EASA Proposed CM-SWCEH-002 Issue 1 – Software Aspects of Certification – Comment Response Document

Comment				Comment summary	Suggested resolution	Comment is an observation or is a suggestion	Comment is substantive or is an objection	EASA comment disposition	EASA response
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1	*see4sys (Engineering company)*	23.2.5	99	The type 2b development cycle needs a clarification about the verification (SW term) of the formalized design (§23.2.5.2). If the system (using system process) is in charge of the formalized design, the ARP4751 should be used. If the software process is used, of course the DO-178 is required. So because it is about the development of software, the DO-178 is applicable. I think there is an inconsistency and I don't understand the need of a type 2 life cycle. Except if a modification of the ARP4751 including software aspects is in progress.				Not accepted	In this life-cycle, only the System Requirements are completely within the system area. The design falls within the area of the software domain, as shown by the figure at the start of the section and by the title of the section. Since the software high-level requirements and the software design are being replaced by the Design Model, software activities have to be performed on the Design Model and those activities are not described in ED-79 / ARP4574. So they have to be done in accordance with ED-12B / DO-178B.
2	*QinetiQ, UK*	23	93-108	The word 'formalised' and variations such as 'formal' is used throughout software engineering as a specific meaning relating to mathematical syntax and semantics; it refers to the discipline of 'formal methods'. This widely accepted meaning conveys a notion of soundness and has been in use for well over 30 years. The formal description of requirements and subsequent formal analysis are not discussed in this section. The use of these terms in Section 23 appears to convey something very loose - along the lines of 'written down' - and appears to refer to graphical design tools and techniques. Therefore the context of the use of the word 'formalised' in this section appears not to be in accordance with the wider, more rigorous understanding and therefore is inappropriate. Note the issue of the Formal Methods Supplement to ED12C later in 2011 will draw a clear distinction between formal methods and model based design and confusion between the 2 should be avoided now.	Remove all use of the word 'formalised' and variations. Replace such text with terms appropriate to model based design, such as requirements model		X	Accepted	We have altered this section of the Certification Memorandum to use the terms 'Specification Model' and 'Design Model' instead of 'Formalized Requirements' and 'Formalized Design' respectively.
3	*QinetiQ, UK*	23.1	93	Avoid naming commercial tools as this implies that they are accepted as a means of compliance and others are not	Refer to 'graphical tool based languages' describing for, example, state machines or control circuits.		X	Not accepted	These tools are only named as examples with which readers may be familiar and only in the Background section, not in the section on Guidance, just as they were named as examples in the previous EASA Certification Review Item (CRI) and the individual EASA Certification Memorandum on this subject. The text only says that some equipment may embed software designed using those tools and makes no statement as to how those tools are regarded by EASA.
4	*QinetiQ, UK*	23.2.8.2 c.	103	In Section 23.2.8.1 it specifically states that objectives for compatibility with the target computer cannot be determined through the use of simulation, but in Section 23.2.8.2 it allows an Applicant to "Perform an analysis to identify any differences between the target environment and the simulation environment and provide a rationale for why these differences are acceptable." So either it is possible to say how to use a simulator to claim credit for target hardware or it is not. At this stage, and given similar problems with proposed MBD Supplement for ED12C, no claims for credit for the use of simulation for target hardware aspects should be allowed.	Remove all references to claims for credit for target hardware through the use of simulation.		X	Not accepted	There is no correlation between sections 23.2.8.1 and 23.2.8.2, which are presenting fully independent guidance. Indeed, 23.2.8.1 deals with simulation for the verification of the model by means of model simulation (therefore cannot verify anything related to the target computer) while 23.2.8.2 deals with verification of the EOC by means of model simulation. In section 23.2.8.2.c, the considerations related to the target computer are directed at the confidence that can be put in the simulation environment. For these reasons, EASA does not agree with proposal to remove these considerations.

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5	*QinetiQ, UK*	23.2.10.7	107	The following statement needs to be adjusted to account for use of auto-coders without the need to qualify the tool: "If the software developer wishes to take certification credit against any of the ED-12B / DO-178B objectives due to the use of auto-coding tools, the auto-coding tool will need to be qualified as a development tool". There is only a need to qualify the auto-coder if the output is not verified by other acceptable means, in the same way that a human programmer output is verified.	Suggest: "If the software developer wishes to take certification credit against any of the ED-12B / DO-178B objectives due to the use of auto-coding tools, without providing verification of the output by undertaking activities described in Section 6.3.3 and Section 6.3.4 of ED-12B / DO178B, the auto-coding tool will need to be qualified as a development tool"		X	Not Accepted	We agree that a tool only needs to be qualified if its outputs are not verified. However, if the applicant wishes to take credit for the use of an auto-coding tool against any of the ED-12B / DO-178B objectives, this means that they are not going to verify the output of the tool in relation to those objectives and they are instead going to claim that the use of the qualified tool is sufficient to meet those objectives. In that case, the note you suggested is not necessary. Otherwise, for an unqualified tool, the output of an auto-coding tool would have to be verified as you said which is covered by the last paragraph of the section.
6	*QinetiQ, UK*	23.2.10.7	107	Be clear that the code expected to be produced is source code in first sentence: "In some cases, the software developer may develop or utilize an auto-coding tool so as to produce code directly"	Change to read "In some cases, the software developer may develop or utilize an auto-coding tool so as to produce source code directly"		X	Accepted	The word 'Source' has been added as suggested.
7	*QinetiQ, UK*	21 & 23	84	Inconsistent guidance between Section 21 and Section 22.3.2. In several places in Section 21, merging of HLR/LLR is "not recommended" into a single data item by EASA. Indeed, in 21.2, EASA does not recommend merging ...because it makes satisfying the objectives of ED12B/DO178B difficult or impossible. In Section 22, guidance from EASA appears to be given as to how a number of system and software processes can firstly be re-labelled as something different and then combined. Either system/software processes can be combined or they cannot; re-naming them should not be a way of getting around the guidance in Section 21. Guidance for an approach using MBD should not be a reason for conflicting guidance.	Either: ensure Section 23 is consistent with existing guidance in ED12B/DO178B for HLR and LLR. Remove new, confusing terminology and guidance on types of life cycle in section 23.2.3. Or: re-word section 21 to be consistent with Section 23 and recommend merging HLR/LRR into one data item.		X	Not Accepted	EASA considers that the content of both sections 21 and 23 are consistent. Section 21 identifies the concerns resulting from the merging between HLR and LLR. It may result in potential non-compliances with respect to the ED12B / DO178B objectives; However, Section 23 is focusing on the use of a specific methodology (model based development) and trying to incorporate the current guidelines as resulting for the ED12C / DO178C discussions. For that purpose, in the case of the use of MBD, specific activities are defined at model level in order to have a similar design assurance, concerning ED12B / DO178B objectives, as using textual requirements and taking into account the specific particularities of this methodology.
8	*Darren Cofer, Rockwell Collins (SC-205 subgroup 6)*	23	93-108	Use of the word "formalized" as in formalized design/specification/requirements is likely to cause confusion. For several decades, the terms formal methods, formal analysis, formalized requirements, etc. have been used in the software engineering field to refer to languages having precise, unambiguous, mathematically defined syntax and semantics, and associated analysis techniques for proving software correctness. This level of rigor does not seem to be what is intended in this section. Furthermore, DO-178C will have associated with it a Formal Methods Supplement providing guidance reqarding the use of formal methods that will be independent of any guidance for model-based software development.	Do not use the word "formalized" in this section. Since this section is about model-based software, it should only refer to design models, specification models, or requirements models, or models used to represent design/specification/requirements.		X	Accepted	We have changed the terminology and avoided the word 'formalized'.
9	*Emcosys GmbH*	General	None	Since 1986 I have involved in development and certification of flight SW for the cabin pressure control system for almost Airbus and Boeing CSA (A320, B737, A330/340, A380, B787) and recently I have worked as DCS/CVE for the A400M M-MMS. I appreciate the publication of these Memoranda, which evidently reflected several relevant topics that I have encountered during carry out the certification tasks for the M-MMS in conjunction with other systems on the A400M aircraft.				Noted	Thank you.

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10	*Emcosys GmbH*	General	None	After review the Memorandum, I still missing of some guidance in the Memorandum regarding the following topic: Worst Case Execution Time (WCET) certification guidance for highly complex CPU with multiple cache levels, branch prediction, and instruction pipelines etc. Such features can lead to very large jitter of the CPU execution time.				Accepted	The Certification Memorandum on Development Assurance of Airborne Electronic Hardware (HW CM) tries to cover the areas you have described.
11	*Emcosys GmbH*	General	None	After review the Memorandum, I still missing of some guidance in the Memorandum regarding the following topic: Non-regression tests strategy for modification of requirement, HW & SW design, bug fixing etc. Normally the regression test is based on the impact analysis of change and the regression test main scope is to demonstrate that the changes are verified. However, the evidence to show that the global system behaviour before and after change is not ensured. Therefore I would be appreciated if some guidance can be given in the memorandum.				Partially accepted	EASA thinks that regression strategy is very important but it is the EASA understanding that ED-12B / DO-178B already covers that.
12	*Emcosys GmbH*	General	None	After review the Memorandum, I still missing of some guidance in the Memorandum regarding the following topic: Software FMEA similar to hardware FMEA for safety critical aircraft function. I.e. the SW errors impact analysis from bottom up may prevent hidden effect of the error at system level.				Partially accepted	EASA agrees but thinks it is more a safety issue.
13	*UK CAA*	11.4 e.	51	Section 11.4.e (Guidelines on acceptable verification of Tool Operational Requirements): This section contains the following statement "However, since the operational requirements may contain additional information not directly related to the verification activity (e.g., the appearance of menus, dialog boxes, configuration), additional guidance is needed to reduce unnecessary verification for verification tools. For verification tools only, those portions of the operational requirements that are used directly in the setting up, conducting, monitoring, and reporting of verification need to be verified as part of tool qualification." Should the final sentence refer to verification tools or did you intend to refer to development tools? **Justification:** The text seems to be attempting to reduce the burden related to qualify verification tools and then levies a task related solely to verification tasks and not development tasks. This is slightly confusing.	**Proposed Text (if applicable):** Possibly replace the reference to verification tools with a reference to development tools?			Noted	The alleviation provided is limited to aspects of additional information that are not related to the verification and do not actually affect the results of the verification, such as the example given of the appearance of dialog boxes. Any aspects of the requirements that would affect the verification still have to be verified. The section states that the verification for development tools is more extensive and includes the testing of abnormal values. It is difficult to see how parts of a development tool could be allowed to remain untested, as a development tool has to undergo the DO-178B life-cycle. We consider that the text is correct in only referring to verification tools in this respect and that this alleviation is acceptable.

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14	*UK CAA*	11.4 g.(2)	52	Section 11.4.g.2 (Guidelines for qualifying combined development and verification tools) – Given that it is extremely unlikely that an applicant would have access to the detailed design/code of a tools demonstrating partitioning is likely to be challenging and they may only be able to find that the output of one tool doesn't appear to affect the output of the other. Is this really going to demonstrate independence of one function from the other or the absence of a feature/item of code that is common to both functions, resulting in a potential common mode error? **Justification:** I'm not sure that the proposed approach will result in the desired outcome but this may be the best that can be achieved and the author may have intended this.	**Proposed Text (if applicable):** Question only, no proposal relevant.			Noted	We understand your concern, however, the alleviation is only allowed when partitioning can be demonstrated. If it is not possible to demonstrate such partitioning for the reasons you describe, then the alleviation will not be allowed, which is a safe position. We therefore consider that the text is acceptable.
15	*UK CAA*	16.4	67	This definition of 'deviation from the rules' refers to the HAS. Should it refer to the SAS? **Justification:** Possible Type	**Proposed Text (if applicable):** Replace reference to HAS with SAS.			Accepted	Comment accepted and section amended.
16	*UK CAA*	16.4	67	The definition of Open Problem Report refers to 'airborne electronic hardware'. Should it refer to software? **Justification:** Possible Type	**Proposed Text (if applicable):** Replace the reference to AEH with a reference to Software.			Accepted	Comment accepted and section amended.
17	*UK CAA*	20.1	82	This section still refers to Assembly Branch Coverage. **Justification:** Assembly Branch Coverage may be a protected term used by just one company.	**Proposed Text (if applicable):** Replace reference to ABC with OOC.			Accepted	Comment accepted and section amended.
18	*UK CAA*	20.1	82	Why does the first bullet refer to Level B and Decision Coverage when the title of the section relates solely to level A (i.e. it only references MCDC)? **Justification:** Referencing Level B software in a leaflet that refers to a Level A methodology (MC/DC) is confusing.	**Proposed Text (if applicable):** Remove reference to level B and decision coverage?			Not Accepted	Comment accepted and paragraph amended. "The approach should generate the same minimum number of test cases as that needed at the source code level for MC / DC coverage."
19	*UK CAA*	22.4	92	Bullet four requires that applicants understand that data coupling analysis and control coupling analysis are two different analyses and can't be combined. This is definitely something that they need to do but a requirement to understand something is a little difficult to show definitive compliance with. Perhaps this bullet could be amended very slightly to include something that will enable the creation of more tangible evidence of compliance. Perhaps something along the lines of 'and develop their plans and procedures accordingly' could be added to the end of the sentence? Justification: This is difficult to show compliance with.	Proposed Text (if applicable): Add a requirement to the end of the bullet to require objective evidence e.g. "...and develop their plans and procedures accordingly' could be added to the end of the sentence"			Accepted	The proposed sentence has been added to the revised text.

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20	*UK CAA*	None	None	What happened to the section on IMA and Non-IMA Platforms, has it been removed or transferred to Avionics? **Justification:** We need to know whether this Memo will still be levied at some point.				Noted	The Certification Memorandum dealing with IMA still exists.
21	*TMDewey Consultancy Ltd*	1.1		Section 1.1: There is no mention of ED-12C; although it has not yet been released it may well be issued before this document, or at least shortly thereafter. As SWCEH-002 states that it applies specifically to ED-12B, it could be seen as being 'out of date' before it is used, even though in some areas (for example section 19 on the use of OOT) it is far more advanced and comprehensive than ED-12C. Arguably, SWCEH-002 is the document that ED-12C should have become. For organisations considering migrating to ED-12C, it would be useful to have a statement recognising the existence of ED-12C and some guidance as to the possible relationship between ED-12C and this document, for example on precedence, compatibility or future plans.				Accepted	EASA anticipates that ED-12C / DO-178C will be published in the near future and that its applicability as guidance will then be recognized. In the meantime, this Software Certification Memorandum will apply to any projects for which the certification basis is defined as being ED-12B / DO-178B before the publication and recognition of ED-12C / DO-178C. Once ED-12C / DO-178C has been published and recognized as guidance, EASA intends to also publish a separate ED-12C / DO-178C version of the Software Certification Memorandum that will take into account the differences between ED-12B / DO-178B and ED-12C / DO-178C along with its supplements. It is anticipated that some sections or sub-sections of this ED-12B / DO-178B Software Certification Memorandum will no longer be needed in the ED-12C / DO-178C Software Certification Memorandum because they will be superseded by ED-12C / DO-178C and its supplements. For example, it is expected that the text in section 23 of this Software Certification Memorandum will not be needed in the ED-12C / DO-178C Software Certification Memorandum because that text will be superseded by the ED-12C / DO-178C Model-based Development and Verification Supplement. Some additional guidance is needed for those ED-12B / DO-178B projects over those next few years and this is why EASA is publishing this ED-12B / DO-178B Software Certification Memorandum even though ED-12C / DO-178C will soon be published. EASA intends to update the ED-12B / DO-178B Software Certification Memorandum and the upcoming ED-12C / DO-178C Software Certification Memorandum whenever it becomes necessary to provide any additional clarifications or to correct any deficiencies in the published Memoranda. The sections of this version of the Software Certification Memorandum do not make any reference to ED-12C / DO-178C and do not include any assumptions as to the contents of that as yet unpublished document. ED-12C / DO-178C is not, therefore, included in the references of this document.
22	*TMDewey Consultancy Ltd*	1.4		Section 1.4: Definition of 'Validation' is given as "The determination that the requirements for a product are sufficiently correct and complete. " That given in ED-12B (also as in ED-12C) is "The process of determining that the requirements are the correct requirements and that they are complete". Presumably the addition of the word 'product' is intended to restrict validation to System Requirements; the addition of the word 'sufficiently' is superfluous. This definition is similar in intent to the definition given in MoD's Def Stan 00-56 "Demonstration that the requirements are appropriate (and meet stakeholder needs)". However, 'appropriate' is vague and 'correct and complete' is insufficient. A better definition is as used in section 17.5, which is 'accurate, consistent, verifiable, correct and complete'. In particular, the concept of a requirement as not being valid if it is not verifiable is very important.				Accepted	The definition has been altered to delete the word 'sufficiently'. The definition is then consistent with the definition given in ARP4754A.

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23	*TMDewey Consultancy Ltd*	4.5		Section 4.5 identifies a "software verification review", but not a validation review; this should be identified, possibly by an external reference.				Noted	EASA agrees with your comment. However in order to stay consistent with ED-12B / DO-178B, only the term verification is used (on purpose). Therefore no change is considered necessary.
24	*TMDewey Consultancy Ltd*	5.3 & 5.3.2 & 5.3.3 b) & 5.3.3 c) & 17.5		Section 5.3.2: This state, "The software certification process involves both the EASA software and CEH experts and the applicant's DOA system. Early coordination should take place between the EASA SW/CEH group and the applicant during an initial certification meeting in order to specifically address their involvement in the software certification activities". It should be made clearer where within SQWCEH-002 guidance stops and certification requirements start; the use of 'will' and 'shall' in section 5.3 seems to imply a mandatory certification requirement. An example is in section 5.3.3b) which states "The applicant should report to EASA about their own monitoring as follows:", but also "Software Review Reports shall be available for consultation"; if the applicant chooses not to report, the Software Review Reports will not be available! Another example is where section 5.3.3 c) states "The applicant will send software certification documents to the SW/CEH group and send system certification documents to the relevant system panels. ", but which documents are to be sent are identified by only "should agree". If agreement is not reached, the SW/CEH group may only get some (or none) of the required documents. An alternative approach is adopted by UK MoD where the safety standard DefStan 00-56 is in two parts, Part 1, Requirements is mandatory and is a relatively short (and therefore more manageable) document of 22 pages; Part 2, Guidance is a lot longer (82 pages) and discusses various optional approaches.				Partially accepted	The wording "shall "and "will" has been replaced by "should", consistently with ED-12B / DO-178B wording.

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25	*TMDewey Consultancy Ltd*	11.3 d.		Section 11.3.d: This section should cover the use of tools outside the software regime which can also introduce errors. An area of tool usage not identified is for tools used in generating software requirements. As this is such a potentially serious problem area, its omission is of concern. With the ever increasing complexity of aircraft and on-board systems, the system designers rely more and more on software tools to understand the intended behaviour of their system and hence derive the appropriate high level software requirements. For example, on a flight control system it is necessary to understand the responses of control surfaces to demands output by the software and how the aircraft will react. The system designers have to ensure (amongst many other considerations) that the aircraft will remain in stable, controlled flight at all times, under all conditions of aircraft orientation, air density, wind direction etc. The tools used to model such behaviour determine the limits, the rates, the timing etc. of the outputs, which are then embedded into the top level software requirements. It is quite possible that any errors introduced at such a high level will not be detected during the software verification process nor the system validation phase.				Not Accepted	Tools need to be qualified if they are used to eliminate, reduce or automate DO-178B processes and the output of the tool is not verified. This means that such tools are used to show compliance with DO-178B objectives. The software plans should indicate which DO-178B objectives are met by which activities. If some of the DO-178B objectives are met by the use of tools at the system level without the outputs being verified, this should be indicated in the software plans and tool qualification should take place even though the activities are at system level. EASA does not consider that this section needs to be updated in order to clarify this point.
26	*TMDewey Consultancy Ltd*	17.5		Section 17.5: In reference to embedded Configuration Files (CF) to be used by the software, it is stated, "The CF design specification should be validated to be accurate, consistent, verifiable, correct, and complete". An error in the CF specification or in the software requirements is equally serious; it would be more consistent if software requirement validation was also a specific process and identified as such in Section 4.5.				Partially accepted	We think that this section about Configuration Files contain all necessary validation and verification activities needed to ensure a correct an appropriate assurance.
27	*TMDewey Consultancy Ltd*	18.1		Section 18.1: It should be made clear that at least the final stage of verification must take place on the target computer; it seems to suggest that all verification could take place on a simulator.				Not Accepted	We do not agree that the text implies that all verification could take place on a simulator. ED-12B / DO-178B actually states that 'selected tests should be performed in the integrated target computer environment'. This section of the certification memorandum does not contradict that statement. This section asks for justification to be provided in cases where the environment is not the same as the target environment and for the environment to be controlled.

