178C project, under certain conditions.
277	Airbus SAS	Page 9, 11.b(2) & 11.c.(2)	Remove those provisos B(2) & C(2)	B(2) & C(2) criteria are already covered within DO178B that request in paragraph 12.2 the verification of the tool in its operational environment 12.2.3.2 The tool operational requirements should contain a description of the tool operational environment. Paragraph 12.2.1 for development tool Paragraph 12.2.2 for verification tool require verification against the tool operational requirements)		Partially accepted. Paragraph 10, <i>Tool Qualification</i> , has been completely rewritten and refers to DO-330 for conducting a change analysis to determine what activities need to be re-performed for “development” tools. Since qualification of verification tools requires meeting objectives in DO-330, which is different from DO-178B for TQL 4, then the tool will need to be requalified using DO-330 when claiming DO-178C compliance unless the tool is required to meet TQL 5.
278	Green Hills Software	Page 9 11.b.(2) and	Section permits reuse of a DO-178B tool for a DO-178C project, but does not account for common differences in operational	Operational environment includes target computer. Some existing tool qualifications (e.g., structural coverage	Add “(target computer changes excepted)” after “environment”.	Partially accepted. Paragraph 10, <i>Tool Qualification</i> , has been completely rewritten and refers to DO-330 for

No.	Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
		11.c.(2)	environment (i.e., target computer) that may be associated with the DO-178C project that the tool's qualification suite can account for.	tools) require re-execution in every operational environment, to show compatibility with the target computer. These tools (and their tests) do not necessarily need to change, but because of this requirement in the AC, would need to be changed just because they are used with a different target computer.		conducting a change analysis to determine what activities need to be re-performed for "development" tools. "Verification" tools should be re-verified using the DO-178B tool qualification process or use DO-330.
279	BA EEDA	Sect 11b(1)&(2)	What is the scope of tool or tool operational environment modification? Is it by definition, a modification implies a re-qualification?	Vagueness of language could lead to misinterpretation.	Clarify by specifying what is considered a modification.	Partially accepted. Paragraph 10, <i>Tool Qualification</i> , has been completely rewritten and refers to DO-330 for conducting a change analysis to determine what activities need to be re-performed for "development" tools.
280	BA EEDA	Sect 11c(1)&(2)	What is the scope of tool or tool operational environment modification? Is it by definition, a modification implies a re-qualification?	Vagueness of language could lead to misinterpretation.	Clarify by specifying what is considered a modification.	Partially accepted. Paragraph 10, <i>Tool Qualification</i> , has been completely rewritten. "Verification" tools should be re-verified using the DO-178B tool qualification process or use DO-330.
281	Eurocopter	Page 9 (§ 11.b.(3))	The statement about the correlation of the DO-178B software level assigned to the tool with the required TQL established by DO-178C is unclear.	Under DO-178B, the level assigned to a development tool to be qualified was supposed to be the level of the airborne software. Consequently, there is no need to perform an assessment, unless there is an upgrade or the airborne software level. Correlation is de facto ensured, according to table 3.	Suggestion is to remove bullet b.(3), or to change it to the following, if this is the objective: <i>"(3) The DO-178B software level assigned to the tool is at least equivalent to the airborne software level required in the new installation"</i> .	Not accepted. Comment no longer applicable. Paragraph 10, <i>Tool Qualification</i> , has been completely rewritten.