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28	*TMDewey Consultancy Ltd*	23.2.2		Section 23.2.2: During the software planning process specifically when 'Formalised Requirements' are involved, guidance is given "Identify their processes for system development, requirement validation, software development and verification for both their formalized items and for the conventional". Errors in requirements have always been a problem, and with the ever increasing complexity of systems, more errors of a more complex nature will inevitably occur on future systems unless steps are taken. Informal requirements are in theory more error prone than 'Formalised Requirements', so logically more guidance should be given on the validation of non-formalised requirements rather than less. Validation of requirements should be identified as a task to take place at the beginning and during the software development process. In particular, at the detailed design review the decisions that have been made at the detailed level need to be considered for possible effects on validation.				Accepted	Text has been added in paragraph 23.2.3 to state where the criteria for validation and verification of requirements can be found in ED-12B / DO-178B and ED-79 / ARP4574. The word 'formalized' has been replaced.
29	*TMDewey Consultancy Ltd*	23.2.5		Section 23.2.5, 'Formalised design replaces SW high-level requirements & SW design': The type of life-cycle identified in this section is potentially the most productive use of Formal Methods. However, a common problem with Formal Methods is reduced visibility. Use of a specialised syntax restricts the visibility of those individuals who are not fully conversant with the syntax; in particular system engineers who produced the Higher-level Requirements may have difficulty reviewing the Formalised Design. In addition, the large step in refinement from a top level 'System Requirement' to the applicable detailed parts of the Formalised Design makes traceability very difficult, as well as being potentially error prone. This section should identify other processes necessary to specifically address the potential difficulties with visibility and top level traceability.				Partially accepted	Our earlier use of the terminology using the word 'formalized' has confused some readers, so we have change the terminology to talk about 'Specification Models' and 'Design Models'. This section of the document is not intended to be related to the use of Formal Methods. Many companies use this life-cycle because the system engineers can produce a design from their requirements in a model-based form that both the system engineers and the software engineers understand. There may be more than one level of system requirements in order to develop the requirements to the stage at which a Design Model can be produced from them. A Note has been added to explain that more than one level of system requirements may be needed in order to elaborate the requirements enough for a Design Model to be produced.
30	*TMDewey Consultancy Ltd*	24.4		Section 24.4: The guidance against the use of pseudo-code is useful and necessary. However, the use of the term 'pseudo-code' may be too specific. It may be better to relate to the general principles in order to cover the use of other similar techniques such as Program Description Language or Structured English. This could also cover aspects of Formal Methods such as the use of specification languages such as VDM (Vienna Development Method).				Noted	We appreciate your agreement with our guidance against the use of pseudo-code, however, we did not intend this section to deal with any formal language or formal method. We intended it to deal with a particular usage of pseudo-code as low-level requirements and instead of actual low-level requirements.
31	*TMDewey Consultancy Ltd*	25.3		Section 25.3: The guidance for consideration of stack overflows is useful. It may be helpful to provide guidance as to choice of programming language with regard to the specific topic of stack overflow (as well as on other topics). This could cover the heightened risk with the use of assembler, as well as the benefits of using a strongly typed language such as Ada rather than a weakly typed language such as C.				Accepted	Thank you.

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32	*TMDewey Consultancy Ltd*	2		Typographical Comment a) Section 2: suggest 'items' rather than “pieces”.				Accepted	"pieces" has been replaced by "items".
33	*TMDewey Consultancy Ltd*	General	None	Typographical Comment b) Recommend to use the spelling form 'ise' rather than 'ize', but whichever, use should be consistent (section 23 uses 'formalised' and 'formalized'.				Noted	The word 'formalized' is no longer used in section 23.
34	*TMDewey Consultancy Ltd*	General	None	Introduction of Safety Requirement concept: Complexity of embedded software has increased significantly over the last decade, and will continue to increase, as will the problems associated with complexity, in particular visibility. The main underlying problem is that the output from the software design process on a moderately complex avionic system (say one with software of around 100KSLOC) is equivalent to a document of several 1000 pages of low level detailed information. For the system specialists, the hardware engineers and the safety assessors to appreciate the subtle safety implications of some particular small detail amongst this complex mass of details is extremely difficult. The software team have the most (but not complete) understanding of the detail, but do not have the detailed understanding of system safety implications. If the top level software requirements identified the 'safety requirements', and processes were defined to give them additional attention, at least then safety would be focussed.				Partially accepted	EASA agrees it is really important to feedback to the safety team and processes any software life cycle data but assumes it is already covered in ED12B / DO178B.
35	*TMDewey Consultancy Ltd*	General	None	Visibility: System engineers should be able to understand low level requirements and be required to attend detailed design reviews. As an example, there may be a system requirement to check that RAM initialisation is correct, but the detail of what the software is to do on detection of a failure is not designed until later; the system engineer needs to be able to confirm that the response is appropriate.				Accepted	Derived requirements created in the frame of the LLR have to be fed back to the safety process and it is already covered by ED12B / DO178B.
36	*TMDewey Consultancy Ltd*	General	None	Insular software development. As systems get larger and the number of people involved increases, the trend is for software development to become more insular, often for the software to be produced by a sub-supplier. The high level software requirements then become contractual, resulting in the software team's aim as being “to meet the requirements, no less, and no more”. The software team needs to be involved in Validation and not be so parochial; they must be involved in 'safety integration'.				Partially accepted	EASA agrees that the software team should be more involved in the safety and system processes for education but it is the choice of each individual company.

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37	*KLM Engineering & Maintenance*	General		The Certification Memorandum is based on an outdated ARINC 667 document. Several definitions/nomenclatures for types of software has been changed, e.g. "Field Loadable Software (FLS)" is replaced by equivalent definitions/nomenclatures such as "A/C Controlled Loadable Software Part (ACLSP) and "A/C Controlled Software (ACS). In addition, in the revised ARINC 667-1 a new grouping was made for the different types of databases, Flight Operational software and Maintenance related software.	It is recommended to make use of the latest Industry Standard document ARINC 667 (ARINC 667-1 of nov. 12, 2010) for the Certification Memorandum.	Observation	Substantive	Not accepted	This Certification Memorandum is intended to clarify the ED12B / DO178B guidance and it may cause confusion to introduce those abbreviations in this standard.
38	*Eurocopter*	3.2	13	"For an ETSO, the applicant may decide to take into account all or part of this guidance contained herein". In case only part of this Certification Memo is taken into account, will the ETSO authorisation be associated with any limitations or restrictions in relation with those aspects that are not taken into account? If yes, how the limitations or restrictions will be made available to the installer? If not, may the installer rely on the ETSO authorisation without putting in question again the ETSO article software approval? Will it be also possible for TCs or STCs holders, as per ETSOs, to decide to take into account all or part of the CM? In a case of a dedicated TC application, who will be in charge of assessing the delta between the CM used in the frame of the approval of an ETSO equipment and the one part of the TC certification basis? For ETSO equipment approved before the issuance of this CM, who will be in charge of assessing the compliance to this CM?	Confirm that the levels of compliance declared in the DDP of an ETSO article are in no case to be put in question again by the installer, or clarify what are the ETSO authorisation holder and installer respective obligations with respect to the aspects addressed in the Certification Memo.	Substantive		Partially accepted	The way of working has not changed. The specific questions you are asking will be answered in a frame of the project between the applicant and the software expert assigned to the project.
39	*Eurocopter*	4.5.4	20	Is the review of open problem reports as described in §16.9.2 part of the final SW conformity review or part of a review at system level?				Noted	From a Software point of view, EASA confirms that the review of OPR is an activity as part of the Final Certification Software Review (as described in section 4.5.4 of the Certification Memo). Having said that, as the analysis of the impact is performed at system / aircraft level, an additional review of the OPRs by the EASA system specialist is generally conducted in parallel. No change is considered necessary in the current text.

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41	*Eurocopter*	5.3.3 b.	30	It is not mentioned in §4 related to reviews that the applicant has to prepare a review report that has to be sent to EASA.	Update §4 consistently with this section.	Suggestion		Accepted	In order to clarify the intent of this item b, the following wording has been introduced in 4.3.b: "The applicant should plan and perform his/her own software review process (independently from the EASA LOI defined in the Certification Memorandum section 5); this software review process may be tailored taking into account similar criteria defined in the Certification Memorandum section 5. Indeed, per Commission Regulation (EC) No 1702/2003 and its annex (part 21), a design assurance system should be maintained for the control and supervision of the design [paragraph 21A.239 (a)], and should include an independent checking function [paragraph 21A.239 (b)]. Per GM No. 1 to 21A.239 (a), 'design assurance' means all those planned and systematic actions necessary to provide adequate confidence that the organisation has the capability to design products or parts). As part of its investigations (per 21A.257), EASA may request the reports of the reviews performed by the applicant. In case of a validation project, where the applicant is not DOA holder (or AP to DOA holder), it is expected that the applicant also performs an equivalent set of reviews per the requirements of his/her national equivalent to part 21. Note: the reviews described in this section are basically separate from the software quality assurance (as described in ED-12B / DO-178B section 8). Nevertheless the software quality assurance team may be involved or take an active part to the establishment of the software review reports."
42	*Eurocopter*	5.3.3 c.	31	This categorization is not in line with the one used at TC level: CAT 1: Subject to EASA formal approval CAT 2: Subject to EASA review and agreement CAT 3: Accepted without further verification (and provided upon request)	Harmonize with the categorization at TC level.	Suggestion		Noted	This is only an example. Each applicant can of course keep their own categorization.
43	*Eurocopter*	7.2	33	Why not identifying the process for ETSOs?	Address the process for ETSOs.		Substantive	Accepted	A note relative to ETSO has been added.
44	*Eurocopter*	10.4	43	What means the "cognizant certification authority specialist" ? Is it a member of the EASA SW/CEH group or a member of the SW panel or may it be a member of a system panel?	Provide a clearer identification of actors and clearer description of the roles and responsibilities all along the document.	Substantive		Accepted	We have removed the word 'cognizant'.
45	*Eurocopter*	11.4 c.	47	To make a link with the §4 related to SW reviews and to use the categorization as defined in §5.3.3.c instead of the one proposed.	Harmonize the categorization of submitted data in the document.	Observation		Noted	A link could be made here but section 4 already makes it clear at which stages of the review process the tool data items are required. The mention of section 5.3.3.c is not understood in this context.

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46	*Eurocopter*	15.2.1	63	Oversight of COTS supplier and vendor is most of the time impossible.	Remove the sentence or add additional provisions to address the possible difficulties raised by COTS.	Substantive		Not accepted	EASA considers that COTS suppliers and vendors should not be excluded from an oversight plan. Supplier management and, in particular, supplier oversight, may have, if not properly performed, a negative effect on the design assurance of the resulting software in which both main supplier and supplier contribute. This concern is also applicable for COTS suppliers and vendors and, hence, their oversight should be planned by the applicant. Please consider the case of COTS software libraries or development / verification tool vendors. In addition, as mentioned in the first paragraph of section 15.2.1, the oversight process should be as necessary for the particular supplier to show the compliance of the corresponding item (software, library, tool, ...) with respect to the certification regulations listed above. Hence, depending on the item, the oversight process may vary and should be presented on a case by case basis by the applicant.
47	*Eurocopter*	15.2.2	64	Supplier management plan is not an ED12B data. This data is not addressed in §4 and §5. This section addresses more engineering activities at system level than supplier oversight.	Harmonize the documents list in the memo.	Suggestion		Accepted	A Supplier Management Plan will be included in Sections 4 and 5 with a note indicating that it can be merged into other planning documentation.
48	*Eurocopter*	16.9.2	70	This section describes activities performed at system level, and some of them are also performed during SW Compliance assessment. Item 6): The compliance assessment to any ED12B objectives is performed at SW conformity level, not at system level. This leads to complete the software conformity review after the complete assessment of the system at H/C level.	Clarify to which level, system or SW, this section applies.		Substantive	Noted	The problem reporting process starts at software level; however the impact could be at system level or aircraft level. The oversight activities depend on the product and the industrial organization between the applicant, its supplier and sub-tier supplier. Therefore compliance with ED-12B/ DO-178B, section 11.20(j) is requested. The software OPRs should be analysis and their assessment should be feedback to system level to determine any potential safety or functional impact.
49	*Eurocopter*	17.5	74	The activities described have to be tailored according to the DAL of the CF.	Make it clear that the activities described have to be tailored according to the DAL of the CF.		Substantive	Noted	The reference requested is reflected in 17.2.
50	*Eurocopter*	General		Many sections address the same data items, activities, or role, or concept but there is no coordination between them. (e.g. PR management is addressed in §4, §15, §16)	To harmonize terms and definitions in the CM. To coordinate the different sections.	Suggestion		Partially accepted	The Certification Memorandum on Software Aspects of Certification (SW) has been improved in order to be more consistent. However, some areas talk about the same thing but with different views. For example, the OPR methodology is described in section 16 whereas sections 4 and 16 give additional information linked to other areas (supplier oversight, review process, etc.). But, those additional pieces of information do not change the methodology of section 16 at all.
51	*Eurocopter*	23	93	Why creating new terminology, and activities in parallel to the ED12C Model Based addendum?	Use the latest issue of ED12C IP for Model based. Use only the wording "model based" instead of "formalized" ("formalized" introduces misunderstanding with "formal methods" as discussed in the frame of ED12C).	Suggestion		Accepted	See answer to comment 2.
52	*Eurocopter*	23	93	This section takes hypothesis that ED79 is applicable to all the systems, which is not the case. ED79 is applicable for "highly-integrated or complex systems", on case by case, following discussion between EASA and the applicant.	To indicate that ED79 is applicable on case by case after discussion between EASA and the applicant.		Substantive	Noted	The text has been augmented to cover situations when ED-79 / ARP4574 or ED-79A / ARP4574A do not apply, and the text now asks for which activities the supplier conducts instead of the ED-79 / ARP4574 activities to which this certification memorandum refers.

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53	*Eurocopter*	23.2.10.6	106	To make a link with the CM section 22 related to structural coverage, data and control coupling.	To make a link with the CM section 22 related to structural coverage, data and control coupling.	Suggestion		Accepted	Text has been added to make the reference as suggested.
54	*Eurocopter*	General		A section dedicated to WCET is missing.	Add a section dedicated to WCET.	Suggestion		Noted	EASA records your request and will try to improve the SW Certification Memorandum in the future. Also, EASA advises EC to bring up this subject in the current Eurocae ED12C / DO178C meetings. The SW Certification Memorandum will be updated next year to take into account the contents of ED12C / DO178C.
55	*Eurocopter*	General		To review the consistency with AEH CM, especially related to determinism aspect (uses of micro caches, data latency …). WCET and Robust partitioning considerations should be addressed at system or LRU level, because of SW and HW are covered by those considerations.	To release a CM at system or equipment level dealing with ED79/ARP4754 and common HW and SW considerations (WCET, Data latency, robust partitioning, uses fo caches, …) or at least to harmonize the SW CM and the HW CM on that considerations.		Substantive	Noted	EASA understands that this comment is dealing with a potential and future system Certification Memorandum. The decision is issue such a Certification Memorandum has been to taken yet but EASA will consider your request.
56	*Eurocopter*	General		A section dedicated to the use of formal methods and techniques is missing.	Introduce a section equivalent to the ED12C "formal method" appendix.	Suggestion		Partially accepted	ED12C / DO178C will address soon formal methods and EASA does think there is a need to introduce it in this Certification Memorandum as it is only used by one manufacturer today.
57	*Boeing Commercial Airplanes*	Multiple areas	We suggest changing "CID" " (configuration index document), to ***"SCI"*** (software configuration index).	This change would match terminology used in ED-12B/DO-178B		X		Accepted	The Certification Memorandum has been updated to take into account your comment.
58	*Boeing Commercial Airplanes*	Multiple areas		This software CM contains multiple "system" activities and requirements to be done by an applicant.	We suggest that EASA create a new separate "system" certification memorandum and move these system activities to that new CM. This would also support usage of ED-79A/ARP4754A by applicants.	X		Partially accepted	EASA recognises that both Certification Memoranda have introduced system considerations. In all cases, EASA thought it was the best way to consider the topic. EASA would like to avoid separating any guidance in multiple Certification Memoranda, it could lead to inconsistency. EASA will consider your request to create a system Certification Memorandum in the future.
59	*Boeing Commercial Airplanes*	1.2	6	Ref Table Row 3: The proposed CM uses ED-79/ARP4754 as a reference. We suggest updating it to ***ED-79A/ARP4754A***.	Update references to the latest current version of the document/standard.		X	Accepted	We now provide references to both versions of ED-79 / ARP4574.
60	*Boeing Commercial Airplanes*	1.3	7	EDITORIAL COMMENT: The acronym "OOT" does not stand for "Object Oriented Technique," but "***Object Oriented Technology***."	Correct the definition of the acronym.	X		Noted	While we agree that OOT can have the meaning given here, the sense of the term as used in the text is that it means 'Object-oriented technique', and it is thus defined in the text. We have kept the definition in the abbreviation list the same so as to be consistent.
61	*Boeing Commercial Airplanes*	1.3	8	EDITORIAL COMMENT: The definition for "SW/CEH" definition should be changed from "Software / Complex Electronic Hwr" to "Software / Complex Electronic ***Hardware***".	For clarity, please spell out the entire word in this definition.	X		Noted	The term has been deleted as it was no longer needed due to other changes.
62	*Boeing Commercial Airplanes*	1.4	9	The definition of Option Selectable Software should include the fact that the components activated may be selected by a configuration file also.	It is part of the definition of configuration files that they can activate certain functionalities of the software, thus leading to a selection of options.		X	Accepted	A note has been added.

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63	*Boeing Commercial Airplanes*	2.1	11	Line 5: The proposed CM correlates itself to FAA Notice 8110.110, which is now expired.	We suggest updating this reference to the pending Change 1 of FAA Order 8110.49 and thus have the most recent information referenced.		X	Noted	The new version of FAA Order 8110.49 has not yet been issued, and we understand that Notice 8110.110 has expired since we incorporated its text. For the moment, we will leave the references as they are, as we cannot refer to a document that has not yet been issued.
64	*Boeing Commercial Airplanes*	2.1 b) & 2.1 c)	11 and 12	There is guidance in the referenced sections that is different from that of the FAA. Although differences are acknowledged and noted, there is no explanation why there are differences.	Harmonization on the subject of this CM is expected. Differences can lead to confusion, non-compliance, and additional workload not accounted for in this CM.		X	Noted	Although EASA and the FAA have endeavoured to harmonize their documentation and keep it consistent, particular problems found in both Europe and the USA have caused EASA to introduce some material that was initially specific to one project, but was later seen to be needed on all projects. That material was initially in CRIs, but is now combined into our Certification Memoranda. Some other material has been introduced in this Certification Memorandum that had previously been agreed between the members of CAST, which includes the FAA.
65	*Boeing Commercial Airplanes*	4.2	14	The definition of "finding" includes non-compliance with this CM. This should be deleted from the definition.	To be consistent with FAA Order 8110.49 and the FAA Job Aid for conducting software reviews, this definition should only include non-compliances with DO-178B.		X	Accepted	The definition of findings has been updated to remove "Certification Memorandum" and add "applicable CRIs" instead.
66	*Boeing Commercial Airplanes*	4.5 a.(2) & 4.5.5	16 and 22	Audit Summary Table, Row 2 The proposed CM states that the software development review should be conducted when at least 75% of the software development data is done and reviewed. We suggest changing "75%" to "50%."	Changing to "50%" will harmonize with FAA Order 8110.49 and allow the applicant to make process updates before significant rework might be required.		X	Not accepted	A review is efficient only if the application of the planned process is mature enough. To this purpose, EASA experience shows that below 75% of readiness of the artefacts, the level of maturity is often not sufficient to perform a representative sampling. This is the reason why EASA does not consider necessary to perform a change to this value. Note: having said that, nothing prevents an applicant to perform additional reviews earlier in the process (e.g. through the software quality assurance activity).
67	*Boeing Commercial Airplanes*	4.5 a.(3) & 4.5.5	16 and 22	Audit Summary Table, Row 3 The proposed CM states that the software verification review should be conducted when at least 75% of the software verification and testing data are complete and reviewed. We suggest changing "75%" to "50%."	Changing to "50%" will harmonize with FAA Order 8110.49 and allow the applicant to make process updates before significant rework might be required.		X	Not accepted	A review is efficient only if the application of the planned process is mature enough. To this purpose, EASA experience shows that below 75% of readiness of the artefacts, the level of maturity is often not sufficient to perform a representative sampling. This is the reason why EASA does not consider necessary to perform a change to this value. Note: having said that, nothing prevents an applicant to perform additional reviews earlier in the process (e.g. through the software quality assurance activity).
68	*Boeing Commercial Airplanes*	4.5 a.(4)	16	SOI #4 should be conducted with a final software conformity review, not a "preliminary."	"Preliminary" used in this paragraph is also inconsistent with Section 4.5.4, which implies the software conformity review is complete.		X	Accepted	The word "preliminary" has been removed from this paragraph.
69	*Boeing Commercial Airplanes*	4.5.1 c.	18	EDITORIAL COMMENT: The 3rd sentence is repeated.	Delete the 4th sentence, as it is identical to the 3rd sentence.	X		Accepted	The 4th sentence has been deleted as suggested.
70	*Boeing Commercial Airplanes*	4.5.2 b. Table 4-2, Row 9	19	We suggest changing the text from "Software Configuration Management" to "Software Configuration Management Records."	Changing as we have suggested will match the terminology as used in ED-12B/DO-178B.		X	Accepted	The text has been modified as suggested.
71	*Boeing Commercial Airplanes*	4.5.2 b. Table 4-2, Row 9	19	A Software Configuration Index (SCI) should be included as available data for the software development review.	Objectives in the referenced Tables include the SCI.		X	Noted	SCI is generally requested at the end of the project. This does not prevent you to request an early draft to your suppliers. No change to the proposed text is considered necessary.
72	*Boeing Commercial Airplanes*	4.5.4 b. Table 4-4, Row 6	21	EDITORIAL COMMENT: In row 6, the ED-12B / DO-178B section is incorrectly shown as "11.18".	Correct the section number to "11.19".	X		Accepted	Reference has been corrected.

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73	*Boeing Commercial Airplanes*	4.5.5	22	Audit Summary Table, Rows 2 and 3 In the "Entry Criteria" column in the Table, change the conducting of the SOI 2 and SOI 3 reviews from when "at least 75%" to "at least 50%" of the artefacts are complete and reviewed. (Also see our comments #10 and #11, above.)	Conducting the SOI 2 and SOI 3 reviews when "at least 75%" of the artefacts are complete may be too late to effect a change in the process without significant rework.		X	Not accepted	A review is efficient only if the application of the planned process is mature enough. To this purpose, EASA experience shows that below 75% of readiness of the artefacts, the level of maturity is often not sufficient to perform a representative sampling. This is the reason why EASA does not consider necessary to perform a change to this value. Note: having said that, nothing prevents an applicant to perform additional reviews earlier in the process (e.g. through the software quality assurance activity).
74	*Boeing Commercial Airplanes*	5.1	25	The third paragraph of this section states that the applicant will produce a document for EASA concurrence. It is not clear what the appropriate "document" should be -- a letter? Just a listing?	Clarify this section to specify what kind of document is required to be produced.		X	Noted	The document to be produced may be an Aircraft-level PSAC or a Software Certification Plan. It is left to the discretion of the applicant and therefore we do not consider necessary to amend the current text of the Certification Memorandum.
75	*Boeing Commercial Airplanes*	5.3.2	28	This section does not give any detail as to what the criteria would be to assign a level of involvement. Could some guidance be added for the applicant as to how this determination is made?	There is not enough information in this section for an applicant to develop a presentation that justifies their proposed level of involvement.		X	Partially accepted	The criteria as proposed have been refined in the updated Certification Memorandum. However more specific guidance cannot be provided due to the generic nature of this section. The detailed criteria are discussed on a project by project basis and consigned in a project specific document (PID).
76	*Boeing Commercial Airplanes*	5.3.3 c. Table 5-2, Column 4 heading	30	We suggest changing the column 4 heading from "CID" to "SCI."	This change should be made in order to match terminology in ED-12B/DO-178B. [There are multiple occurrences throughout the certification memorandum.]		X	Accepted	The text has been updated as suggested.
77	*Boeing Commercial Airplanes*	9.9 a.	39	We suggest changing "Plan for Software Aspects of Certification (PSAC)" to ***"system certification plan."***	This would give earlier visibility to certification authorities about the usage of user-modifiable software.		X	Not Accepted	The use of UMS should certainly be mentioned in the PSAC, so EASA would prefer to leave the text of this sentence as it is. Identifying any UMS in the System Certification Plan would be useful.
78	*Boeing Commercial Airplanes*	11.4 c.(1) iii. & 11.4 d.	50	This requirement for the specified data is not consistent with that being proposed in the Tool Qualification Supplement of DO-178C, as it does not require any completeness or correctness of the Tool Operational Requirements (TOR) for a verification tool.	There should be consistency between the soon-to-be- released Tool Qualification Supplement and this EASA CM.			Noted	This Certification Memorandum applies to DO-178B projects. Projects that adopt DO-178C as part of their certification basis will apply DO-178C and its Tool Qualification Supplement. In the meantime, this Certification Memorandum is being kept consistent with the tool qualification guidance from the existing FAA Order for DO-178B projects.
79	*Boeing Commercial Airplanes*	12.3 f.(4)	56	EDITORIAL **COMMENT:** There is a formatting problem between the words "unaffected" and "portions."	Format should be corrected prior to final publication of this CM.	X		Accepted	Text modified as suggested.
80	*Boeing Commercial Airplanes*	15.2.2	64	Item 3 (Tasks and responsibilities) and Item 5 (Integration verification activity) are too vague (i.e., Responsibilities for what? Responsible person for what?) The corresponding item in FAA Notice 8110.110 specifies "the designee's" responsibilities.	The scope of these items needs clarification. As written, the scope is too large.		X	Partially Accepted	Item 3 has been updated to clarify the scope "in the oversight of suppliers". Concerning Item 5 is identified in the last part of the paragraph.
81	*Boeing Commercial Airplanes*	16.4 6th bullet, last line, last word	67	**EDITORIAL COMMENT:** In the 6th bullet, correct the term "HAS." to ***"SAS."***	The correct acronym should be "SAS," referring to the Software Accomplishment Summary.	X		Accepted	Comment accepted and section amended.
82	*Boeing Commercial Airplanes*	16.4 7th bullet, last line	67	**EDITORIAL COMMENT:** In the 7th bullet, correct the phrase "airborne electronic hardware" to state ***"airborne electronic software."***	The correct word should be "software," as this is the CM on software.	X		Accepted	Comment accepted and section amended.

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83	*Boeing Commercial Airplanes*	16.5	67	We recommend replacing Type 3 with problems in the development data, rather than deviations. The text would then state: *"• Type 3: Any problem that is not of type 0, 1 or 2, but that is a problem with the development data (i.e., the requirements, design, or test procedures). If agreed between the aircraft/engine manufacturer and the equipment/software supplier, this type should be divided into two sub-types:* *o Type 3A: a 'significant' problem with the data, whose effects could be to lower the assurance that the airborne software behaves as intended and has no unintended behaviour.* *o Type 3B: a 'non-significant' problem with the data that does not affect the assurance obtained."*	Deviations are not typically identified as a Problem Report. Additionally, deviations to approved plans are supposed to be identified explicitly in the SAS. In light of this, the CM's proposed Type 3 appears to be inappropriate.		X	Not Accepted	From EASA's perspective, when a deviation (departure) from the plans and standards is approved, it means that the OPR is closed (e.g. SAS contains the information). EASA wanted to introduce in this section that an OPR resulting from a deviation from plans and standards was not intended and cannot therefore be considered as a process evolution.
84	*Boeing Commercial Airplanes*	16.7 6th Bullet	69	Remove "Scheduled closure date for the OPR" from the information to provide in the SAS. Add a comment that significant Type 2A OPRs should provide a date for fielding a fix for the OPR.	If the problem is not significant, it may never be worth the time to fix. Significant problems that are not fixed prior to entry into service need to have a plan in place for correcting the problem in service.		X	Accepted	EASA agrees on the intent of the content and suggests a different wording that OPR closure document should take into account the typology of the OPR (see section 16.5).
85	*Boeing Commercial Airplanes*	16.8	69	We are concerned that there are system activities/requirements in a software certification memorandum. We suggest moving this section to a separate "system" certification memorandum. (Also see our comment #2, above.)	For more clarity and less confusion, we request that system and software activities be kept in separate CMs.		X	Not Accepted	As EASA has not yet issued "what Boeing calls a Systems Certification Memorandum", EASA thinks that guidance specific to a given issue / concern / problem should be defined in this section. If such a System Certification Memorandum is issued, the section might be amended.
86	*Boeing Commercial Airplanes*	21	84	This section would be better if the stated objective of the section was to ensure that there is a distinction made in the software data between HLRs and LLRs. If these distinctions are clearly made in the software data, then it is not clear that the stated objections remain.	What is important overall is being able to see what the software as a whole needs to do, how the software architecture supports that intent, and the specific requirements for each piece of the software towards meeting those needs.	X		Noted	Intended objective is not only to make a distinction between HLR and LLR data in terms of packaging. Objective is to highlight the risks for the design assurance if HLR and LLR are merged and managed under the same processes. The different concerns are detailed in the Cert Memorandum (Section 21.1.1) and goes far beyond to the fact that they are packaged together. This corresponds to the case in which there is a single layer of requirements with mixed characteristics: HLR-like and LLR-like.
87	*Boeing Commercial Airplanes*	21.1	84	Use of term "same data item" appears to preclude the use of a single requirements-and-traceability database.	We request the text be revised to allow use of a single requirements-and-traceability database.		X	Accepted	"data item" is substituted by "requirements document". Making it explicit, it is understood that there is freedom to package the traceability information separately or HLR / LLR together.
88	*Boeing Commercial Airplanes*	22.4 4th bullet	92	We suggest the sentence be rephrased to state: "Since data coupling and control coupling analyses are two different activities, Applicants should provide a report for data coupling analysis and a separate report for the control coupling analysis."	Our suggested text provides better clarification of the objective.		X	Accepted	The proposed sentence has been added to the revised text.
89	*Boeing Commercial Airplanes*	23.2.3 Fig. 1	96	EDITORIAL COMMENT: The color shading in Figure 1 is not distinguishable when the CM is printed in black and white.	We suggest that the shading in the table be changed so that it can be easily read and easily understood in black and white paper format or other medium.	X		Accepted	The colours have been changed so that they are more distinguishable in black and white and the borders between the boxes have been made thicker.

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90	*Boeing Commercial Airplanes*	23.2.8	103-105	Configuration management and quality assurance aspects of using the simulation for verification credit are not addressed.	To remove potential questions and ambiguity, the expectations for these two integral processes when using the simulation for credit should be made clear.		X	Noted	The configuration management and quality / process assurance aspects from the classical standards are obviously applicable to MBD artefacts and therefore to simulation artefacts as well. EASA believes this does not need to be introduced in this section as it may raise the doubt in other parts of the Certification Memorandum.
91	*Boeing Commercial Airplanes*	24	109	This section is stating an opinion about use of Pseudo- code that may be true in some examples, but may not be true of all or even most examples.	Unless clarified, we are concerned that the CM guidance could be prone to misuse or "over interpretation" by the compliance finders.	X		Noted	We have rewritten this section and stated how pseudo-code may be used.
92	*Garmin*	General	None	This comment is relative the EASA suggested comment response document and not with respect to Proposed CM - SWCEH - 002 Issue: 01. 1. Excel spreadsheets are a poor method of completing comments on draft documents as there are several limitations with entering text. While we realize there may be advantages to sorting comments using Excel, it is preferable to use Word tables to provide feedback as Word provides much better tools for text manipulation including spelling and grammar checking. 2. It is unclear as to the expectation to complete the ""Comment is an observation or is a suggestion" column and its relationship to the "Comment is substantive or is an objection" column. For "observations", Garmin did not make an entry as "substantive" or "objection". For all "suggestions", Garmin entered "objection" since our expectation is that EASA should consider the "suggestion" and make changes consistent with it. 3. The comment response document as provided on the EASA web site was password protected. Since EASA web site indicates use of the CRD format is preferable but not mandatory, it seems inappropriate to password protect the CRD format.	1. In the future, use Word rather than Excel for the preferred CRD format. 2. Remove the observation/suggestion and substantive/objection columns as it should be clear from the comment summary and suggested resolution as to the categorization of the comment. 3. Do not password protect the CRD format.	Suggestion	Objection	Noted	EASA understands your concern and will improve this method in the future.
93	*Garmin*	General	All	Since EUROCAE ED-12C / RTCA DO-178C are nearing completion, it does not seem worthwhile to consolidate the EASA software certification memos at this time. Areas such as tool qualification, model-based development, object-oriented design, and other items included in this memo will be covered extensively in the ED-12C / DO-178C supplements and ED-94C / DO-248C. Additional guidance in the form of a certification memo is not necessary.	EASA should wait for ED-12C / DO-178C and their supplements to be published and then revise its software cert memo(s).	Suggestion	Objection	Partially accepted	EASA thought necessary to update the current Certification Memoranda and to request public consultation for the new projects. Those Certification Memoranda will be updated to take into account any update of Eurocae / SAE / RTCA standards such as ED12B / DO178B.
94	*Garmin*	General	Various	Many sections of this CM are largely copies of previously issued CMs. Consolidation of previous CMs into this new CM will cost industry considerably in terms of revisions to existing responses, trace matrices, etc. with no benefit to industry or improvement to safety. It would be better if this CM covered only those topics that aren't already covered in previously issued CMs.	Remove sections of this CM that are already contained in previously issued CMs.	Suggestion	Objection	Noted	EASA considers effective and relevant to regroup in 2 Certification Memoranda the old Certification Memoranda and to take into account the new technology met in past projects even on areas already covered in the old Certification Memoranda. Also, the old Certification Memoranda were not public commented and EASA thought to improve and strengthen its process.

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95	*Garmin*	General	Various	FAA Notice 8110.110 has expired and thus is no longer in effect. Garmin's understanding is that FAA is considering incorporating the content of Notice 8110.110 into FAA Order 8110.49 Change 1.	In order to retain appropriate harmonization and coordination, EASA should refrain from publishing proposed CM - SWCEH - 002 Issue:01 until FAA completes its update and then should make appropriate reference changes throughout proposed CM - SWCEH - 002 Issue:01.	Suggestion	Objection	Partially accepted	The FAA order has not yet been updated and EASA wanted to take into account this particular FAA notice 8110.110.
96	Garmin	2.1 a)	12/114	Paragraph 2.1 item a) includes a bullet acknowledging that sections 16.1 through 16.7 differ from FAA Notice 8110.110 Chapter 2.	This bullet should indicate that 16.1 through 16.8 differ from FAA Notice 8110.110 Chapter 2. Section 16.8 is equivalent to section 3.7 of EASA Certification Memo MEMO-SWCEH-003, ISSUE: 1, REV: 4 (dated 27/10/2008).	Suggestion	Objection	Accepted	Text corrected as suggested.
97	*Garmin*	4.3 b.	15/114	This paragraph states: "The applicant should perform an equivalent software review process meeting the same objectives as described in this section. The review reports are usually requested by EASA." This is a change from EASA Certification Memo MEMO-SWCEH-001, ISSUE: 1, REV: 2 (dated 16/05/2008), section 2.3. This is also not required by FAA Order 8110.49 Chapter 2. While it may be prudent for an applicant to "perform an equivalent software review process meeting the same objectives", unless EASA is willing to use the resulting "review reports" to reduce their level of involvement, it is unclear why an applicant should expect EASA to request them.	Remove paragraph 4.3 b so that the guidance is consistent with EASA Certification Memo MEMO-SWCEH-001, ISSUE: 1, REV: 2 (dated 16/05/2008), section 2.3.	Suggestion	Objection	Not accepted	In order to clarify the intent of this item b, the following wording has been introduced in 4.3.b: "The applicant should plan and perform his/her own software review process (independently from the EASA LOI defined in the Certification Memorandum section 5); this software review process may be tailored taking into account similar criteria defined in the Certification Memorandum section 5. Indeed, per Commission Regulation (EC) No 1702/2003 and its annex (part 21), a design assurance system should be maintained for the control and supervision of the design [paragraph 21A.239(a)], and should include an independent checking function [paragraph 21A.239(b)]. Per GM No. 1 to 21A.239(a), 'design assurance' means all those planned and systematic actions necessary to provide adequate confidence that the organisation has the capability to design products or parts). As part of its investigations (per 21A.257), EASA may request the reports of the reviews performed by the applicant. In case of a validation project, where the applicant is not DOA holder (or AP to DOA holder), it is expected that the applicant also performs an equivalent set of reviews per the requirements of his/her national equivalent to part 21. Note: the reviews described in this section are basically separate from the software quality assurance (as described in ED-12B / DO-178B section 8). Nevertheless the software quality assurance team may be involved or take an active part to the establishment of the software review reports.
98	*Garmin*	4.4 a.(4)	15/114	"DOA" is included in this statement and in many others; it is also included in the Abbreviations. "ODA" is not used.	Consider using ODA rather than DOA, or using both.	Suggestion	Objection	Noted	The comment is acknowledged by EASA but no change to the existing text is considered necessary.

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99	*Garmin*	4.5.5	22/114	This new section is not present in EASA Certification Memo MEMO-SWCEH-001, ISSUE: 1, REV: 2 (dated 16/05/2008), section 2.5. The text in this section is also not consistent with FAA Order 8110.49 Chapter 2. For example, both the Software Design and Software Verification audits indicate that 75% of the life cycle data should be maintained in configuration while FAA Order 8110.49 Chapter 2 paragraph 2-3 a(2), for Software Design, and paragraph 2-3 a(3), for Software Verification, indicate that they "should be conducted when a representative portion (typically at least 50 percent)" of the data is "complete and reviewed". If cert authorities deem audits are required, they should be conducted sooner rather than later in the life cycle process to reduce the risk of extensive rework by the applicant.	Change to be consistent with FAA Order 8110.49 such that Design and Verification audits can be conducted when at least 50 percent of the data is complete and reviewed.	Suggestion	Objection	Not accepted	A review is efficient only if the application of the planned process is mature enough. To this purpose, EASA experience shows that below 75% of readiness of the artefacts, the level of maturity is often not sufficient to perform a representative sampling. This is the reason why EASA does not consider necessary to perform a change to this value. Note: having said that, nothing prevents an applicant to perform additional reviews earlier in the process (e.g. through the software quality assurance activity).
100	*Garmin*	4.5.5	22/114	4.5.5 (Continued) Similarly, the Final review indicates it should be conducted "Once all SW activities are finished and at least 1 month prior to final system / equipment certification review." While it is reasonable to expect such a review to be conducted "Once all SW activities are finished" it is unclear what basis EASA uses to introduce additional delays into a project by including the phrase "at least month prior to final system / equipment certification review". FAA Order 8110.49 paragraph 2-3 a(4) indicates that the Final audit should be conducted when "the software application(s) is ready for formal system certification approval." Additionally, the Software Planning audit indicates that both the "TQP" and the "Life cycle data of qualified tools" should be available during the audit. While it is reasonable to expect the TQP to be available during the planning phase of a project, it is unclear how EASA can expect the "Life cycle data of qualified tools" to be available at the planning phase of a project when such data typically would be generated later in the project. FAA Order 8110.49 Figure 2-3 indicates that Software Tool Qualification Data should be available during the Verification audit.	Change the Final audit to be "Once all SW activities are finished". Move "Life cycle data of qualified tools" from the Planning audit to the Verification audit.			Accepted	The wording "once all activities are finished and at least 1 month prior to final system / equipment certification" has been changed to "Once the software application(s) is ready for formal certification approval." in the updated text. Concerning your second point, it is agreed that the tool qualification data (other than TQP) are generally presented later during the process. Therefore it has been shifted to SOI#3.
101	*Garmin*	5	26/114 - 31/114	Is it feasible for EASA to be involved to the extent specified in this guidance?	The guidance should be reviewed and revised according to the level of involvement that EASA can realistically support.	Suggestion	Objection	Noted	EASA confirms that the level of involvement as described in the section 5 of this Certification Memorandum is the way projects are commonly handled on a daily basis. No change to this section is considered necessary.

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102	*Garmin*	5.3.3 a. Table 5-1	30/114	The LOW LOI row includes an expectation for "1 on-site audit or desktop reviews". The inclusion of the "on-site audit" is a change from EASA Certification Memo MEMO-SWCEH-001, ISSUE:1, REV:2 (dated 16/05/2008), section 3.4.3 a Table 3-1. This change is also not consistent with the expectations in FAA Order 8110.49 Chapter 3 Figure 3-4 for the LOW LOI. An on-site audit is a significant applicant expense; it is unclear how EASA justifies the additional applicant cost with the LOW safety risk.	Remove "on-site audit or" from the Table 5-1 LOW LOI row.	Suggestion	Objection	Accepted	The "on site audit" has been removed for LOW involvement.
103	*Garmin*	12.1	68/114	Possible incorrect reference to "this CRI."	Change the reference to "this CM."	Suggestion	Objection	Accepted	We have altered the text on page 114 as suggested.
104	*Garmin*	15	63/114 - 65/114	It is unclear as to how EASA (and FAA) intend to apply the supplier oversight guidance in this section. In particular, what does EASA (and FAA) mean by the term "applicant"? Is it only referring to an aircraft manufacturer applying for a TC or STC and its sub-tier suppliers or is the intention to also apply this to a ETSO (or TSO) holder? If to a TSO holder, how can this guidance be applied?	Given the context of Section 15, the term "applicant" would best be limited to an aircraft manufacturer applying for a TC or STC.	Suggestion	Objection	Not accepted	EASA prefers to keep the term "applicant" as it covers the equipment supplier (ETSO applicant) and the aircraft / engine / propeller manufacturer (TC applicant). For this latter case, it is the normal process that the applicable guidance should be flown-down to system, equipment and sub-tier suppliers as necessary (depending on the industrial organisation). Additionally, please note that this Certification Memorandum is intended to be used as initial basis for CRIs whose compliance demonstration is under applicant responsibility.
105	*Garmin*	15.1 c.	63/114	This paragraph includes the statement "When this data is retained by a sub-tier supplier, it may not be readily available to us." while FAA Notice 8110.110 Chapter 1 paragraph 2.d, includes the statement "When this data is retained by a foreign supplier, it may not be readily available to us." Changing the text from "foreign supplier" to "sub-tier supplier" is a substantive change that is inconsistent with harmonization.	Since EASA removed FAA Notice 8110.110 Chapter 1 paragraph 2.c, which is also about foreign supplier concerns, to be consistent, it should also remove paragraph 15.1 c.	Suggestion	Objection	Noted	EASA has not included the considerations from the FAA about foreign suppliers but has identified that some of the potential risks identified by the FAA could also be applicable for sub-tier suppliers. This is the purpose of the 15.1.c. Then, resulting text is an adaptation of the FAA Order but intended to cover the situation in which complex project organisations may lead to the fact that sub-tier suppliers' data is not easily visible to the certification authority.
106	*Garmin*	15.2.2 6.	64/114	This paragraph includes the phrase "including those in foreign locations".	Since EASA removed FAA Notice 8110.110 Chapter 1 paragraph 2.c, which is about foreign supplier concerns, to be consistent, the phrase "including those in foreign locations should be removed from paragraph 15.2.2 item 6.	Suggestion	Objection	Accepted	Text is removed. However, the rationale is slightly different from the proposed one by the reviewer. The rationale is that it is not necessary to make any special distinction for foreign suppliers: information about all the sub-tier suppliers should be managed, independently on the location.
107	*Garmin*	16.1 - 16.8	66/114 - 68/114	While proposed CM - SWCEH -002 Issue:01 paragraph 2.1 item a) acknowledges that sections 16.1 through 16.7 differ from FAA Notice 8110.110 Chapter 2, the magnitude of the differences is significant and leads to lack of harmonization and coordination between cert authorities and consequently additional applicant effort. Furthermore, the EASA guidance contained in proposed CM - SWCEH -002 Issue:01 sections 16.1 through 16.8 pertaining to Management of Problem Reports, while substantially the same as that contained in EASA Certification Memo MEMO-SWCEH-003, ISSUE:1, REV:4 (dated 27/10/2008), is also significantly different than what is required by ED-12B / DO-178B and from what is known at this point, what will be required by ED-12C / DO-178C, particularly in the areas of Typology of Open Problem Reports, Guidelines on OPR Management, and Contents of Software Accomplishment Summary (SAS).	EASA should harmonize the section 16 guidance with other internationally recognized guidance (ED-12C / DO-178C) regarding open problem reporting.	Suggestion	Objection	Not Accepted	As stated in section 2.1 item a), sections 16.1 through 16.7 differ from FAA Notice 8110.110 Chapter 2. Once ED-12C / DO-178C has been published and recognized as guidance, EASA intends to also publish a separate ED-12C / DO-178C version of the Software Certification Memorandum that will take into account the differences between ED-12B / DO-178B and ED-12C / DO-178C along with its supplements. It is anticipated that some sections or sub-sections of this ED-12B / DO-178B Software Certification Memorandum will no longer be needed in the ED-12C / DO-178C Software Certification Memorandum because they will be superseded by ED-12C / DO-178C and its supplements.