No.	Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
282	Garmin	Page 9, 11.c	The text implies that a DO-178B tool qualification process may not be used if the tool is modified or the operation environment has been modified.	Table 3 indicates that a TQL-5 tool correlates with a verification tool under DO-178B. Consequently, a DO-178B qualification process should still be usable for a tool that is assessed to be TQL-5.	Remove paragraph 11.c.(1) and 11.c.(2).	Partially accepted. Paragraph 10, <i>Tool Qualification</i> , has been completely rewritten. Since qualification of verification tools requires meeting objectives in DO-330, which is different from DO-178B for TQL 4, then the tool will need to be requalified using DO-330 when claiming DO-178C compliance unless the tool is required to meet TQL 5.
283	L-3 Communications	Page 9, Paragraph 11.c.(3)	The current correlation indicates that verification tools developed to DO-178B Level A or B will always need to be re-qualified when moving to DO-178C.	Consistency.	Verification tool qualification requirement should be the same as for development tools.	Not accepted. The tool qualification process for development tools under DO-178B is similar to the qualification process for Criteria 1 tools under DO-178C/DO-330 (i.e., the process rigor of each is comparable). However, for verification tools that require TQL 4 qualification (meet criteria 2), the process requires a higher level of rigor than under DO-178B; therefore, the tool needs to be requalified to claim DO-178C credit.
284	Sikorsky Aircraft ODA	Pg 9, para 11d	This para does not appear consistent with paras 11 b and c.	Para d says you can continue using 178B for tool mods for existing 178B projects without conditions. But paras b and c say you can only continue tool qual activities using 178B under very restricted conditions. Apparent contradiction.		No recommendation provided. Paragraph 10, <i>Tool Qualification</i> , has been completely rewritten. There are different requirements for b. and c. because b. does not involve claiming compliance to DO-178C, where c. does.
285	TCCA	Page 9 Paragraph 11 d.	For new tools DO-178B section 12.2 may not be applicable.	There are new tools that are neither verification nor development. They are between and the only applicable guidelines are the section 12.2 of DO-178C coupled with DO-330.	State that DO-178C section 12.2 coupled with DO-330 should be used.	Not accepted. Paragraph 10, <i>Tool Qualification</i> , has been completely rewritten. For a project where compliance to DO-178C is not going to be claimed, 10.b. allows use of existing DO-178B tool qualification process. New tools used in a DO-178C project should use DO-330.

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286	Eurocopter	Page 9 (§ 11.d)	When established that the original approval baseline (DO-178B) is acceptable for legacy system software, DO-178B fully applies, including section 12.2.	<i>"DO-178B, section 12.2, can be used"</i> suggests that it is only one possibility in such case, whereas it should be the standard way.	Suggestion: <i>"d. For a DO-178B project, DO-178B section 12.2 remains applicable.</i> <i>The applicant may nevertheless use DO-330 in order to qualify new or modified tools."</i>	Not accepted. Paragraph 10, <i>Tool Qualification</i> , has been completely rewritten. The applicant can always propose to use DO-330 to qualify a tool for use in a DO-178B project.
	Final Text	Paragraph 11 changed to paragraph 10	<p>11. 10. Tool Qualification. DO-178C, section 12.2, and DO-330 provide an acceptable method for tool qualification. DO-330 contains its own complete set of objectives, activities, and life cycle data for tool qualification. For legacy systems with DO-178B software involving tool qualification or use of legacy tools on current DO-178C projects, the following subparagraphs provide guidance for establishing if any additional activity or qualification is necessary for compliance with this AC.</p> <p>a. <u>If your legacy system software was previously approved using DO-178 or DO-178A, and you intend to use a new or modified tool for modifications to the legacy system software, use the criteria of DO-178C, section 12.2, to determine if tool qualification is needed. If you need to qualify the tool, use the software level assigned by the system safety assessment for determining the required TQL, and use DO-330 for the applicable objectives, activities, guidance, and life cycle data. You may declare the tool as having satisfied DO-330 and not the legacy system software as having satisfied DO-178C.</u></p> <p>b. <u>If your legacy system software was previously approved using DO-178B, and you do not intend to claim compliance to DO-178C, you can use your DO-178B tool qualification processes for qualifying new or modified tools in support of modifications to DO-178B legacy system software.</u></p> <p>c. <u>If your legacy system software was previously approved using DO-178B, you intend to claim compliance to DO-178C, and you have DO-178B legacy tools that need to be qualified, follow the guidance of this subparagraph.</u></p> <p><u>(1) DO-178C establishes five levels of tool qualification based on the tool use and its potential impact in the software life cycle processes (see DO-178C, section 12.2.2 and Table 12-1). However, DO-178C does not address the use of tools previously qualified to the DO-178B criteria. For a tool previously qualified as a DO-178B development tool or verification tool, use Table 32 (below) to determine the correlation between the DO-178B tool qualification type and DO-178C tool criteria and tool qualification levels (TQLs).</u></p>			