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108	*Garmin*	16.5 & 16.6	67/114 and 68/114	16.5 Type 0 & 16.6 Type 0 Identification of problems with a safety impact is not necessary since those problems will be resolved before certification.	Problems that should be resolved before certification will be resolved before certification. At the time of certification, there would be no evidence that such a category existed since all such problems would have been resolved. The reason for categorization is to classify problems that are deferred beyond certification.	Suggestion	Objection	Not Accepted	In some cases, at the time of certification Type 0 or Type 1 open problems are still open for certification, therefore EASA needs them to be classified and recorded, as some of these OPRs might have means of mitigation of operating limitations which are to ensure that there are no adverse effects on safety at the aircraft / engine level.
109	*Garmin*	16.9.1	69/114	Includes the statement "..., the applicant should discuss in their Software Configuration Management Plan, or other appropriate planning documents, how they will oversee their supplier's and sub-tier supplier's software problem reporting process." It is not clear how this can be applied in all situations. For example, there are often situations where an aircraft OEM will develop aircraft-specific software (e.g., Take Off and Landing Distance [TOLD] calculations) to be included in its supplier's equipment, where the supplier will then become the "applicant" for a TSO. In such a situation, the aircraft OEM is both the "applicant" and a "sub-tier supplier" to its equipment supplier and it is not necessary to require the equipment supplier to describe the aircraft OEM's software problem reporting process as the aircraft OEM should be well aware of its own software problem reporting process.	Clarify that it is not necessary for an equipment supplier to describe an aircraft OEM's software problem reporting process when the aircraft OEM is a sub-tier supplier to its own equipment supplier.	Suggestion	Objection	Not Accepted	The oversight activities depend on the product and the industrial organization between the applicant, its supplier and sub-tier supplier. In EASA, the Parts and Appliances section, responsible for ETSOs, is located in a different Certification department as the Expert Department, which is responsible for the technical involvement for certification, therefore it might not be the same persons involved for the ETSO approval at equipment level as for the system approval at AC / Engine level.
110	*Garmin*	16.9.1 1)	69/114	Indicates that "The plans should describe each of the applicant's supplier's and sub-tier supplier's problem reporting processes that will ensure problems are reported, assessed, resolved, implemented, re-verified (regression testing and analysis), closed, and controlled. The plans should consider all problems related to software, databases, data items, and electronic files used in any systems and equipment installed on the aircraft." Are not the suppliers and sub-tier suppliers also subject to ED-12B / DO-178B? If so, it may be appropriate for the applicant to summarize the supplier processes or indicate how the applicant's processes will interact with the supplier processes or to include a reference to the supplier processes but it is not clear what EASA (or FAA) purpose will be served by describing in detail the "processes that will ensure problems are reported, assessed, resolved, implemented, re-verified (regression testing and analysis), closed, and controlled" for each of the supplier's and sub-tier supplier's problem reporting processes. Furthermore, databases should be outside the scope of this cert memo, especially aeronautical databases covered under the DO-200A process.	Reduce the expectation for plan content to what is really required by the applicant to manage supplier problem reports. Remove databases from the scope of 16.9.1 1).	Suggestion	Objection	Not Accepted	From a software point of view, information on the all problems related to software, databases, data items, and electronic files used in any systems and equipment installed on the aircraft need to be considered, therefore this information should be recorded in the plans.

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111	*Garmin*	16.9.1 2)	69/114	Includes the statement "The categories described above should be used." As noted elsewhere in Garmin's comments, the Typology requirements of proposed CM - SWCEH -002 Issue: 01 paragraph 16.5 is significantly different than what is required by ED-12B / DO-178B. This is also a change from FAA Notice 8110.110 Chapter 2 paragraph 3.a. (2) and its subparagraphs.	Remove the statement "The categories described above should be used." and make the typology requirements consistent with those in other accepted certification guidance.	Suggestion	Objection	Partially accepted	As stated in 16.5, the typology proposed in this Certification Memorandum is one possible way to classify OPRs. Also, section 16.6 states that an equivalent typology may be proposed.
112	*Garmin*	16.9.1 3) d)	70/114	States "The plans should state that suppliers will have only one problem reporting system in order to assure that the applicant will have visibility into all problems and that no problems are hidden from the applicant." While only having one problem reporting system is an appropriate goal, the use of the term "will" is inconsistent with the ED-12B / DO-178B 7.2.3 Note that states "Note: Software life cycle process and software product problems may be recorded in separate problem reporting systems." This issue is also present in FAA Notice 8110.110 Chapter 2 paragraph 3.a.(3)(d). Furthermore, this paragraph could be interpreted to mean that all of an applicant's suppliers must use a single problem reporting system. This interpretation would be extremely difficult to accommodate.	This statement should be modified to ensure that it does not impose a requirement on a supplier to have one problem reporting system when the supplier needs to have separate problem reporting systems for life cycle processes from those associated with the software product. Additionally, this paragraph should be clarified that it is not meant to impose a single problem reporting system across all of an applicant's suppliers.	Suggestion	Objection	Accepted	The wording has been changed accordingly to the first comment "will" replaces by "should". This subsection has been updated and contains the note of ED12B / DO178B section 7.2.3.
113	*Garmin*	16.9.1 5) b)	70/114	States "Since a significant number of unresolved problem reports indicate that the software may not be fully mature and its assurance questionable, the applicant should describe a process for establishing an upper boundary or target limit on the number of problem reports allowed to be deferred until after type certification." The ambiguity of this statement will lead to interpretation problems by aircraft OEMs and certification authorities. It provides no guidance on what constitutes "a significant number" with respect to software characteristics. For example, ten problem reports in a Level A software function are more likely to be significant than ten problem reports in a Level D software function. Similarly, ten problem reports in a Level C software function with a large number of software requirements and/or code size are less likely to be significant than ten problems in another Level C software function with a small number of software requirements and/or code size.	Clarify that a "significant number" can vary depending on the software characteristics, including specific examples such as provided in the Comment summary column.	Suggestion	Objection	Not Accepted	EASA confirms that a "significant number of unresolved problem reports..." can vary from project to project, therefore the number will be decided by EASA on a case by case basis.

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114	*Garmin*	16.9.1 5) c)	70/114	Includes the statement "The plan should establish a means of determining a time limit by which unresolved problem reports deferred beyond certification will be resolved." The ambiguity of this statement will lead to interpretation problems by aircraft OEMs and cert authorities. It provides no guidance on what constitutes an acceptable time limit with respect to software characteristics. For example, a problem report in a Level A software function that has an adverse safety impact should be addressed more quickly than a problem report in a Level D software function that has no safety impact; in the case of the Level D software function, it should be acceptable to leave such a problem report open indefinitely.	Clarify that the "time limit" can vary depending on the software characteristics, including specific examples such as provided in the Comment summary column.	Suggestion	Objection	Not Accepted	EASA confirms that a "time limit by which unresolved problem reports deferred beyond certification..." can vary from project to project, therefore the time limit will be decided by EASA on a case by case basis.
115	*Garmin*	16.9.2 4)	70/114	Includes the statement "The applicant may need help to determine which problems to resolve before certification." We would presume that such help is already being provided by the certification authority; consequently, this statement is obvious and unnecessary.	Remove the quoted statement from this paragraph.	Suggestion	Objection	Not Accepted	EASA sees the need to keep this sentence as some smaller applicants may not know that the help and support from the Authority can be requested in the field of: airworthiness directives, service bulletins, or operating limitations and other mandatory corrections or conditions.
116	*Garmin*	18.2	76/114	This section states that the Software Verification Plan should include information regarding the software development environment. The software development environment is not applicable to the software verification plan. Per RTCA/DO-178B (11.2 and 11.3), the software development environment is described in the Software Development Plan and not the Software Verification Plan.	The software development environment should not be included in this paragraph.	Suggestion	Objection	Not Accepted	The objectives referred to in this section are verification objectives, so the means to comply with those objectives should be in the Verification Plan, which is what the text states.
117	*Garmin*	18.2	77/114	This section includes a statement that the Software Configuration Management Plan should include "A problem reporting and assessing system for the software development and verification environment that is available to all users of the environment (see section 16 of this Certification Memorandum)." This requirement is not consistent with RTCA/DO-178B. Per RTCA/DO-178B 7.2.9, there are three types of tools associated with the software life cycle environment that require SCM: Qualified (subject to CC1 or CC2), non-qualified tools for building and loading SW (subject to CC2) and all others (subject to configuration identification). Per RTCA/DO-178B 12.2.3.b, qualified software development tools require CC1 while qualified verification tools require CC2. Per RTCA/DO-178B Table 7-1, only CC1 data are required to meet the SCM Problem Reporting objective. Consequently, a problem reporting system is only required for qualified development tools.	The sentence should be reworded as follows: "A problem reporting and assessing system, as required, for the qualified tools that are part of the software development environment that is …"	Suggestion	Objection	Not Accepted	We do not agree that ED-12B / DO-178B states what the comment states. ED-12B / DO-178B states that the tools used to build and load the software should comply with the objectives associated with Control Category 2 data, as a minimum. It does not say that the tools used to develop the software should be categorized as CC2 items.
118	*Garmin*	19.2	80/114 - 81/114	General The term "flow analysis" is used in several places in this section. What is flow analysis?	The term "flow analysis" should be defined or other defined terms should be used instead.	Suggestion	Objection	Accepted	Changed to "data flow / control flow analysis".

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119	*Garmin*	19.2 (b)	79/114	This paragraph promotes use-cases to achieve traceability between functional requirements and objects. Other approaches are equally valid. Sequence diagrams for example, can be used to effectively bridge the gap.	The statement regarding use-cases could be rewritten as "Use-cases or other diagrams allow...".	Suggestion	Objection	Noted	EASA considers that the concern of the reviewer is already covered by the existing text. It is mentioned: "Use-cases with diagrams allow traceability from a functional description of software to an object-oriented design and therefore naturally promote traceability from the requirements down to the code.". Then, the use of other diagrams is also covered.
120	*Garmin*	19.2 (c) 3rd paragraph	80/114	It is not clear what the paragraph beginning with "Furthermore, with the possible" means. Encapsulation is generally a good thing and serves to reduce coupling. Protected or private data is protected from execution access but is not unknown to the programmer. Class declarations provide far more information than procedural language functional declarations. In bullet 2, requiring specific requirements and test cases for each "hidden" method could be onerous and could encourage large and monolithic functions. In bullet 3, this is true regardless of the programming method so what is unique for OOT?	This paragraph and its bullets should be removed.	Suggestion	Objection	Not Accepted	Major concern from EASA is to avoid potential unintended functionality inside the class. Programmers that implement a class have no access to the internal data of the class and may exercise unintended functionality if the description of the class is incompletely documented. Proposed means are intended to prevent such situation.
121	*Garmin*	19.2 (e) Item 16	81/114	Item 16 ends with a comma and appears to be incomplete.	Complete the statement, or modify the punctuation to make it clear that the statement is complete as written.	Suggestion	Objection	Accepted	Added "...".
122	*Garmin*	19.2 (e) Item 16	81/114	It is not clear what the second part of the sentence means. Is initialization the key issue as it relates to the other items? What is an "on time" call?	This statement should be clarified and if it is specific to initialization, it should be stated so.	Suggestion	Objection	Accepted	Sentence reworded removing the reference to "on time calls".
123	*Garmin*	20.1	82/114	In most instances, Section 20 changes the term "Assembly Branch Coverage" previously used in EASA Certification Memo MEMO-SWCEH-010, ISSUE:1, REV:2 (dated 16/05/2008) to "Object Code Coverage". However, in the last paragraph of section 20.1, the term "Assembly Branch Coverage" is still used.	Change "Assembly Branch Coverage" to "Object Code Coverage" or "OCC".	Suggestion	Objection	Accepted	Comment accepted and section amended.
124	*Garmin*	20.2 bullet 1	82/114	States that "The approach should generate the same minimum number of test cases as that needed at the source code level appropriate to the software level of the application (e.g., MC/DC for Level A, decision coverage for Level B)." Previously in section 20.1, it is recognized that an applicant may propose the OCC alternative by "taking advantage of the "short-circuiting" aspects of modern compilers". The guidance to generate the same minimum number of test cases is inconsistent with ED-94C / DO-248C DP #13 which recognizes that there are times when fewer test cases are required for short-circuiting compilers. Furthermore, section 20.1 correctly states that the use of OCC is to satisfy the ED-12B / DO-178B, Table A-7, objective 5 for MCDC. Consequently, the reference to "decision coverage for Level B" is inconsistent with the stated purpose of this section.	With respect to the number of test cases, this paragraph should be removed in favor of or otherwise harmonized with ED-94C / DO-248C when it is published. With respect to the Level B decision coverage reference, this reference should be removed.	Suggestion	Objection	Accepted	Comment accepted and paragraph amended. "The approach should generate the same minimum number of test cases as that needed at the source code level for MC / DC coverage."

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125	*Garmin*	20.2	82/114	The bullet items are substantially modified from the numbered list items in EASA Certification Memo MEMO-SWCEH-010, ISSUE: 1, REV: 2 (dated 16/05/2008) section 3. Revising the content in this manner will cost industry considerably in terms of revisions to existing responses, trace matrices, etc. with no benefit to industry or improvement to safety.	Adjust the 20.2 bullet items to minimize the changes to the numbered list items in EASA Certification Memo MEMO-SWCEH-010, ISSUE: 1, REV: 2 (dated 16/05/2008) section 3.	Suggestion	Objection	Noted	EASA understands the concern, however the wording has been agreed between "Certification Authorities Software Team" see Position Paper CAST-17 on "Structural Coverage of Object Code".
126	*Garmin*	20.2 bullet 5	82/114	States "Analysis of the object code or qualification of a tool may be necessary to ensure that design and coding rules were followed and that the compiler performed as expected." The statement contains two thoughts: one regarding analysis of object code to ensure that the compiler performs as expected and another regarding qualification of a tool to ensure that design and coding rules were followed. Additionally, ED-12B / DO-178B already require object code analysis for Level A, so this aspect of the statement is redundant with guidance that an applicant is already expected to follow.	Revise the statement to only address the tool qualification to ensure that design and coding rules are followed.	Suggestion	Objection	Noted	The content of Section 20.2 is identical to that agreed between the "Certification Authorities Software Team" - see Position Paper CAST-17 on "Structural Coverage of Object Code". However if this statement is redundant with guidance that an applicant is already expected to follow it should not be considered as additional work for the applicant.
127	*Garmin*	20.2 bullet 6	82/114	States "Traceability between object code, source code, design, and requirements should exist." ED-12B / DO-178B already require traceability between object code, source code, design and requirements for Level A software. Hence this statement is redundant with guidance that an applicant is already expected to follow.	Remove this statement.	Suggestion	Objection	Noted	The content of Section 20.2 is identical to that agreed between the "Certification Authorities Software Team" see Position Paper CAST-17 on "Structural Coverage of Object Code". However if this statement is redundant with guidance that an applicant is already expected to follow it should not be considered as additional work for the applicant.
128	*Garmin*	20.2 bullet 8	82/114	States "The approaches for data coupling analysis and control coupling analysis should be performed by the applicant/developer, whether the coverage is performed on the linked object code or not." ED-12B / DO-178B already require data coupling and control coupling analysis for Level A software. Hence this statement is redundant with guidance that an applicant is already expected to follow.	Remove this statement.	Suggestion	Objection	Noted	The content of Section 20.2 is identical to that agreed between the "Certification Authorities Software Team" see Position Paper CAST-17 on "Structural Coverage of Object Code". However if this statement is redundant with guidance that an applicant is already expected to follow it should not be considered as additional work for the applicant.
129	*Garmin*	20.2 bullet 9	82/114	States "Data should be available to substantiate any object code not covered." This is a substantial change from EASA Certification Memo MEMO-SWCEH-010, ISSUE:1, REV:2 (dated 16/05/2008) section 3 and is inconsistent with the purpose of OCC, which is to show that an equivalent level of coverage is obtained to that required by ED-12B / DO-178B, Table A-7, objective 5 for MCDC.	Remove this statement.	Suggestion	Objection	Noted	The content of Section 20.2 is identical to that agreed between the "Certification Authorities Software Team" see Position Paper CAST-17 on "Structural Coverage of Object Code". However if this statement is redundant with guidance that an applicant is already expected to follow it should not be considered as additional work for the applicant.
130	*Garmin*	20.2 bullet 10 sub-bullet 3	83/114	Asks "How are long jump and long throw addressed (do they allow multiple entries and exits)?" Definitions for the terms "long jump and long throw" would be beneficial to understanding why this question is being asked.	Provide definitions for "long jump and long throw".	Suggestion	Objection	Noted	The content of Section 20.2 is identical to that agreed between the "Certification Authorities Software Team" see Position Paper CAST-17 on "Structural Coverage of Object Code". However if this statement is redundant with guidance that an applicant is already expected to follow it should not be considered as additional work for the applicant.

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131	*Garmin*	20.2 bullet 10 sub-bullet 9	83/114	Asks "Do functions of the compiler (e.g., pre-parser) need to be qualified for the proposed compiler options and optimizations intended to be used?" ED-12B / DO-178B already require analysis to show traceability between source code and object code. This analysis should include compiler functions such as a pre-parser. Hence, this question is redundant with guidance that an applicant is already expected to follow.	Remove this question.	Suggestion	Objection	Noted	The content of Section 20.2 is identical to that agreed between the "Certification Authorities Software Team" see Position Paper CAST-17 on "Structural Coverage of Object Code". However if this statement is redundant with guidance that an applicant is already expected to follow it should not be considered as additional work for the applicant.
132	*Garmin*	20.2 bullet 10 sub-bullet 10	83/114	Asks "Is analysis of the object code needed to ensure design and coding rules were followed and that the compiler behaved as expected?" ED-12B / DO-178B already require design reviews and code reviews to ensure that design and coding rules were followed. Additionally, ED-12B / DO-178B already require object code analysis to ensure the compiler behaves as expected. Hence, both aspects of this question are redundant with guidance that an applicant is already expected to follow.	Remove this question.	Suggestion	Objection	Noted	The content of Section 20.2 is identical to that agreed between the "Certification Authorities Software Team" see Position Paper CAST-17 on "Structural Coverage of Object Code". However if this statement is redundant with guidance that an applicant is already expected to follow it should not be considered as additional work for the applicant.
133	*Garmin*	20.2 bullet 10 sub-bullet 13	83/114	Asks "Should linker or loader functions be qualified?" ED-12B / DO-178B already require analysis to show traceability between source code and object code. This analysis should include linker and loader functions. Hence, this question is redundant with guidance that an applicant is already expected to follow.	Remove this question.	Suggestion	Objection	Noted	The content of Section 20.2 is identical to that agreed between the "Certification Authorities Software Team" see Position Paper CAST-17 on "Structural Coverage of Object Code". However if this statement is redundant with guidance that an applicant is already expected to follow it should not be considered as additional work for the applicant.
134	*Garmin*	21	84/114 - 87/114	The topic of merging high-level and low-level requirements is being addressed by a proposed FAQ #81 for ED-94C / DO-248C.	This section should be removed in favour of or otherwise harmonized with ED-94C / DO-248C when it is published.	Suggestion	Objection	Noted	As general rule, once the ED12C / DO178C and ED94C / DO248C are published, it will be necessary to reassess some of the elements in the Certification Memorandum. Comment is retained for further consideration.
135	*Garmin*	22	89/114 - 92/114	Guidance in this section vastly exceeds what is specified in ED 12B / DO-178B and ED-94 / DO-248B FAQ #67. Such guidance has not been previously applied and will significantly raise cost without any justifiable safety benefit.	This section should be removed.	Suggestion	Objection	Not accepted	EASA does not share the commenter's view and does not agree to remove this section. The guidance related to Data and Control Coupling introduced in ED-12B / DO-178B and ED-94 / DO-248B FAQ #67 is limited and therefore clarifications about this topic are necessary. This section 22 will help in reaching an harmonized level of understanding of this topic within the industry and therefore will contribute to reach an adequate and harmonized level of safety.
136	*Garmin*	22.2.1	88/114	The 4th sentence from the bottom of the page contains "that that the software."	Remove the extra "that."	Suggestion	Objection	Accepted	The additional "that" has been removed in the revised text.
137	*Garmin*	22.2.3	89/114	This section quotes ED-94 / DO-248B. There could be copyright implications.	Permission should be obtained from EUROCAE / RTCA for copying this text and the permission should be noted in this document.	Observation		Accepted	The subsection 22.2.3 has been removed.
138	*Garmin*	23.2.5.4	100/ 114	This section is labelled "Other Required Activities" as is section 23.2.6.6 and possibly others; yet the first sentence in document (the Purpose and Scope) says this CM is guidance material and as such it should not contain "requirements".	Label this section Other Applicable Activities.	Suggestion	Objection	Accepted	The text has been altered as suggested.

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139	*Garmin*	23.2.6.7	103/114	This section addresses system requirements verification. The verification of system requirements seems to be out of scope for a software memo.	This section should be removed.	Suggestion	Objection	Not Accepted	While we understand that it may seem strange to reference system verification in a software certification memorandum, this is the complement of the validation of the system requirements that is also called for in this document. Testing of the system requirements is necessary to ensure that the system requirements are fulfilled and that the model-based components of the system life-cycle operate as specified within the system. The verification of the system requirements was similarly called for by the previous EASA individual certification memorandum on this subject and the EASA CRIs on this subject, so this item is not new.
140	*Garmin*	23.2.8.2	104/ 114	In paragraphs "d" and "e", Source Code and Object Code are inconsistently capitalized. In these two paragraphs they are capitalized differently in the same paragraph. Also Software product is capitalized in "e" but not in "d." There are instances of inconsistent capitalization of these terms throughout this document.	Use capitalization consistently throughout the document.	Suggestion	Objection	Partially accepted	This capitalization is used on purpose in order to be consistent with DO-178/ED-12B, where the capitalization of "Source Code" and "Executable Object Code" is used to characterize the final software product. Regarding the capitalization of "Software product" in item e, we agree it is a mistake and it has been corrected in the updated Certification Memorandum text.
141	*Garmin*	23.2.10.1	105/ 114	The first paragraph includes the words, "must be shown." The next paragraph uses "should be expressed." Another example of this is in 23.2.10.3 where "should" then "must" then "should" are used.	Since this is guidance material, use "should be shown."	Suggestion	Objection	Accepted	The text has been altered as suggested.
142	*Garmin*	24	109/114 - 111/114	The topic of pseudo-code as low-level requirements is being addressed by a proposed FAQ #82 for ED-94C / DO-248C.	This section should be removed in favor of or otherwise harmonized with ED-94C / DO-248C when it is published.	Suggestion	Objection	Noted	We have rewritten this section to be compatible with a text proposal for FAQ #82.
143	*Garmin*	25	112/114 - 113/114	WG-71 / SC-205 IP #253 brought up the topic of stack overflows for inclusion as a ED-94C / DO-248C FAQ but IP #253 was never brought before plenary for discussion. The section 25 guidance within this CM seems more developed than IP #253 draft 3 dated 29-Jun-09.	If IP #253 is ultimately included as a ED-94-C / DO-248C FAQ, this section should be removed in favor of or otherwise harmonized with ED-94C / DO-248C when it is published.	Observation		Accepted	
144	*Garmin*	25.2	112/114	The text in this section suggests that worst case stack analysis is only possible "at the source code level by counting the sizes of all data declarations and parameters" and through the use of testing. It then points out the problems associated with both of these methods. However, this guidance does not appropriately consider other capabilities available to applicants whereby the worst case stack analysis uses the actual stack size allocated by the compiler. The actual stack size information is typically available via compiler listings, directly from the object code, or even from the linker. Using the actual compiler-generated stack size avoids the problems mentioned with performing the worst case analysis via source code level analysis and testing, although it does not overcome the issues related to hardware failure, SEU, etc.	The guidance should be revised to acknowledge the other methods available to perform worst case stack analysis using the actual stack allocation and indicate this method is preferable to the source code level analysis and testing methods.	Suggestion	Objection	Partially accepted	EASA agrees that the actual stack allocation may be useful to provide assurance regarding this issue. First, ED-12B / DO-178B request in section 6.3.4.f that the review of the source code should cover the stack usage and EASA should recognise this. In addition, EASA reminds that the complier / linker are not qualified and when specific assurance is taken from complier / linker listings, an analysis should be provided to be able to get credit from it.
145	*Garmin*	25.3 d)	113/ 114	Item d) ends in a comma, yet it is the end of the list.	Correct the punctuation in this list.	Suggestion	Objection	Accepted	Sentence corrected.
146	*FAA*	1.2	6	The table references SAE ARP 4754. However SAE ARP 4754A was issued in December 2010.	Recommend referencing SAE ARP 4754A	X		Accepted	Reference has been added.

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147	*FAA*	1.3	7	The abbreviation IFCA should be ICA.	Change IFCA to ICA	X		Accepted	Text corrected.
148	*FAA*	5.3.1 b.	28	FHA acceptance at the system level should be done in coordination with flight test. The pilots involved in the certification should be involved in the accepting the functional failure conditions.	Do the systems specialists coordinate with the EASA flight test pilots in accepting the FHA? Systems specialists may not have the operational experience to make the final call on the classification of the functional failure conditions	X		Noted	EASA confirms that the relevant operational failure conditions are reviewed with the flight-test specialists (EASA panel 1). Those details are not in the scope of this Cert Memorandum.
149	*FAA*	7.6 b.	35	IFCA should be ICA. ICA is correctly defined in 7.6a	Change IFCA to ICA	X		Accepted	Text altered as suggested.
150	*FAA*	7.6 f.	35	IFCA should be ICA. ICA is correctly defined in 7.6a	Change IFCA to ICA	X		Accepted	Text altered as suggested.
151	*FAA*	23.2.8.2 e.	104	There may be minor differences (e.g. header) between the source code use for simulation and the source code of the final software product.	Include the following: "If there are any differences, they must be minor and justified."	X		Accepted	The wording you suggest has been added in the updated text of the Certification Memorandum.
152	*FAA*	13	59	The real purpose of the software change impact analysis is not just to determine if the changes are Major or Minor at the system or aircraft level, but to determine the impact of the changes on the software product to ensure that all impacted areas, functions, requirements, data, etc. are analyzed, and that regression testing is performed to re-verify that the software will continue to function properly and robustly. This would include hardware changes impacting the software. The guidance of the FAA Order was slanted toward the Major/minor question but that was not the original intent.	Incorporate the types of analyses to be conducted for software and hardware changes as defined in the order		X	Noted	EASA appreciates that the material in chapter 11 of FAA Order 8110.49 is helpful to companies performing change impact analyses and that many companies follow the FAA text in this respect. However, it is not currently EASA policy to add material to the requirements of Part 21 in respect of major / minor change determination so EASA does not wish to alter the text of section 13 of this Certification Memorandum at this time.
153	*FAA*	6	32	Presumably EASA has a defined process and guidelines for ensuring the conformity of parts (including software parts, and AEH parts) and the installation of those parts on an aircraft to validate that it meets the aircraft's type design and/or supplemental TC (modifications).	EASA should specify the guidelines for conforming that the parts and installation meet the defined aircraft type design. For software, parts may include resident (embedded) parts, field-loadable applications, aeronautical databases, configuration files (if separately loadable). May also need to address "electronic part marking" where the software part number and version is only electronically marked within the equipment, and a query is needed to confirm those part numbers. Some of this may be part of the maintenance procedures for that equipment and ensuring its conformance.		X	Partially accepted	The topics highlighted in the comment are already included in various places of Part 21 (part numbering) or other sections of this Certification Memorandum (section 4 and 5).
154	*FAA*	Cover page	1	Cover page 3rd block This paragraph describes the Certification Memoranda as: "…intended to provide guidance … and ... may provide complementary... guidance for compliance demonstration …" yet also states that CM "…must not be misconstrued as formally adopted Acceptable Means of Compliance (AMC) or as Guidance Material ..."	Uses of the term "guidance" appear to conflict. Either this conflict must be resolved by use of different terminology or, if there is a difference between the use of the terms "guidance" and "Guidance Material", then these should be defined or explained.	X		Partially accepted	The wording used in this Certification Memorandum is consistent with the definition provided in Part 21.
155	*FAA*	1.3	7, 8	Should be titled "Acronyms" since these are Acronyms and not Abbreviations.	Change to "1.3 Acronyms"		X	Noted	According to Webster's online dictionary, as used in the USA, an acronym is an abbreviation formed from initial letters (as FBI). Since the standard form of EASA documents is to have a section entitled 'Abbreviations' and an acronym is a form of abbreviation, we would prefer to leave the name of the heading as it is.

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156	*FAA*	1.3	7	FHA Acronym definition: because CM is referencing SAE ARP 4754, it should use its terms.	FHA Acronym definition should be "FH...Assessment", not "FH...Analysis".		X	Accepted	Text corrected.
157	*FAA*	1.3	8	PSSA Acronym definition: because CM is referencing SAE ARP 4754, it should use its terms.	PSSA Acronym definition should be "PSS...Assessment", not "PSS...Analysis".		X	Accepted	Text corrected.
158	*FAA*	1.3	8	MC/DC Acronym: because CM is referencing ED/DO-178B, it should use same terminology.	Change MCDC to "MC/DC" per ED/DO-178B terminology.		X	Accepted	Text altered, however MC / DC does not appear in DO-178B, it is a term that appears in DO-248.
159	*FAA*	1.3	8	SW/CEH definition: should end with "Hardware" for completeness/correctness.	Change "Hwr" to "Hardware" at end of definition.	X		Noted	The term has been deleted as it was no longer needed due to other changes.
160	*FAA*	4.5.2 c.	19	Objective listed for A-10 "(objective 3)" is different from that in Order 8110.49 "(Objectives 1-2)".	Correct if an oversight and not an intentional difference.	X		Partially accepted	After a careful analysis of the content of ED-12B / DO-178B sections 9.0 and 9.1, EASA believes that the objectives A10-1 and 2 are more related to the planning phase and therefore should appear only as SOI #1 evaluation criteria. Also (see answer to comment 401), the objective A10-3 is more related opt the end of a project (SOI#4 evaluation criteria). For all these reasons, the best solution is to remove references to table A10 objectives in this section 4.5.2.c
161	*FAA*	4.5.3 b. Table 4-3	20	Was it an oversight, or is there a reason Object Code was removed from this Table?	Replace if an oversight and not an intentional removal.	X		Accepted	It was an oversight. Object Code has been added. Thank you.
162	*FAA*	4.5.3 c.	20	Objective listed for A-10 "(objective 3)" is different from that in Order 8110.49 "(all objectives)".	Correct if an oversight and not an intentional difference.	X		Partially accepted	After a careful analysis of the content of ED-12B / DO-178B sections 9.0 and 9.1, EASA believes that the objectives A10-1 and 2 are more related to the planning phase and therefore should appear only as SOI #1 evaluation criteria. Also (see answer to comment 401), the objective A10-3 is more related to the end of a project (SOI#4 evaluation criteria). For all these reasons, the best solution is to remove references to table A10 objectives in this section 4.5.2.c
163	*FAA*	4.5.4 b. Table 4-4	21	The ED/DO Section reference for SQAP is incorrectly listed as "11.18" instead of "11.19".	Change "11.18" to "11.19".		X	Accepted	Reference has been corrected.
164	*FAA*	7.4 f. Note 2	34	This CM changed "data integrity algorithms" to "CRC" thus limiting the original scope of the Note to imply that only CRC is an acceptable algorithm; I don't believe this is appropriate.	Change back to "data integrity algorithms"		X	Accepted	The text has been changed as suggested.
165	*FAA*	16.4 Last bullet on "OPR"	67	This definition states it applies to "AEH" and not "SW" as it should.	Change "airborne electronic hardware" to "software".		X	Accepted	Comment accepted and section amended;
166	*FAA*	16.5 & 16.6 & 16.7 & 16.8	67, 68, 69	The proscriptive nature of these sections may cause a problem during validations; e.g., if a U.S. manufacturer has used other OPR typology classifications, but EASA insists on seeing these classifications.	None.	X		Not Accepted	Section 16.5 states: "<u>One possible way</u> to classify OPRs that is acceptable to EASA... " Section 16.6 states: "All OPRs should be categorized according to the typology of problems defined in this Certification Memorandum, <u>or an equivalent</u> typology. If an <u>equivalent typology</u> is proposed, any new type(s) should correspond to only one of the types (0, 1, 2 or 3) as defined in this section of this Certification Memorandum."

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167	*FAA*	16.9.1 3) d)	70	The sentence "The plans should state that suppliers will have only one problem reporting system in order to assure that the applicant will have visibility into all problems and that no problems are hidden from the applicant." implies that only one PR system can be used, even if different ones are required to address different processes, as is allowed by ED/DO-178B.	Change to: "The plans should state that suppliers will have only one problem reporting system except when ED/DO-178B's Section 7.2.3 Note is applicable, that is, use of separate systems is allowable for handling differences between life cycle process related versus software product related problem reports, in order to assure that the applicant will have visibility into all problems and that no problems are hidden from the applicant."		X	Accepted	This subsection has been updated and contains the note of ED12B / DO178B section 7.2.3.
168	*FAA*	17.5	74	The "Validation" bullet implies that ED/DO Section 5.1 defines "validated" processes in a way that it does not. Although many of the words used (e.g., verifiable, correct, complete, consistent) appear in ED/DO Section 5.1, the word "valid…" itself does not appear anywhere in ED/DO Section 5.1.	Remove the reference to ED/DO-178B Section 5.1 since it is not valid.		X	Accepted	Validation is defined in ED12B / DO178B when system requirements are invoked and there is a possibility that CF are directly defined from system requirements. However, to avoid confusion, "Validated" has been replaced by "reviewed & analysed".
169	*FAA*	18.2 second "1)" - under SCMP sentence	77	This section states "A description of the configuration control system to be used for the software development and verification environment."	To be more accurate, this should say "…to be used IN the software development and verification environments..." (CAPS used above to highlight changes)	X		Not Accepted	We disagree that the configuration control system is IN the development and verification environment. This section is about having a system to control the configuration OF the software development and verification environment, and that system might not be within the environment itself. It can be argued that the development and verification environments are separate but for now we have kept the text consistent with the FAA text from which this section was developed.
170	*FAA*	2 & 2.1 & 19	11, 78	Section 2 uses the term "object-oriented technology" whereas the rest of the CM uses the term "Object-Oriented Techniques".	The terminology should be consistent throughout the CM unless the difference is intentional.	X		Accepted	The text has been made consistent.
171	*FAA*	20.1 & 20.2	82	These sections refer to Assembly (code) as being Object code. Per ED/DO definitions, Assembly language (code) is considered a form of Source Code. Also, Assembly code is not "linked" as bullet 8 of 20.2 would imply.	Should delete these incorrect correlations which are not in agreement with the ED/DO.		X	Noted	EASA understands the concern, however the wording has been agreed between "Certification Authorities Software Team" see Position Paper CAST-17 on "Structural Coverage of Object Code".
172	*FAA*	21	84	The actual topic of concern is not "Merging High-Level and Low-Level Requirements" but a "Single Level of Requirements". The current title/topic wording implies that multiple levels are first developed, and then merged; I do not believe that is a logical or realistic scenario.	Change Title/topic from "Merging High-Level and Low-Level Requirements" to "Single Level of Requirements".		X	Noted	EASA fully agrees that this Section is talking about a single level of requirements but would prefer to keep the title as it is mentioned in the CAST Paper 15.
173	*FAA*	25.2 Last 6 bullets	111	Most of these bullets cited as reasons for Stack Overflows could not be fixed by having a Real Time Stack Monitoring Function and might possibly be causes for the RTSMF failing as well, or of it being ineffective. So, the Guidance of Section 25.3 which is suggesting a RTSMF does not seem to be of much more benefit than the previously accepted stack analysis, especially given the "not trivial" nature of providing it.	None.	X		Partially accepted	The intent of this list is to provide some examples where the RTSMF may be useful. Indeed, the RTSMF may be not cover any kind HW failure of software misbehaviour and may fail itself but it may provide an added value as the software is interacting with other the interfaces. Most manufacturers implement RTSMF to provide an additional layer of fault detection at stack level. Section 25.3 -Guidance- does not impose such monitoring.

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174	*MathWorks Technical Marketing*	23.2.6.6 & 23.2.4.5 & 23.2.5.4		23.2.6.6 Other Required Activities. The other general activities and objectives that are applicable to this life-cycle are shown below in the section dealing with General Principles and Activities. These include: · Traceability and Granularity of Requirements / Design Elements. · Derived Requirements / Elements. · Non-Functional Requirements · Requirement Coverage Analysis. · Verification that Source Code Complies with Requirements and Standards. · Structural Coverage of Source / Object Code. · Qualification of Auto-coding Tools. · Compliance with Standards. The bullet regarding Qualification of Auto-coding tools should not fall under Required Activities. This activity should be optional and will be dependent upon any certification credit sought for the tool as described earlier in the document. The same comment applies to sections 23.2.4.5 and 23.2.5.4.				Partially accepted	The title of these headings has been changed to 'Other Applicable Activities', so the text no longer says that they are required. The text of the section that actually is referred to regarding the qualification of auto-coding tools states that the tool has to be qualified if the developer wishes to take credit against ED-12B / DO-178B objectives. This makes it clear that the activity only has to be done where it is applicable.
175	*Rolls-Royce plc*	All	None	Suggest changing references to DAL to IDAL or FDAL as appropriate throughout, in line with the guidance of ARP 4754A				Partially accepted	This Certification Memorandum should also take into account the previous DAL allocation and wording (ED79 / ARP4754). Many subsections have been updated and incorporate now "IDAL" and "FDAL".
176	*Rolls-Royce plc*	1.2		Should now reference ED-79A instead of ED-79				Accepted	Reference to ED-79A / ARP4574A has been added.
177	*Rolls-Royce plc*	All	None	Suggest EASA review use of "aircraft" throughout the document, and clarify whether they intend this document to apply only to aircraft or equally to engine or propeller applications. IN many cases use of "aircraft/engine/propeller" may be more appropriate				Noted	In section 3.2, the Certification Memorandum explicitly states that it applies to aircraft systems and engine. The wording used is aircraft systems and engine.
178	*Rolls-Royce plc*	16.4	67	Final bullet - it should mention software rather than Airborne Electronic Hardware.				Accepted	Comment accepted and section amended.
179	*Rolls-Royce plc*	16.6	68	2nd para talks about "this CRI" but this is a Certification Memo, not a Certification Review Item				Accepted	Comment accepted and section amended.
180	*Rolls-Royce plc*	16.7	68	"The EASA team may reject a request for certification if the number of remaining OPRs is too high…" Rolls-Royce considers that quantity of OPRs alone is not a reasonable ground on which to withhold certification. Rather such a decision should be based on the impact of the OPRs on the safety case for the aircraft/engine/propeller (e.g. for engines, the effects of the OPRs should be assessed against CS-E510)				Not Accepted	It is correct that the EASA team may reject a request for certification if the number of remaining OPRs is too high, or if there is no evidence of an adequate action plan to close the OPRs. The number and safety impact of the OPRs as well as the period and plan to track the progress of the closure of the OPRs, will be dealt on a case-by-case basis depending on the project.

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181	*Gulfstream Aerospace Comments*			The proposed rule will significantly and unnecessarily increase cost and increase the time for software development. Whereas N8110.49 and the Software Job Aid presently offer guidance on the use of audits to find compliance, they allow and provide guidance on the scope of audits to be applied as appropriate for each situation. The proposed rule will require extensive mandatory audits to be conducted across all situations. For example: - SOI audits would be mandatory for all software - A formal process for handling SEU's will be needed - COTS software will require formal Verification and Validation - Processes will need to be developed for monitoring sub-tier suppliers - Formal requirements will be applied to graphic processors - Requirements are added for the PR process - Formal change processes will be followed				Partially accepted	The proposed Certification Memorandum mainly reintroduces and groups past Certification Memoranda. Some updates are made but it does not change significantly the way of working. Please find information on the specific areas you have mentioned: - SOI audits would be mandatory for all software: Applicant may define their LoI taking into account multiple and various inputs (criticality, PDS, etc.) - See section 5. This review process is harmonized with the FAA orders. - A formal process for handling SEU's will be needed: It is up to the applicant to define their own way to handle the SEU risk, EASA do not prescribe the method. ED135 / ARP4761A is currently working to update this area. - COTS software will require formal Verification and Validation: COTS does not require formal V&V. There are many possibilities to introduce COTS and depending on the project and COTS, some activities need to be performed in order to provide confidence that the COTS is well managed. - Processes will need to be developed for monitoring sub-tier suppliers: EASA thinks (and hopes) that processes to monitor suppliers already exist. EASA would like this process to be documented if not already done. - Formal requirements will be applied to graphic processors: CGP is an area of concern as the FC linked to them is usually Catastrophic. EASA just reuse the generic FAA IP and CAST to cover the issue. - Requirements are added for the PR process: There are no new rules as it is a copy / paste of the existing EASA CRI harmonized with the FAA IP. - Formal change processes will be followed: The change process did not change from the past for software and a dedicated list of items has been established for AEH.
182	*Gulfstream Aerospace Comments*			The present software infrastructure will need to be enhanced at the OEM, suppler, and sub-supplier level to meet the proposed requirements, and in many cases the enhancements are excessive for many of the tasks. Gulfstream strongly recommends instead that the proposed ruling be revised to allow requirements to be tailored as appropriate for each situation.				Partially accepted	As said in the comment 181, the proposed Certification Memorandum does not change significantly the way of working. See section 5. This review process is harmonized with the FAA orders. Processes will need to be developed for monitoring sub-tier suppliers: EASA thinks (and hopes) that processes to monitor suppliers already exist. EASA would like this process to be documented if not already done.
183	*Gulfstream Aerospace Comments*			We trust that these comments will be given due consideration. If there are any questions, or if I can be of further assistance, please do not hesitate to contact Bill Clark at (912) 965-4949 or GAC.Cert@Gulfstream.com.				Noted	

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184	*Embraer*			The document is not taking into account the revision " A of ARP4754 issued recently. Regarding the definition of DAL, although not seems to affect significantly the document, the new ARP4754A has a chapter showing clearly how to set the DAL, which is not reflected in this document and may lead to a "misleading" interpretation. This situation happens today with the existence of the DO-178B, DO-254 and the FAA Policy PS-ANM-03-117-09, which provides guidance not fully aligned on how to allocate DAL to items. Another example of non-alignment with the new ARP4754A is the section 23.2.1 0.9 (pg. 108) which contains a concept of independence, according to ARP4754 was slightly changed in the revision A of that document. Thus, Embraer suggests an alignment between this CM and ARP4754.				Partially accepted	We have included ED-79A / ARP4574A in the references and have attempted to provide references to the sections of that document in addition to those of ED-79 / ARP4574. This Certification Memorandum should also take into account the previous DAL allocation and wording (ED79 / ARP4754). However, next Certification Memorandum version will take into account the new ED79A / ARP4754A. Also, the independence concept explained in both does contradict each other.