No.	Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition																																
			Table 42 - Correlation Between DO-178B Tool Qualification Type and DO-178C Tool Criteria/TQL																																			
			<table border="1"> <thead> <tr> <th data-bbox="1131 375 1403 477"><i>DO-178B Tool Qualification Type</i></th> <th data-bbox="1403 375 1612 477"><i>Software Level</i></th> <th data-bbox="1612 375 1811 477"><i>DO-178C Tool Criteria</i></th> <th data-bbox="1811 375 2010 477"><i>DO-178C/DO-330 TQL</i></th> </tr> </thead> <tbody> <tr> <td>Development</td> <td>A</td> <td>1</td> <td>TQL-1</td> </tr> <tr> <td>Development</td> <td>B</td> <td>1</td> <td>TQL-2</td> </tr> <tr> <td>Development</td> <td>C</td> <td>1</td> <td>TQL-3</td> </tr> <tr> <td>Development</td> <td>D</td> <td>1</td> <td>TQL-4</td> </tr> <tr> <td>Verification</td> <td>A, B</td> <td>2</td> <td>TQL-4</td> </tr> <tr> <td>Verification</td> <td>C, D</td> <td>2</td> <td>TQL-5</td> </tr> <tr> <td>Verification</td> <td>All</td> <td>3</td> <td>TQL-5</td> </tr> </tbody> </table>				<i>DO-178B Tool Qualification Type</i>	<i>Software Level</i>	<i>DO-178C Tool Criteria</i>	<i>DO-178C/DO-330 TQL</i>	Development	A	1	TQL-1	Development	B	1	TQL-2	Development	C	1	TQL-3	Development	D	1	TQL-4	Verification	A, B	2	TQL-4	Verification	C, D	2	TQL-5	Verification	All	3	TQL-5
<i>DO-178B Tool Qualification Type</i>	<i>Software Level</i>	<i>DO-178C Tool Criteria</i>	<i>DO-178C/DO-330 TQL</i>																																			
Development	A	1	TQL-1																																			
Development	B	1	TQL-2																																			
Development	C	1	TQL-3																																			
Development	D	1	TQL-4																																			
Verification	A, B	2	TQL-4																																			
Verification	C, D	2	TQL-5																																			
Verification	All	3	TQL-5																																			
			<p style="color: red;">If a development tool was previously qualified using DO-178B, you may continue to use the DO-178B qualification process for a DO-178C project, provided that:</p> <ul style="list-style-type: none"> (1) The tool has not been modified; (2) The tool operational environment has not been modified; and (3) The DO-178B software level assigned to the tool correlates with or exceeds the required TQL established by DO-178C. (4) If one or more of these conditions are not met, the tool should be qualified using DO-178C and DO-330. <p style="color: blue;">(2) <u>Development Tools Previously Qualified Using DO-178B.</u></p> <p style="color: blue;">(a) <u>If the DO-178B software level assigned to the tool correlates with or exceeds the required TQL established by DO-178C, you may continue to use your DO-178B tool qualification processes for a DO-178C project or use DO-330.</u></p> <ul style="list-style-type: none"> (i) <u>If there are changes to the tool’s operational environment, refer to DO-330, section 11.2.2, for guidance on performing an analysis to determine what activities need to be performed or re-performed.</u> (ii) <u>If there are changes to the tool, refer to DO-330, section 11.2.3, for conducting a tool change impact analysis. Use the tool change impact analysis to determine the potential impact of the change on the generated code and the needed re-verification activities.</u> <p style="color: blue;">(b) <u>If the DO-178B software level assigned to the tool does not satisfy the required TQL for a DO-178C project, you should re-qualify the tool using DO-330.</u></p> <p style="color: blue;">(c) <u>You may declare your tool as having satisfied DO-330 if all changes to the tool and your tool qualification processes satisfy DO-330.</u></p>																																			