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185	*Italian Civil Aviation Authority (ENAC)*	13		Paragraph 13 on SW change impact analysis recalls as guideline the PART21A.91 and relevant Guidance Material and does not take any advantage of the FAA Order 8110.49 that describes how to be able to analyze (change impact analysis) with the aim to classify SW changes with respect to their minor or major nature.In my experience the FAA order 8110.49 is very useful for discussion with applicant that are facing such classification because it is very specific and exhaustive and it forces the applicant not only to classify the change but also (and above all) to analyze it by considering a full set of disciplines, as it requires to consider the change both in its mere SW aspect (% of the change and so on) both in its effect on the machine, and to track the reasons of the classification helps to get a deep knowledge of the change (above all for certification on changes previously designed and implemented e.g. on a military ac) that SW department "only", without the avionics dept and above all without the flight dep (that is always difficult to get in the loop) probably would not have reached. I have some times experienced, for instance, discussions on SW changes related to an avionics change (MAJOR or MINOR) in which, only by requiring a foregoing SW change classification/impact analysis independent by the avionic change classification, the nature (and thus the importance and the need to consider it with a "MAJOR change" attitude) of the change has been exposed. This, of course, has nothing to do with administrative matters. I think that the GM to Part21 should be considered when issuing the relevant procedures of the applicant DOA Handbook and not recalled as the only mean to assess SW changes because this material is not enough "SW oriented" (e.g. consider only executable SW, processor and so on) (and to me not even too clear in that part…) and does not provide useful material to perform a change impact analysis. I guess that such FAA Order can always be taken as a reference, if it is considered necessary, but with a specific session of an EASA SW MEMO that doesn't recall it at all, it will be much and much more difficult to bring it in the certification loop as the relevant CRIs will not recall it. Thus, my comment is to recall the FAA Order 8110.49 chapter 11 as method suitable to perform a SW change impact analysis.	Thus, my comment is to recall the FAA Order 8110.49 chapter 11 as method suitable to perform a SW change impact analysis	X		Noted	This comment is similar to comment 152 from the FAA, to which we have provided the following answer - EASA appreciates that the material in chapter 11 of FAA Order 8110.49 is helpful to companies performing change impact analyses and that many companies follow the FAA text in this respect. However, it is not currently EASA policy to add material to the requirements of Part 21 in respect of major / minor change determination so EASA does not wish to alter the text of section 13 of this Certification Memorandum at this time.

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186	*Italian Civil Aviation Authority (ENAC)*	16		Completely agreed on the aim and nature of the paragraph; nevertheless I have experienced some troubles when I have tried to use the proposed OPR typologies. Probably due to the cross disciplinary nature of the team required to analyze OPR or to the fact that the classification is not completely clear to me, thus it is difficult to provide explanation when required. For instance, what does "with a safety impact" mean? (type 0). Is it related to the CAT or HAZ functional failures "1309 oriented" or not? At that point safety assessment specialists around the table begin to argue. And how could a failure with a "significant functional consequence" (type 1A) have no safety impact? (are we talking about crew workload? Are those related to the 1309 failure condition having a MAJOR effect? In this case, why not considering the significant reduction in safety margin also?. NOW it's time to argue for flight engineers around the table…. And how can I be convinced that type 3A OPRs "whose effects could be to lower the assurance that the airborne software behaves as intended and has no unintended behaviour" do not end to have a safety impact (it depends on the unintended behaviour..), it is the reason why the structural coverage is required and no dead code is allowed... Thus, to me, the best thing to do is to say that the proposed one is just one example of the acceptable classification. The mandatory concept is to define the typologies intended to be used (SW supplier and sub-tier supplier) and its management depending on type of OPR, in the relevant software plans in order to seek for the authority concurrence.	Thus, to me, the best thing to do is to say that the proposed one is just one example of the acceptable classification. The mandatory concept is to define the typologies intended to be used (SW supplier and sub-tier supplier) and its management depending on type of OPR, in the relevant software plans in order to seek for the authority concurrence.	x		Noted	Section 16.5 states: "One possible way to classify OPRs that is acceptable to EASA... " Section 16.6 states: "All OPRs should be categorized according to the typology of problems defined in this Certification Memorandum, or an equivalent typology. If an equivalent typology is proposed, any new type(s) should correspond to only one of the types (0, 1, 2 or 3) as defined in this section of this Certification Memorandum."
187	*SAFRAN*	General		Initially CRI was dedicated to a particular program with the objective to precise and assign objectives for some specific topics incompletely covered by ED-12B. This proposed certification memorandum, merging a collection of EASA CRI or FAA CAST papers, appears like a new version of ED-12B but without assigning clearly objectives for each topic addressed; in such case the mean of compliance to provide is difficult to define and shall be precise. Furthermore to demonstrate the conformity to each § of this document feels a very strong and difficult work and requires to define clear objectives to be more efficient. This remark applies in particular to §21, 22, 24.			Objection	Not accepted	As said, SW Certification Memorandum is a collection of old CRIs applied to past projects. As those CRIs have not been challenged in the past, EASA does not see why it could lead to specific issues. About Section, 21, 22 and 24, there are linked to specific issues, they are fully harmonized with CAST papers and request only some information (analysis) when used.
188	*SAFRAN*	General	All	This Certification Memorandum should provide a clear distinction between clarification of ED12B/DO-178B guidance material and additional requirement considered by EASA as additional acceptable means of compliance (i.e. needing formal compliance substantiation).			Objection	Not accepted	As indicated in the Certification Memorandum, there is no new requirement compared to ED12B / DO178B. Also, those Certification Memoranda are going to be raised on project by a way of a CRI and will be discussed with the applicant.
189	*SAFRAN*	General	All	Some parts of this CM is system and safety strongly oriented (FLS, User modifiable software, OPR ...). In such a case, those aspects have to be considered at system/safety level (i.e. out of the SW life cycle).			Objection	Partially accepted	This Certification Memorandum has sometimes introduces topics related to system and safety processes due to their strong interaction with the HW data life cycle.

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190	*SAFRAN*	General	All	Knowing that a CM is often called up in a CRI, it should be clearly mentioned how the justification of compliance is expected by the Agency.			Objection	Accepted	When the CRIs is closed, an Interpretative Material (IM) is issued. It may contain some additional clarification about how justification is done but EASA thinks it is up to each supplier to determine its own methodology to reach any objective.
191	*SAFRAN*	1.1	9	In front of references and requirements provided in the next chapter, the scope of this CM needs to be precise (SW domain only or applicable to some system area?)		Suggestion	Substantive	Noted	The scope of this Certification Memorandum is the Software domain in relation to ED-12B / DO-178B. However, some aspects related to software are decided or managed at system level, such as Problem Reporting, Safety Assessment and DAL allocation (as mentioned in sections 16 and 17). In addition, in section 23, some activities that are normally conducted at the software level are conducted at the system level instead for some model-based development software life-cycles. In that section, the validation and verification of requirements at the system level has to be performed.
192	*SAFRAN*	1.2	9	Reference to FAA Order, Notice, CAST papers as used later in this CM could be listed here	Suggestion			Noted	EASA wishes to maintain compatibility with the current EASA document template. This certification memorandum will be discussed within EASA so other references may later be included.
193	*SAFRAN*	1.4	9	Definitions is restricted to EASA actors	Add to that chapter the definition of remaining actors: Applicant, supplier, sub-tier supplier, CVE...	Suggestion	Substantive	Partially accepted	We have added CVE to the list of abbreviations. The term 'Applicant' is already defined in ED-12B / DO-178B. In this Certification Memorandum, we do not define words that are commonly used in the industry (equipment supplier, sub-tier supplier etc.). Some of the other definitions are already in Part 21, ED-12B / DO-178B etc.
194	*SAFRAN*	1.4	9	Some definitions are missing for some EASA actors	Add to that chapter the definition of remaining EASA actors: PCM, coordinator...	Suggestion	Substantive	Not Accepted	PCM means 'Project Certification Manager" (see acronym in section 1.3). A coordinator is someone who coordinates. We have not provided definitions of terms that are commonly used within industry or that are common English words.
195	*SAFRAN*	1.4	9	Definitions provided in the §1-7. of FAA order 8110.49 can be reused		Suggestion		Not Accepted	We have included the definitions from the FAA Order that were relevant to this Certification Memorandum but some definitions that are common terms within the industry have not been included. Some of the definitions have been provided within the sections that use them.
196	*SAFRAN*	3.2	13	The applicant may decide also to take into account all or part of this guidance			Objection	Accepted	SW and HW Certification Memoranda will be called by a CRI which will be discussed in the frame of the project: no change on the way of working.

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197	*SAFRAN*	4.3 b.	15	Such a SW review process requirement is more related to a DOA organisation; according to LOI, it should be precised if these reports are considered as deliverable or consultable at applicant's site.	Clarify if these review report are part of certification data according to LOI.	Observation	Substantive	Partially accepted	In order to clarify the intent of this item b, the following wording has been introduced in 4.3.b: "The applicant should plan and perform his/her own software review process (independently from the EASA LOI defined in the Certification Memorandum section 5); this software review process may be tailored taking into account similar criteria defined in the Certification Memorandum section 5. Indeed, per Commission Regulation (EC) No 1702/2003 and its annex (part 21), a design assurance system should be maintained for the control and supervision of the design [paragraph 21A.239 (a)], and should include an independent checking function [paragraph 21A.239 (b)]. Per GM No. 1 to 21A.239 (a), 'design assurance' means all those planned and systematic actions necessary to provide adequate confidence that the organisation has the capability to design products or parts). As part of its investigations (per 21A.257), EASA may request the reports of the reviews performed by the applicant. In case of a validation project, where the applicant is not DOA holder (or AP to DOA holder), it is expected that the applicant also performs an equivalent set of reviews per the requirements of his/her national equivalent to part 21. Note: the reviews described in this section are basically separate from the software quality assurance (as described in ED-12B / DO-178B section 8). Nevertheless the software quality assurance team may be involved or take an active part to the establishment of the software review reports."
198	*SAFRAN*	4.5 a.(2) & 4.5 a.(3)	16	"At least 75%" cannot be a fixe and unique criteria: it should be defined jointly with EASA SW panel within each project, according to process maturity, project size and complexity, team skill level, incremental life cycle...	75% to be removed as a formal expectation from EASA; criteria need to be discussed according to project characteristics		Objection	Not accepted	A review is efficient only if the application of the planned process is mature enough. To this purpose, EASA experience shows that below 75% of readiness of the artefacts, the level of maturity is often not sufficient to perform a representative sampling. This is the reason why EASA does not consider necessary to perform a change to this value. Note: having said that, nothing prevents an applicant to perform additional reviews earlier in the process (e.g. through the software quality assurance activity).
199	*SAFRAN*	4.5.1	17	If formal compliance substantiation is expected, means of compliance have to be discussed latest during the SOI1 planning stage	Add in this chapter a statement on the CM/CRI for the software planning review (CRI needs to be provided before SOI1)		Objection	Not accepted	The process of setting up the list of MoC is of course required before entering the compliance determination. EASA intent is to agree on the CRIs with the applicant before SOI#1 but depending on the project (e.g. new technologies…) it may happen that CRIs are not agreed prior to SOI#1. Therefore no prescriptive guidance can be introduced in the Certification Memorandum on this matter.
200	*SAFRAN*	4.5.1	17	According to the §9 of ED-12B/DO-178B, EASA team have to provide at the SOI1 planning stage an agreement on the PSAC document	Add in this chapter the agreement provided by the EASA team on the means of compliance (PSAC document and sub-plans)		Objection	Noted	The closure of the SOI#1 is the formal step for approving the PSAC (when the EASA is involved in this SOI#1 stage based on the LOI as described in section 5 of this Certification Memo). EASA does not consider necessary to add an additional statement in the Certification Memorandum about this topic.
201	*SAFRAN*	4.5.2	18	Software load procedure is not part of SOI-2 life cycle data (§DO-178B §11.11)?	Observation			Accepted	The "software load procedure" has been added to the updated text.
202	*SAFRAN*	4.5.1 & 4.5.2	17, 18	Archive of SW life cycle data (table A8-4) are performed for SOI4	Suppress the need to provide archive data before SOI-4	Observation	Objection	Accepted	The objective A8-4 has been removed from section 4.5.1.c.
203	*SAFRAN*	4.5.2 c.	19	Precise that SECI provided for SOI-2 can be limited to the configuration of the development environment		Suggestion	Substantive	Accepted	The mention "development environment aspects" has been added.

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204	*SAFRAN*	4.5.3 b.	20	Tools qualification data can be incomplete for SOI-3	Add that tool qualification data can be incomplete for SOI-3		Objection	Not accepted	There is no point in delaying the production of a TAS to the SOI#4 where the tool is used to reduce, eliminate or automate some portions of the development or verification activities. Therefore, the "Tool Qualification Data" have been kept in the tables 4-2 and 4-3.
205	*SAFRAN*	4.5.2 c. & 4.5.3 c.	19, 20	Compliance substantiation is expected for SOI-4 (SAS, SCI)	Remove reference to A10-3	Suggestion	Substantive	Accepted	The objective A10-3 has been removed from section 4.5.1.c.
206	*SAFRAN*	4.5.4	Table 4.4	SQAR quoted 11.18 instead of 11.19.		Observation	Substantive	Accepted	Reference has been corrected.
207	*SAFRAN*	4.5.4 b.	21	Tool Accomplishment summary is missing (can be limited to development tools)		Suggestion	Substantive	Not accepted	There is no point in delaying the production of a TAS to the SOI#4 where the tool is used to reduce, eliminate or automate some portions of the development or verification activities. Therefore, the "Tool Qualification Data" have been kept in the tables 4-2 and 4-3.
208	*SAFRAN*	4.5.5	22	"At least 75%" cannot be a fix and unique criteria: it should be defined jointly with EASA SW panel according to process maturity, project size and complexity, team skill level, incremental life cycle...	75% to be removed as a formal expectation from EASA; criteria need to be discussed according to project characteristics		Objection	Not accepted	A review is efficient only if the application of the planned process is mature enough. To this purpose, EASA experience shows that below 75% of readiness of the artefacts, the level of maturity is often not sufficient to perform a representative sampling. This is the reason why EASA does not consider necessary to perform a change to this value. Note: having said that, nothing prevents an applicant to perform additional reviews earlier in the process (e.g. through the software quality assurance activity).
209	*SAFRAN*	4.6	23	LOI and EASA Software Review Process need to be discussed with the EASA team at the beginning of the project and fixed latest at the planning stage, ; it can be part of PSAC according to DO-178B 11.1c	To add in the SOI-1 planning stage the objective to get the LOI and EASA SW review process		Objection	Noted	Your point is understood. However, this activity is not directly linked to the SOI#1 activity, as it is part of the determination of compliance phase. The LOI definition phase is logically supposed to occur before starting the demonstration of compliance. Having said that, the section 4.4.b already supports this idea in stating that the "certification authority involvement in a software project should be documented as early as possible in the project." Based on this, no change is considered necessary to the Certification Memorandum text.
210	*SAFRAN*	4.7 b.	23	The notification letter is not integrated in the current EASA practices; did you have in mind to keep that kind of formal notification?		Observation		Accepted	This section 4.7 has been reworked extensively in the updated Certification Memorandum in order to better reflect current practices.
211	*SAFRAN*	5.3.3 c.	30	Table 5-2 gives only an example of the certification documents to be provided to SW group. Documentation to be delivered by the applicant need to be identified by the SW group (a form similar to that used by FAA can be used - ref. to 8110.49 Appendix 1)	Provide formal identification of documentation needed for agreement, for information, or on request. Such an information must be part of the planning stage outputs (can be recorded in the SOI1 minutes of meeting)	Suggestion	Substantive	Noted	The details on the documentation to be delivered are decided on a project by project basis and consigned in project specific documents (e.g. PID). Therefore EASA does not consider necessary to modify the Certification Memorandum text.
212	*SAFRAN*	5.5.3 c.	30	"The allocation of certification documentation ... Shall be clearly documented in the system certification plans" is outside the scope of the CM; address this topic with a specific system CM.	Suppress that sentence		Objection	Accepted	This sentence has been removed in the updated Certification Memorandum.

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213	*SAFRAN*	7		This chapter provides some additional guidance to be used for FLS approval; most of them are system or safety related. What is the EASA organisation in front of?	Precise the EASA involvement and life cycle data expectation in front of FLS (covering also system and safety considerations).		Objection	Noted	The EASA level of involvement in the initial certification is not affected by the presence or absence of FLS. The specific aspects of FLS that need to be checked by EASA or agreed by EASA are already stated in this section. Any software life-cycle data additional to the items listed in ED-12B / DO-178B are stated in this section, e.g. 'the applicant's on-board loading system and procedures should be approved by the certification authorities' in section 7.4 (g) (3). This section is common with the corresponding section of FAA Order 8110.49 and EASA would prefer only to change the text of this section if any aspects are found that are actually incorrect. This comment does not point out any such aspects.
214	*SAFRAN*	16		The analysis of the SW (or CEH) problems should be part of the system and safety process; classification according to CM typology have to be considered as an output of these process and summarized in the SCS			Objection	Noted	EASA considers that even if the equipment manufacturer has sufficient knowledge to explain the functional effect of an OPR on the equipment / item, only the aircraft / engine manufacturer can assess or confirm the potential effect at the system / aircraft / engine level. However, all OPRs should be recorded in the Accomplishment Summary or equivalent certification document. In the upcoming EASA Certification Memorandum "System Aspects linked to Software and Airborne Electronic Hardware" a section will be dedicated for OPRs at System Level.
215	*SAFRAN*	16.4	67	a. item "Fault": what means (1)? b. item "Failure condition": what means […] at the end of the phrase? C. item "Deviation from the rules": HAS instead of SAS.			Observation	Accepted	Definitions have been updated to reflect your comment and ED12B / DO178B definitions.
216	*SAFRAN*	13.1	59	Where are the paragraphs 21A.91, 21A.95 and 21A.97?			Observation	Noted	These are paragraphs within the Part 21 regulations that are referred to in this section of the certification memorandum.
217	*SAFRAN*	16.5	67	The typology introduces the notions "problem whose consequence is a failure of the system" or "having no safety impact on the aircraft/engine". So clearly the OPR cannot be classified in the scope of the software activities alone and the classification shall be effectively done at system level. In consequence one can ask “What is the effective perimeter of the OPR classification; system or software?” Another issue to consider is when the final product is decomposed in different components that can be used for some in different projects. The classification for a component shall be considered independently and then shall be "reclassified" depending on the mitigations or others mechanisms used to integrate the component. This situation is not taken into account by the §, and may be introduced in the §16.8.			Objection	Not Accepted	Section 16.5 states: *"• Type 0: a problem whose consequence is a failure – under certain conditions - of the system, with a safety impact.* *• Type 1: a problem whose consequence is a failure – under certain conditions - of the system, having no safety impact on the aircraft / engine. (This needs to be confirmed by the aircraft / engine manufacturer)."* EASA agrees that OPR cannot be classified in the scope of the software activities alone and the classification shall be effectively done at system level (see section 16). Therefore in the upcoming EASA Certification Memorandum"System Aspects linked to Software and Airborne Electronic Hardware" a section will be dedicated for OPRs at System Level. The issue of the final product being decomposed in different components / suppliers / sub-tier suppliers has been considered in section 16.9.

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218	*SAFRAN*	16.8	69	System certification Summary should be outside the scope of the CM	Remove §16.8	Suggestion	Substantive	Not Accepted	As an EASA "System Aspects linked to Software and Airborne Electronic Hardware" Certification Memorandum does not exist at the moment, EASA considers that this aspect should be addressed in this Certification Memorandum. Section 16.8 might then be amended if a Certification Memorandum "System Aspects linked to Software and Airborne Electronic Hardware" is released.
219	*SAFRAN*	18.1	76	"ED-12B/DO-178B" doesn't require but recommend to use the target computer for SW testing (ref. to DO-178B §6.4.1)	To replace "require" by "recommend"	Suggestion	Objection	Accepted	The word 'require' has been removed.
220	*SAFRAN*	18.2	76	SW development environment is provided through SDP instead of SVP		Suggestion		Noted	The objectives referred to in this section are verification objectives, so the means to comply with those objectives should be in the Verification Plan, which is what the text states.
221	*SAFRAN*	18.2	76	"system software supplier" ? To be clarified		Suggestion		Noted	There can be more than one software supplier for a system, as some components may be developed by separate suppliers. The phrase 'system software suppliers' refers to the software suppliers for a given system.
222	*SAFRAN*	20.1	82	Mention that this section is applicable for DAL A only			Objection	Noted	MC / DC coverage only apples to DAL A software anyway so we did not consider it necessary to add this in the title.
223	*SAFRAN*	20.1	82	Is Object Code Coverage (OCC) different from Assembly Branch Coverage (ABC)? ABC is not referenced is the document (only in abbreviations) In the following example, Object Code Coverage is achieved but not the MC/DC.	For test cases selection, the applicant should verify that for each condition in a decision independently affects that decision's outcome. The condition affects a decision's outcome by varying just that condition.	Suggestion		Partially Accepted	Comment accepted and section 20.1 amended.
224	*SAFRAN*	21.3	86	Is that chapter strictly linked with HLR/LLR merging?		Observation	Substantive	Accepted	EASA has assessed the comment and it concurs with the reviewer that there is no need to repeat the FAQ text in the Cert Memo. Section is removed and reference to this FAQ is made in the text.
225	*SAFRAN*	23.2		Verification and validation effort shall be modulated according to DAL level			Objection	Accepted	Text has been added to state this.
226	*SAFRAN*	23.2.1	93	Formalized Requirements stated in a formalized language. - Does it mean the use of formal method? - Does it exclude the use of key-word to express the requirements? - Does it exclude functional architecture to express Formalized Requirements? The section states that it is not necessary to produce a set of Formalized Requirements in order to produce a Formalized Design. The higher-level Requirements seem to be not formalized. In these cases, how is it possible to verify the consistency, accuracy and completeness of the requirements and how to be compliant with the recommendations of section 11.6 b. of DO-178B (Requirements standards): Notations to be used to express requirements, such as data flow diagrams and formal specification languages	Suggestions are the following: - To detail what is formalized language - To make a difference between functional architecture (specification) and physical or organic architecture (design)	Suggestion	Substantive	Noted	The terminology has been changed so as to avoid use of the word 'formalized'. The higher-level requirements will be reviewed against either the system requirement standards or the software requirement standards, depending on the life-cycle.

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227	*SAFRAN*	23.2.4.1	97	In case ED-79/ARP4754 is not mandatory, precise that applicant can propose a process satisfying the same objectives		Suggestion	Substantive	Accepted	A paragraph has been added in 23.1 to say that where ED-79 / ARP4574 is not part of the certification basis, applicants should state which activities they do that are equivalent to the ED-79 / ARP4574 activities.
228	*SAFRAN*	23.2.4.6	98	In case ED-79/APR4754 is not project mandatory, precise that applicant can provide an process satisfying the same objectives		Suggestion	Substantive	Accepted	A paragraph has been added in 23.1 to say that where ED-79 / ARP4574 is not part of the certification basis, applicants should state which activities they do that are equivalent to the ED-79 / ARP4574 activities.
229	*SAFRAN*	23.2.5		In case 2b, shall we understood that two kind of actors (SW people and system designers) can work on the same formalized design; please clarify in front of produced life cycle data		Suggestion	Substantive	Accepted	In type 2b, the Design Model may be produced by the system engineers with or without the help of the software engineers, but then enters the software domain, where it replaces the software high-level requirements and the software design. The life-cycle data is already described in the section and the activities. The higher-level requirements are validated as ED-79 / ARP4574 system requirements and the Design Model is verified as in ED-12B / DO-178B. We have altered the text to attempt to clarify the situation.
230	*SAFRAN*	23.2.5.2	99	Precise the definition of "Simulation of Executable Formalized Design".		Suggestion	Substantive	Not accepted	This is explained in section 23.2.8, which is the section that provides the details of the activities to be performed.
231	*SAFRAN*	24		To avoid any misunderstanding in front of form of textual requirements, give a precise definition of pseudo-code		Suggestion		Accepted	We have rewritten this section.
232	*SAFRAN*	24		Give a clear definition of EASA expectation for "real" low-level requirements		Suggestion	Substantive	Noted	We have rewritten this section and it now omits the text you mentioned.
233	*SAFRAN*	24.2	109	Section states that the use of pseudo-code to express low-level requirements is not compatible with the ED-12B/DO-178B definition of low-level requirements. Does it exclude the use of structured and formalized LLR? What is the difference with section 23? - Pseudo-code can be considered as a formalized Design or a formalized language. - The granularity of traceability is also a an objective for a Formalized Design (section 23) As for section 23, how is it possible to verify the consistency, accuracy and completeness of the LLR? How to be compliant with section 11.7 f. fo DO-178B (design standards): Complexity restrictions, for example, maximum level of nested calls or conditional structures, use of unconditional branches, and number of entry/exit points of code components.	Suggestions are the following: - Use of the term "structured and formalized LLR" instead of "Pseudo-code" to avoid confusion - To express functional LLR with the input and output data of the LLR - To suppress implementation detail and how to access to the data (pointer, register,...). They mask the LLR inputs/outputs - To use a Data Dictionary for description of data structure and how to access them. - To suppress useless loops (all unconditional loops: for example for table initialization or assignment) - For algorithm that doesn't not need particular structure, to prefer the use of a function name in the LLR expression and to reference the section that describes that function (equation, label formatting) - When several equivalent implementation solutions are possible, to express relationship between conditions (exclusive, inclusive,...) as derived LLR in the way to avoid nested structures that make the LLR less readable and that force the implementation. - To identify the formalized LLR and to trace them with the HLR Additional recommendation: - To define formalized LLR with a structure independent of the code implementation, i.e. independent of code changes (for example due to optimization)	Suggestion	Substantive	Not accepted	This section does not deal with the use of formalized languages or formalized specifications and in fact the definitions of pseudo-code that we have found all state that pseudo-code is not a formalized language.

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234	*SAFRAN*	25		WCET considerations could be introduced at the same level.		Suggestion		Noted	EASA records your request and will try to improve the SW Certification Memorandum in the future with regards to WCET aspects.
235	*Latécoére*	All	None	Applicant role has to be clarified I	Identify which type of applicant is relevant		X	Noted	The applicant is the usual name given to a manufacturer who applied for a TC / STC. It may be used as well for a supplier who applied for an ETSOA.
236	*Latécoére*	All	None	Something is confusing: SW level or system level?	Has to be modified		X	Noted	In this Certification Memorandum, the Development Assurance Level (DAL) mentioned is the SW DAL.
237	*Latécoére*	All	None	need to identify more precisely requirement according to DAL	Needs to be clarified		X	Partially accepted	The Certification Memorandum is going to be called by a CRI and discussions with the applicants will be done afterwards. During those discussions, applicability per DAL will be discussed. In some instances, a sentence has been added to indicate the SW DAL.
238	*Latécoére*	1.4	9	verification and validation need to be harmonized with DO178B	Needs to be clarified	X		Noted	The definitions of verification and validation have instead been made consistent with the more recent definitions given in ARP4754A.
239	*Latécoére*	4.3 b.	15	SW review report only if under DOA	Has to be modified		X	Partially accepted	In order to clarify the intent of this item b, the following wording has been introduced in 4.3.b: "The applicant should plan and perform his/her own software review process (independently from the EASA LOI defined in the Certification Memorandum section 5); this software review process may be tailored taking into account similar criteria defined in the Certification Memorandum section 5. Indeed, per Commission Regulation (EC) No 1702/2003 and its annex (part 21), a design assurance system should be maintained for the control and supervision of the design [paragraph 21A.239 (a)], and should include an independent checking function [paragraph 21A.239 (b)]. Per GM No. 1 to 21A.239 (a), 'design assurance' means all those planned and systematic actions necessary to provide adequate confidence that the organisation has the capability to design products or parts). As part of its investigations (per 21A.257), EASA may request the reports of the reviews performed by the applicant. In case of a validation project, where the applicant is not DOA holder (or AP to DOA holder), it is expected that the applicant also performs an equivalent set of reviews per the requirements of his/her national equivalent to part 21. Note: the reviews described in this section are basically separate from the software quality assurance (as described in ED-12B / DO-178B section 8). Nevertheless the software quality assurance team may be involved or take an active part to the establishment of the software review reports.
240	*Latécoére*	4.5.3	20	Transition criteria has to be clarified	Needs to be clarified		X	Noted	In the absence of a concrete suggested resolution, EASA does not know what to add as a clarification. Therefore the text is not modified.
241	*Latécoére*	5.3.3 b.	30	SW review report only if under DOA	Has to be modified	X		Partially accepted	In order to clarify the intent this item 5.3.3b has been reworded. In addition, additional clarifications have been added in section 4.3.b.

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242	*Latécoére*	5.3.3 c.	30	Same than 233	Has to be modified		X	Noted	This area of concern could be discussed in the frame of a certification project. In the absence of a concrete suggested resolution, no change is performed to the proposed text.
243	*Latécoére*	10.4	43	Cognizant certification authority?	Needs to be clarified		X	Accepted	We have removed the word 'cognizant'.
244	*Latécoére*	15.2.1	63	Oversight plans and procedures?	Needs to be clarified		X	Noted	Text has been updated and, hopefully, clarified as result of this and other comments.
245	*Latécoére*	16.9	69	Are system certification documents relevant for DO178B process?	Has to be modified		X TBC	Not Accepted	EASA is requesting for the OPR section 16.9 of this Certification Memo: "The System Certification Summary or an equivalent certification document should describe:" As an EASA "System Aspects linked to Software and Airborne Electronic Hardware" Certification Memorandum does not exist at the moment, EASA considers that this aspect should be addressed in this Certification Memo. Section 16.9 might then be amended if a Certification Memorandum "System Aspects linked to Software and Airborne Electronic Hardware" is released.
246	*Latécoére*	18.2	76	System SW supplier > level ?	Has to be modified		X TBC	Not accepted	This comment is not clear to us and there is no clear suggestion as to what should be modified. For the intended meaning of 'system software suppliers', please refer to the answer to comment 221.
247	*Latécoére*	23.2.5.4	100	What is the definition of non functional requirement?	Needs to be clarified		X	Accepted	The text of paragraph 23.2.10.3 has been altered to define this term.
248	*Koch AvionicCert*	2.1	11	The EASA Cert Memo and FAA Order 8110.49/ N8110.110 should be better harmonized. Many companies work for Airbus and Boeing in parallel. It is neither practical nor understandable that there are significant differences between software development processes for similar aircraft. Refer to attached PPT Slide showing the different interpretations.				Noted	Great efforts have been made to harmonize the FAA and EASA material. 14 of the sections contain almost the same material as is used by the FAA. Additional sections have been added that incorporate some material from CAST Papers that have been agreed by the FAA software specialists as part of CAST. We have also provided a section to point out where our material differs from that of the FAA in order to assist applicants.
249	*Koch AvionicCert*	3.2	13	The meaning of this sentence is not clear: "Caution should be taken as the content of Certification Memoranda may have changed by the time the equipment is installed in the Aircraft/Engine. In any case, the installed equipment should finally comply with the Aircraft/Engine Certification Basis (including certain Certification Review Items)".				Noted	The wording has been defined in accordance with the Rulemaking Directorate and did not present any issue. Do not hesitate to come back to EASA in case there is a remaining issue.
250	*Koch AvionicCert*	*23.2*	*94*	"should be identified during the planning stage" should be "should be identified during the planning process"				Accepted	The text has been altered.

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251	*Koch AvionicCert*	4.6 & 17.2	23 38 39	(1) The software level (s), as determined by a system safety assessment. This definition is wrong on several pages. "as determined by the Safety Assessment Process".	The System Safety Assessment is a subpart of the Safety Assessment. The software level(s) are defined during Functional Hazard Assessment and Preliminary System Safety Assessment, not in the System Safety Assessment process. (refer to CS-25 / SAE ARP 4761)			Accepted	The wording has been changed as suggested.
252	*Koch AvionicCert*	4	14	GUIDELINES FOR THE SOFTWARE REVIEW PROCESS The reviews listed here and the reviews required by Airbus ABD0100.2.4 and 2.7 are inconsistent.	Harmonisation is required.			Not accepted	It is not EASA intention to align with the internal procedure put in place by each aircraft manufacturer (Airbus is obviously not the only one) or equipment supplier.
253	*Koch AvionicCert*	11	45	GUIDELINES FOR THE QUALIFICATION OF SOFTWARE TOOLS USING ED-12B / DO-178B "A trial period may be used as a means to demonstrate compliance with the tool operational requirements." The application of the trial period should be explained.				Not accepted	The trial period mentioned in this section is already described in paragraph 12.2.1 c of DO-178B, which says that the demonstration that a tool complies with its Tool Operational Requirements may involve a trial period during which a verification of the tool output is performed and tool-related problems are analyzed, recorded and corrected. The table in the Certification Memorandum where this text appears is merely showing whether a trial period applies to development or to verification tools.
254	*Koch AvionicCert*	11	45	Tool Product Service History is an important factor when talking about Tool Qualification. However this issue to be used to get qualification credit is not included in this section. However in "Guidelines for tools developed before AMC 20-115B issuance:" As an alternative, service history may be considered for such tools. Section 14 GUIDELINES FOR APPROVING REUSED SOFTWARE LIFE CYCLE DATA addresses this issue: Tool qualification data. The certification authorities can approve reuse, if the tool is used exactly as specified in the qualification approval as part of the original certification, and the applicant has access to the tool qualification data.	Tool Qualification should be extented: Usage of Tools Product Service History Reference to Section 16 Tool qualification data. There are several tools which are required by Airbus. These tools are used in many projects. (Example: DOORS, Clearcase, Clearquest) There should be a database available, which can be used as a reference for all development and verification tools used in similar projects already.			Noted	Sections 11 and 14 of this document correspond to chapters in existing FAA guidance material, so EASA would like to maintain commonality with those chapters and not modify sections 11 and 14 unless something is found that is actually incorrect. Regarding the tools mentioned such as DOORS, Clearcase and Clearquest, these are not tools that are normally qualified in the context of ED-12B / DO-178B, even though they are used to store data related to ED-12B / DO-178B. The qualification of tools depends on the version of the tool and the context of the usage of the tool, for instance, the target processor involved. EASA considers it preferable for the issues of tool qualification to be dealt with on a project by project basis, rather than by a central database that may be misleading due to the differences between projects and that EASA would have to attempt to maintain.
255	*Koch AvionicCert*	11	45	There are some inconsistencies between DO-178B and DO-254 tool qualification requirements. DO-254 makes significant distinction e.g. for DAL D there is no tool qualification required. This inconsistency is not comprehensible with respect to safety considerations.	DO-178B and DO-254 tool qualification should be harmonized			Noted	While EASA notes the inconsistency described in the comment, EASA does not at present wish to alter the guidance in respect of tool qualification for either DO-254 or DO-178B.

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256	*Koch AvionicCert*	17	72	EMBEDDED SOFTWARE CONFIGURATION FILES "This section of this Certification Memorandum does not apply to configuration files with a P/N that is the same as that of the executable software. Such configuration files are certified as part of the executable software by using ED¬12B/DO¬178B, which adequately addresses the development (including verification) of such embedded configuration files and the associated executable software" DO-178B does not adequately cover the usage of embedded configuration files, if they are part of the operational software. Much equipment uses several parameters, e.g. an ECU for an aircraft engine can use 6000 to 20000 parameters. The entire functionality of the engine behaviour is defined by the parameters itself. The testing of such software can be a challenge, due to the combination of all parameter are almost not testable. Further a change of the contents of only one parameter is often considered as a "minor change". Indeed such a change can have serious effects on the aircraft (e.g. change of a parameter defining over-speed warning) which should be classified as major change.	There should be a clarification for the handling of software based parameter data as part of the embedded software (e.g. hundreds of parameters stored in RAM during operation). A parameter can be inadvertent changed and can affect the equipment behaviour in a safety-relevant manner.			Partially Accepted	EASA agrees that CF which are part of the operational software need to be carefully managed. However, their development is basically covered by ED12B / DO178B.
257	*Koch AvionicCert*	23.2.3	96	Ch 23.2.3 defines: "Activities for the review and analysis of requirements at the system level are referred to in ED-79 / ARP4754 as being validation activities but in ED-12B / DO-178B, the review and analysis of requirements at the software level are referred to as being verification activities. This Certification Memorandum will, therefore, use the term 'validation' for these activities at the system level and 'verification' for these activities at the software level." However: The term validation is used in several places in a different meaning (e.g. Page 22 4 Final Software Certification Review, or Page 65 (c) Software life cycle data.: "The plan should address the validation and verification of data with regard to all processes,"	Validation is not part of SW Development as defined in Ch 23.2.3. The Cert Memo uses the term in the SW Development Context however.			Partially Accepted	The reference to validation in section 4 has been removed. The reference to validation in section 15 appears to be consistent with the definition provided in this document. Validation is not part of the ED-12B / DO-178B life-cycle but as we have explained in section 23, in some life-cycles, the requirements for a model are at the system level. The activities of ensuring that the requirements at system level are correct, consistent etc. are referred to as validation. This is why validation is mentioned in section 23. We do not imply that validation is part of a normal ED-12B / DO-178B life-cycle.
258	*Koch AvionicCert*	23.2.4.4	98	Verification of the Executable Object Code The ED-12B / DO-178B Hardware / Software Integration testing as described in ED-12B /DO-178B paragraph 6.4.3 a. must be conducted with the ED-12B / DO-178B Executable Object Code loaded onto the target processor in the host environment. What is the meaning of host environment?				Accepted	The word 'host' has been replaced by 'target'.

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259	*Koch AvionicCert*	23.2.5.3	100	Verification of the Executable Object Code The ED-12B / DO-178B Hardware / Software Integration testing as described in ED-12B / DO-178B paragraph 6.4.3 a. must be conducted with the ED-12B / DO-178B Executable Object Code loaded onto the target processor in the host environment. What is the meaning of host environment?				Accepted	The word 'host' has been removed.
260	*Koch AvionicCert*	23.2.6.5	102	In all cases, the ED-12B / DO-178B Hardware / Software Integration testing as described in ED-12B / DO-178B paragraph 6.4.3 a. must be conducted with the ED-12B / DO-178B Executable Object Code loaded onto the target processor in the host environment. What is the meaning of host environment?				Accepted	The word 'host' has been removed.
261	*Koch AvionicCert*	23.2.5.10		General principles and activities This chapter refers to the traditional DO-178B objectives (tables). Some of them are not consistent to the MDB approach however.	Not merging new and traditional approach.			Not Accepted	If there are items in 23.2.10 (not 23.2.5.10) that are not applicable, it would have been helpful if you had pointed these out. As it is, without knowing which items you refer to, we cannot deal with your comment.
262	*Koch AvionicCert*	23.2.4.4 & 23.2.5.3 & 23.2.6.5	98 100 102	"The Executable Object Code (EOC) should be shown to comply with the objectives in ED-12B / DO-178B Table A-6, including compliance with the software high-level requirements (which are the higher-level requirements for the Formalized Design) and compliance with the low-level requirements, which are within the Formalized Design." Remark: What are the activities defined in Table A-6 and are they not covered by table A-7 (here Requirements-Based Hardware/Software Integration Testing)? There seems to be an overlapping, which is not explained in DO-178B/DO-248. Maybe therefore the Cert Memo defines in addition: "The ED-12B / DO-178B Hardware / Software Integration testing as described in ED-12B / DO-178B paragraph 6.4.3 a. must be conducted with the ED-12B / DO-178B Executable Object Code loaded onto the target processor in the host environment.	Clarification of the activities / objectives to be performed in order to satisfy table A-6 is required.			Noted	Table A-6 contains the objectives for the software to be tested with normal range and robustness values and to be tested to be compatible with the target computer. Table A-7 contains the objectives that are related to the test cases and procedures and to the structural coverage that has to be shown while executing requirement-based tests. Tables A-6 and A-7 are both related to the testing of software, but the objectives in the two tables cover different aspects of that testing. The extra stipulation of this Certification Memorandum about where hardware / software integration testing has to be carried out was inserted to ensure that the object code was compatible with the target computer. ED-12B / DO-178B do not require that all testing has to be done in the target environment. When model-based development is used, some testing can be performed in a model simulation environment. However, it is vital to ensure that the final executable object code is compatible with the target computer by conducting at least the hardware / software integration on the target. This is why EASA inserted that text.
263	*Koch AvionicCert*	1.4	102	The term "Higher-level Requirements" is confusing and can be misunderstood in contrast to "High Level Requirements" as defined in ED12B/DO-178B.	Usage of term "Specification" or "System Requirements"			Noted	EASA has used this term for several years in its previous certification memoranda and CRIs on model-based development without problems. The term 'higher' is used because these are requirements at the next higher level than the level of a model.

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264	*Koch AvionicCert*	24	109	24 THE USE OF PSEUDO¬CODE AS LOW¬LEVEL REQUIREMENTS Some suppliers develop the Source Code and then later on they produce the design in form of a reverse engineering activity. This approach is incorrect and probably one of the EASA concerns of this section. However the use of a Requirements/Design Language (e.g. Pseudocode seems to be a better solution as using verbal textual requirements. Pseudocode is a written statement of an algorithm using a restricted and well-defined vocabulary which should be independent of the programming language used. Using textual representation leads always to ambiguity. Further drawing a Nassi Shneidermann Diagram or using a Flow Chart is equivalent to writing Pseudo Code. With respect to MBD: The drawing of a Model is similar to the usage of Pseudo Code. So the same EASA concerns are valid for the MDB approach. In case of using SCADE it is even worse, the Design Model represents the source code (there is no longer source code as it is in the traditional way). Example: DO-248 “FAQ #35: What are low-level requirements and how may they be tested?” provides a good example: System Requirement 1.a.b: "The FADEC shall detect and accommodate the NL signal for open and short circuit failures, and range failures per hardware dependent software requirements specification limitations." Software High-Level Requirement 2.b.c: "If the NL rotor speed is outside the range of 5% and 95% or if the NL rate of change is greater than 10% per second, then a fault shall be declared."	con't Software Low-Level Requirement (i.e., Design) 3.e.f: “The resolution of NL shall be at least 0.01%” "If the NL rotor speed is outside the range of 5% and 95% or if the NL rate of change is greater than 10% per second, then a fault shall be declared." “The resolution of NL shall be at least 0.01%” This Low Level Requirement is written in a way comparable to Pseudo Code. However it is just a copy of the High Level Requirement without a refinement and there is no relationship to the Source Code Implementation with respect to variables and their resolution, etc. Example 2: The resolution of NL shall be 0.01%” IF NL Rotor_Speed is less than 5 % OR Rotor_Speed is greater than 95 % OR if NL rate of change is greater than 10% per second THEN a fault shall be declared. Example 3: Even the following textual requirement contains ambiguity: When the EOR FLAG is ON AND the Channel A is ready OR the TXT_IN Flag is SET, DO CALCULATE. An approach based on Pseudo Code would prevent a misleading interpretation: IF (EOR_FLAG is set to TRUE AND the Channel A is set to READY) OR TXT_IN Flag is TRUE, THEN DO_CALCULATE In general the EASA approach is acceptable. Refer to Nr.			Noted	We are happy that you find our approach acceptable and hope that you will also find our new text acceptable.