No.	Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
			<p>If a verification tool was previously qualified using DO-178B, you may continue to use the DO-178B qualification process for a DO-178C project, provided that:</p> <p>(1) The tool has not been modified;</p> <p>(2) The tool operational environment has not been modified; and</p> <p>(3) The tool qualification level required by DO-178C is TQL5.</p> <p>(4) If one or more of these conditions are not met, the tool should be qualified using DO-178C and DO-330.</p> <p><u>(3) Verification Tools Previously Qualified Using DO-178B.</u></p> <p><u>(a) If the tool qualification level required for a DO-178C project is TQL5, and your verification tool was previously qualified using DO-178B:</u></p> <p><u>(i) You may continue to use your DO-178B tool qualification process.</u></p> <p><u>(ii) If there are changes to the tool or the tool’s operational environment, you should conduct a tool change impact analysis and re-verify the tool using your DO-178B tool qualification processes or re-qualify the tool using DO-330.</u></p> <p><u>(b) If the tool qualification level required for a DO-178C project is TQL4, you should re-qualify your verification tool using DO-330.</u></p> <p><u>(c) You may declare your tool as having satisfied DO-330 if all changes to the tool and your tool qualification processes satisfy DO-330.</u></p> <p>d. For a DO-178B project, DO-178B, section 12.2, can be used for qualifying new or modified tools in support of modifications to DO-178B legacy system software.</p>			
	Original Proposed Text	Paragraph 12	<p>12. Related Regulatory, Advisory, and Industry Material.</p> <p>a. 14 CFR Applicable Sections. 14 CFR parts 21, 23, 25, 27, 29, 33, and 35.</p> <p>b. FAA ACs.</p> <p>(AC listing not included here for brevity; see draft AC)</p> <p>c. Industry Documents.</p> <p>(SAE and RTCA document listing not included here for brevity; see draft AC)</p>			
287	Honeywell ODA	Page 10, Para 12.b.	Consider adding the latest draft AC 33.28-1	Depending on timing, may be available and will be the latest guidance.	Add released AC to the document list if available.	Not accepted. Revision levels are not specified.

No.	Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
	Final Text	Paragraph 12 changed to paragraph 11	<p>12. 11. Related Regulatory, Advisory, and Industry Material.</p> <p>a. 14 CFR Applicable Sections. 14 CFR parts 21, 23, 25, 27, 29, 33, and 35.</p> <p>b. FAA ACs. (AC listing not included here for brevity)</p> <p>c. Industry Documents. (Complete SAE and RTCA document listing not included here for brevity)</p> <p>(6) RTCA DO-248C, Supporting Information for DO-178C and DO-278A, dated December 13, 2011.</p>			
	Original Proposed Text	Paragraph 13	<p>13. Where to Get Referenced Documents.</p> <p>a. Order SAE documents from SAE World Headquarters, 400 Commonwealth Drive, Warrendale, PA, 15096-0001, telephone (724) 776-4970, fax (724) 776-0790. You can also order copies through the SAE website at www.sae.org.</p> <p>b. Order copies of RTCA documents from RTCA, Inc., 1150 18th Street, NW, Suite 910 Washington, DC 20036, telephone (202) 833-9339, fax (202) 833-9434. You can also order copies on the RTCA website at www.rtca.org.</p> <p>c. Order copies of 14 CFR part 21, Subpart O, Technical Standard Order Authorizations, from the Superintendent of Documents, Government Printing Office, P.O. Box 37154, Pittsburgh, PA 15250-7954, telephone (202) 512-1800, fax (202) 512-2250. You can also order copies online at http://bookstore.gpo.gov/products/sku/869-076-00041-4.</p> <p>d. Access copies of ACs online at http://www.faa.gov/regulations_policies/advisory_circulars/.</p>			
288	Elbit Systems Ltd.	Page 11 § 13	Where to Get Referenced Documents	Removal of access detailed data since It may be changed in the future. Simple point to the relevant website: It contains ALL the methods to get the referenced documents	Remove the address, phone & fax data, leaving only the website info: a. SAE documents can be ordered as described in SAE website at www.sae.org . b. RTCA documents can be ordered as described in RTCA website at www.rtca.org . c. Copies of 14 CFR part 21, Subpart O, can be ordered as described in the U.S Government Bookstore website http://bookstore.gpo.gov/products/	Not accepted. The ordering information provided is typical of what's included in most ACs.

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					sku/869-076-00041-4. d. ACs can be accessed at the FAA website http://www.faa.gov/regulations/policies/advisory_circulars/	
	Final Text	Paragraph 13 changed to paragraph 12	13. <u>12.</u> Where to Get Referenced Documents. No change to content.			