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265	*Koch AvionicCert*	24	109	Chapter 24 is related to the Usage of Pseudo Code. However it also clarifies some requirements regarding Structural Testing and Structural Coverage Analysis in general and independent of Pseudo Code Usage. Some companies are not aware about the significant differences of "Structural Coverage Analysis" and "Structural Testing" and also not regarding the differences between White Box and Black-Box Testing (Requirement-Based Testing). Consequently several companies using a complete wrong test approach. They often perform Low-Level Testing in a host environment including a host compiler just in order to achieve the required test coverage. Sometimes the use the Source Code in order to establish the test cases and to achieve the required test coverage. The result of this activity is obviously valueless; therefore EASA should clarify this specific topic within this Cert Memo or add it into section 18.	Recommendations: Test Coverage Analysis should always be performed using the test type and test environment which is representative to the integrated target computer environment where practically. This is typically during HW/SW Integration Testing. Only in cases where this approach is not feasible; a more synthetic or isolated environment should be used. The differences between the test environment used and the target computer and the ability to detect specific errors should be justified in the PSAC. Note: Host-based Low-Level Testing can never replace HW/SW Integration Testing in the integrated target environment but vice versa.			Noted	We are happy that you find that our memorandum points out some items that suppliers have not all recognized. We did not consider that the material you mentioned fits well with section 18.
266	*Koch AvionicCert*	13	59	GM 21A.91 does not provide details with respect to Software Changes. FAA N 8110.85 GUIDELINES FOR THE OVERSIGHT OF SOFTWARE CHANGE IMPACT ANALYSES USED TO CLASSIFY SOFTWARE CHANGES AS MAJOR OR MINOR provides some helpful information.	Adoption of conents of N8110.85 into CertMemo			Noted	The commenter may wish to note that the FAA Notice referred to in the comment has been superseded by section 11 of FAA Order 8110.49 since 2003. This comment is similar to comment 152 from the FAA, which has been answered as follows - EASA appreciates that the material in chapter 11 of FAA Order 8110.49 is helpful to companies performing change impact analyses and that many companies follow the FAA text in this respect. However, it is not currently EASA policy to add material to the requirements of Part 21 in respect of major / minor change determination so EASA does not wish to alter the text of section 13 of this Certification Memorandum at this time.
267	*Koch AvionicCert*	23.2.2	94	The abbreviation CSCI is part of old military development standards. It is not used in the Civil airborne world.				Noted	We needed a term to express the same concept as a CSCI but we could not find any other suitable term, which is why we used it. It appears that this has not caused a great problem because this is the only comment that remarks on our use of this term. We would therefore prefer to use this term until we find another that expresses the same meaning.
268	*Koch AvionicCert*	22	88	CLARIFICATION OF STRUCTURAL COVERAGE ANALYSES OF DATA COUPLING AND CONTROL COUPLING The Guidance in 22.4 is too weak. There are always discussions with respect to this topic, but no concrete solutions. Assuming all required test activities (incl. Requirement-based test coverage, Structural Coverage Analysis, Data- and Control Flow Analysis based on Static Code Analyser and Review of SW Architecture (based on stringent requirements in the development standards) have been performed, which additional requirements have to be satisfied?				Noted	Your comment is acknowledged but in the absence of concrete suggestion, no change is considered.

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269	*Koch AvionicCert*	General	None	The Cert Memo does not take the influence of SW DAL variations into account. This is especially important for the sections 11, 20, 21, 23 and 24.				Partially accepted	Certification Memoranda are generic by nature and they are called by CRIs. When the CRI is issued, any variation is indicated to take into account multiple and various factors.
270	*Koch AvionicCert*	General	None	Distinction between new development models / traditional development: The Cert Memo should clearly distinguish between new development models and traditional development life cycles (as MDB) Example: Section 21 MERGING HIGH-LEVEL AND LOW-LEVEL REQUIREMENTS Merging of HIGH-LEVEL AND LOW-LEVEL REQUIREMENTS is a usual approach in MDB as shown in chapter 23.2.5 "Types 2a and 2b – Formalized design replaces software high level requirements and software design".				Accepted	MBD developments are not concerned by section 21 as there are multiple layers of requirements not only one or two).
271	*Koch AvionicCert*	General	None	CS-23 / CS-25 Distinction There are only two remaining very large aircraft manufacturer companies (Airbus and Boeing (in alphabetical order)). Consequently most of the companies applying for software approval are suppliers to one or both of these companies. Further there are several European Aircraft Manufacturer which build CS-23-aircraft (e.g. Pilatus, Diamond Aircraft). Most of the EASA Cert Memos are based on formerly AIRBUS CS-25 projects (beside of the SW Cert Memo) applicable for large aircraft. The CS-25 projects have to follow CS-25-1309 and the related AMC25-1309. For CS-23 projects no equivalence to AMC 23-1309-1D exists. However for FAA-Projects AC 25-1309-1D is applicable. AC25-1309 contains a table which defines the "RELATIONSHIP AMONG AIRPLANE CLASSES, PROBABILITIES, SEVERITY OF FAILURE CONDITIONS, AND SOFTWARE AND COMPLEX HARDWARE DALs" This table reduces the DAL depending on the Failure Condition Classification and the aircraft class definition.	The EASA Cert Memo should consider these reductions. As a consequence the requirements for a CS-23 aircraft are the same as for an CS-25 aircraft, which is not comprehensible. Further: Equipment/system suppliers are faced with a lot of different requirements depending on aircraft manufacturer, aircraft class, certification authority (EASA/FAA) and so on. In order to minimize the additional effort, the EASA Cert Memo should be extended and take into account the CS-23 DAL modulation (as defined in FAA AC23-1309) and should also harmonize the content of Cert Memos with relevant FAA Orders (as FAA Order 8110.49) and ACs.			Partially accepted	In addition, to Boeing and Airbus, there are many other CS25 manufacturers (Dassault, Gulfstream, Embraer, Bombardier, etc.). This Certification Memorandum does not talk about the DAL assignment done in frame of all projects including CS23 projects. The method to assign DALs may be based on AC231309D, it is outside of this Certification Memorandum.

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272	*Koch AvionicCert*	General	None	Inconsistencies between Airbus and EASA Cert Memos Some of the Certification Memos are based on previous CRIs, developed in the framework of Airbus projects (e.g. A380, A400M A350). For all Airbus suppliers the applicable guidelines (as DO-178B and DO-254) are extended and interpreted by Airbus ABD0100, ABD0200 and aircraft-specific CRIs. Many regulations of ABD0100 are not consistent to the current SW- and HW Certification Memos and to the EASA/Airbus CRIs.	A lot of difficulties are the result of this unpleasant situation, for example: - Airbus Software Reviews (see ABD0100.2.4) are not in compliance with EASA Cert Memo Examples: There is no Software Conformity Review foreseen in ABD0100, Tool Qualification is different, Use of OOA/OOP) - Airbus Reviews and QA activities concentrate mainly on ABD0100 and not on EASA Certification Memos. - On the other hand EASA Certification Specialist does not consider the specific ABD0100 SW process requirements. - Even worse several process requirements are defined in the Airbus PTS (Pur-chaser Technical Specification). - For each Airbus Aircraft Type a different set of ABD0100 and EASA CRIs exists, each of it containing different requirements. - Some of the EASA/Airbus CRIs are implemented in the Airbus ABD0100 already. Example: ABD0100.1.10, CHAP 10 – SOFTWARE, Chapter 17 Management of Open Problems is similar to EASA Cert Memo 16 MANAGEMENT OF PROBLEM REPORTS but is different in some aspects. Many suppliers have to consider the EASA Cert Memos and the Airbus/EASA CRIs in parallel, which are almost different.			Not accepted	EASA Certification Memoranda are not linked to Airbus ABD100 or ABD200. EASA Certification Memoranda are self consistent and there is not need of Airbus knowledge to manage them. Those Certification Memoranda are reusing past Certification Memoranda which were used on all projects (Boeing, Gulfstream, Dassault, Rolls Royce, EC, etc.).
273	*APSYS*	3.2	13	Some clarifications are needed concerning interface between this document and CRIs.		X		Noted	This Certification Memorandum will be called by a CRI in the frame of a project and will be discussed with the applicant by the software expert allocated to the project. The way of working does not change.
274	*APSYS*	4.3 a.	14	"Software Review Process" is confusing because "Reviews" is a term that is already extensively used for applicant activities (verification and SQA).	suggest to use "Software Certification Assessment Process", "Software Certification Process" or equivalent instead	X		Not accepted	As indicated in section 4.3.b, the reviews conducted by the applicant should be equivalent to the ones performed by EASA. Therefore it is not agreed that a difference should be made between EASA and applicant reviews.

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275	*APSYS*	4.3 a. & 4.3 b.	14	4.3.a. states that "This section does not change the intent of ED-12B / DO-178B with regard to the software review process." 4.3.b states that " The applicant should perform an equivalent software review process ..." Comment : 1/ DO-178B does not define "software review process" 2/ Statements in 4.3.b seems contradictory with statements in 4.3.a	remove 4.3.b		X	Partially accepted	In order to clarify the intent of this item b, the following wording has been introduced in 4.3.b: "The applicant should plan and perform his/her own software review process (independently from the EASA LOI defined in the Certification Memorandum section 5); this software review process may be tailored taking into account similar criteria defined in the Certification Memorandum section 5. Indeed, per Commission Regulation (EC) No 1702/2003 and its annex (part 21), a design assurance system should be maintained for the control and supervision of the design [paragraph 21A.239 (a)], and should include an independent checking function [paragraph 21A.239 (b)]. Per GM No. 1 to 21A.239 (a), 'design assurance' means all those planned and systematic actions necessary to provide adequate confidence that the organisation has the capability to design products or parts). As part of its investigations (per 21A.257), EASA may request the reports of the reviews performed by the applicant. In case of a validation project, where the applicant is not DOA holder (or AP to DOA holder), it is expected that the applicant also performs an equivalent set of reviews per the requirements of his/her national equivalent to part 21. Note: the reviews described in this section are basically separate from the software quality assurance (as described in ED-12B / DO-178B section 8). Nevertheless the software quality assurance team may be involved or take an active part to the establishment of the software review reports."
276	*APSYS*	4.1		It is not clear if this chapter provides description of EASA activities or if it provides additional requirements for applicants. In the last case, requiring the applicant to implement a "review process meeting" seems to be useless since there is already a SQA process implemented as per DO-178B.	Suggest to clearly distinguishing requirement for SW/CEH expert and requirements for applicant.		X	Partially accepted	It seems that the sentence in question has been misunderstood: the guideline does not introduce a "review process meeting" but rather requests the applicant to have a "review process [that is] meeting the objectives as described in this section". In order to clarify this aspect, the word "meeting" has been replaced by "that is fulfilling". In addition, we confirm that EASA expectation is that the reviews performed by an applicant (SQA or other) are commensurate with the guidance introduced in this section 4.
277	*APSYS*	4.5.2	18	"Software Development Review" Comment: name of this review is not consistent with its content since scope of this review is far more broader than development process.	For visibility purpose : 1/ Suggest to use "audit" instead of "review" in order to distinguish applicant activities from SW/CEH expert activities. 2/ change "Software Development Review" by a less confusing term such as SOI #1,2,3,4		X	Partially accepted	To 1/: As indicated in section 4.3.b, the reviews conducted by the applicant should be equivalent to the ones performed by EASA. Therefore it is not agreed that a difference should be made between EASA and applicant reviews. To 2/: The wording "Development review" precisely intends to cover both the ED-80 / DO-254 "requirements review" and "design review". Having said that, reading the section 4.5.2 again, EASA has noticed that some errors have been introduced in the items (1) to (3) that can explain your confusion. This has been corrected in the updated text.
278	*APSYS*	4.5		This document should explain how is managed the cases where incremental / iterative processes are implemented with partial availability of life cycle data. In a more general way, certification audit organisation should be adapted to various kind of possible life cycle.	Precise that audit may be focused on restricted functional domains.	X		Noted	The use of an incremental or iterative development process does not alter the need for the reviews described in this section 4.5. If EASA or the applicant judges necessary to perform additional reviews on top of the 4 that are planned, nothing prevents it. As ED-12B, this Certification Memorandum covers a minimum guidance without imposing a specific process. Based on this explanation, no change to the text is deemed necessary.

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279	*APSYS*	4.5.5		In Airbus referential for example, SDP/SVP/SCMP/SQAP are not systematically provided to EASA		X		Noted	The plans and standards documents are necessary to perform the Software Planning Review. In general this review is performed on a desktop basis as it requires no sampling data. Therefore EASA prefers to keep the mention in the Certification Memorandum that these data should be provided.
280	*APSYS*	4		What about EASA involvement for modification on previously certified program?		X		Noted	This section 4 is about defining the guidelines for the review process, not the level of involvement (this is the subject of section 5). Having said that, those sections are not specific to one type of approval and therefore can be applied also to the approval of modifications.
281	*APSYS*	7.6		Out of scope regarding pure SW considerations		X		Not accepted	Maintenance and part numbering are essential aspects of FLS that are also dealt with in the corresponding FAA material.
282	*APSYS*	9.3		CM should not add new requirement. If UMS is already used in a product developed regarding ED12B/D0178 prior to version B, ED12/DO178 B should not automatically become the new certification basis for UMS aspects.		X		Noted	If UMS is already used in a developed product and is not modified, this section does not apply. However, if a change introduces UMS into software developed under guidance prior to ED-12B / DO-178B, the development of UMS is not covered by the earlier guidance, so ED-12B / DO-178B should be applied. This Certification Memorandum does not add any new requirement in this area.
283	*APSYS*	12.3 & 12.4		Not in line with some existing AIRBUS CRIs: CRI SE 20 (Single Aisle) for instance requires to develop SW according to DO178B if the modification is classified as a significant change. DO178B is not required regarding a program: on SA DO178B is applicable in case of significant change not because DO178B is required on SA.			X	Not accepted	This is already in the text. Paragraph 12.4 d says 'If the change is not a small, simple change, all the changes to the software and all of the components affected by the change should be assured using ED-12B / DO-178B (as discussed in paragraph 12.3 f of this Certification Memorandum).'
284	*APSYS*	16.9		There is no Software Configuration Management Plan at applicant level. This plan exists at supplier's level only. On the other hand, involvement of flight tests, human factors, system engineers is not defined in Software Configuration Management plan. This paragraph addresses more than pure SW aspects as defined in §11.4 of the DO178B.		X		Not Accepted	The applicant needs to assess and signoff the Software Configuration Management Plan. Therefore the applicant is aware and responsible w.r.t. to the certification activities of its content. It is not only the Software Configuration Management Plan which is requested. Section 16.9.1 states: "... the applicant should discuss in their Software Configuration Management Plan, or other appropriate planning documents..."
285	*APSYS*	18.2.4		"If development tools … in the integrated environment:" not clear sentence	reword	X		Accepted	Sentence removed.
286	*APSYS*	18.2 1) for SCMP		"The plan should identify the person …." It is a new requirement for SCMP.	Should be changed into a list for the EASA auditor.	X		Partially accepted	We have deleted the need to identify the person.
287	*APSYS*	21.1		"the system-level requirements are "directly" highly refined (i.e., created in one refinement step)" not understood	clarify	X		Accepted	Text improved referring to "highly detailed".

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288	*APSYS*	21.1.1		Agree that HLR and LLR at the same level prevent from being Do178B compliant due to lack of traceability. However, not fully agree with following statements : • "The consistency of the software requirements document is not ensured when modifying airborne software." • "The consistency and relevance of software requirements document with other development life cycle output data (source code, design architecture, system specification, etc.) is not ensured."	Remove or reword statements		X	Not accepted	Reason for disagreement is not presented by the reviewer. Without this information, it is not possible to assess the reviewer concern.
289	*APSYS*	21.1.2		"In addition, verification activities performed on HLR and LLR cannot be achieved at the same time, since the production processes are distinct. » Even if HLR and LLR are developed separately, verification of both can be done in the same time.	Remove or reword statement.		X	Accepted	EASA reworded the sentence: "In addition, verification activities performed on HLR and LLR are typically based on different processes ".
290	*APSYS*	17.5		3rd bullet : For clarity purpose and for consistency with DO-178B, we suggest not to use validation when talking about activities related to DO-178B	Use verification for DO-178B related activities		X	Not Accepted	Here the section is talking about the correctness and completeness of the Configuration File against the system requirements and it is called validation in ED12B / DO178B.
291	*APSYS*	23		"Formalised requirement / design" is confusing and usually not well understood for newcomers : - some applicant understand "formal" - definition of "formalised" is subjective : is pseudo code formalised requirement ? - not consistent with DO-178C terminology (that use the term model)	Suggest to use a standard & "worldwide understood" terminology such as "model" instead of "formalized requirement / design".		X	Accepted	The word 'formalized' has been replaced and the word 'model' is now used.
292	*APSYS*	23.2.2 j)	95	bullet J : " (...) the applicant should identify the differences between the simulator / emulator and the target processor and justify why those differences are acceptable." This should be required only in the case where certification credit is sought from simulation for EOC verification.	clarify	X		Accepted	The sentence has been reworded to clarify that tool qualification is only needed when credit is sought.
293	*APSYS*	23.2.4		type 1 : don't see the need to address type #1 as this case is fully covered by DO-178B.	clarify that DO-178B is a mean of compliance to CRI F15 F17, F22, …		X	Not accepted	Type 1 is only partly covered by ED-12B / DO-178B, which does not address the use of model-based development. Some extra guidance was necessary for use of model-based development with ED-12B / DO-178B. Future CRIs will make reference to this certification memorandum.
294	*APSYS*	23.2.4.3	97	2nd bullet :"coverage of formalised design" by what ?	complete / clarify	X		Noted	The coverage of Design Models is explained in the separate sub-section 22.3.9. The text says that there is a separate section with that heading below.
295	*APSYS*	23.2.5.2		"Coverage of the formalised design": not clear of which coverage it is referred to.	Clarify.	X		Not accepted	This is explained in section 23.2.9, which is the section that provides the details of the activities to be performed.

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296	*APSYS*	24.1		There is a need of a clear definition of what is pseudo code in order to make this paper easy to implement.	Add a definition of what EASA consider to be pseudo code.		X	Noted	We have rewritten this section.
297	*APSYS*	24.2		"If such module tests were to be misinterpreted as being structural coverage tests then the result should always be 100% structural coverage, which means that the activity would not be effective in detecting unintended functionality or unexpected behaviour." COMMENT: The reason why structural test is bad is first of all that structural testing does not allow to detect any implementation error, contrary to requirement based test. (see also next comment)	reword suggestion : If such module tests were to be misinterpreted as being structural coverage tests then the result should always be 100% successful testing, which means that the activity would not be effective in detecting implementation error.		X	Accepted	We have rewritten this section and mentioned that the ability to detect implementation errors is reduced when pseudo-code is used.
298	*APSYS*	24.2		"If such module tests were to be misinterpreted as being structural coverage tests then the result should always be 100% structural coverage, which means that the activity would not be effective in detecting unintended functionality or unexpected behaviour." - Fully Agree with the inanity of structural testing - Not agree with the underlying concept that structural coverage analysis purpose would be to detect unintended function : indeed structural coverage analysis is first a verification/assessment of test cases completeness. As a side effect it may potentially detect unintended function in the code or missing requirement, but it is not the primay goal of structural coverage analysis. APSYS understanding of "unintended functions" is the following: Unintended functions are the result of development error. DO-178B is the mean to limit the risk of development error. Therefore it is not a specific activity but the application of the complete DO-178B guidance that contribute to the avoidance of unintended function.		X		Partially Accepted	We have rewritten this section and mentioned that testing pseudo-code structures prevents the detection of unexercised code, which is the purpose of structural coverage analysis.
299	*APSYS*	24.4.2	111	APSYS fully agree with 24.4.1 guidance. 24.4.2 guidance are deemed to severe and contradictory : In one hand EASA recognize that "in some cases the use of a kind of pseudo code may ease the understanding of the flow of the low-level requirements". But on another hand EASA requires, for this "good pseudo code" a huge amount of analysis and justifications that will prevent any applicant to use it.	removed guidance §2 and replace it by a list of case where pseudo code might be deemed an acceptable complement of LLR by EASA.		X	Noted	We have rewritten this section and stated how pseudo-code may be used.

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300	*APSYS*	24.4.2 Last §	111	The use of language semantic structure: "CASE" or "UNTIL" are common English words so they can be used for description purposes. For example, the § under discussion begins with "IN CASES"	remove last §		X	Accepted	We have rewritten this section.
301	*Dassault Aviation*	General	-	After review of the certification memorandum in reference, you will find here-attached the Dassault Aviation's comments and associated position. In synthesis, it has been identified the need to: - clarify how to handle this kind of certification memorandum compared to the Program Certification basis (CS- xx Requirements, CRI) - modify the certification memo to stay in their domain (SW or AEH). The ARP 4754/ED79 aspects have to be considered in another memorandum if necessary - clarify the cert memo as proposed to avoid misunderstanding and misinterpretation				Partially accepted	The way of working has not changed. CRIs are raised in a frame of a project, contain or not a Certification Memorandum and are discussed in a frame of a project. EASA recognises that both Certification Memoranda have introduced system considerations. In all cases, EASA thought it was the best way to consider the topic. EASA would like to avoid separating any guidance in multiple Certification Memoranda, it could lead to inconsistency. EASA will consider creating a system Certification Memorandum in the future. All public comments have been taken into account and both Certification Memoranda have been updated accordingly to avoid any inconsistency
302	*Dassault Aviation*	General	-	In addition, these certification memorandum have to be completed in view to detail how the applicant could take credit of the demonstration of compliance to DO178B and DO254 performed by the supplier in the frame of an ETSO (or validation of TSO) or another applicant in the frame of TC or STC application. Effectively, some aspects of the activities performed (Assurance Quality process, development process, traceability …) could be considered as generic. Therefore it will be possible to take credit of the statement of compliance performed to avoid to perform it again for each application. This additional check appears as useless and induces important manpower consumption for the industry and certification authority without additional gain in term of safety. There is a need to detail, what could be considered as "generic" and how it will be possible to take credit of a statement of compliance previously stated in the frame of an EASA certification or validation.				Partially accepted	This information you are requesting is part of the discussion that need to be done between the EASA expert and your experts. It is a case-by-case discussion which shall take into account the project, the level of reuse for a given project, the use of ETSO equipment, etc.

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303	*Dassault Aviation*	All	All	The role of the applicant is ambiguous in many section of this document. It should be clarified and the supplier should be involved in many cases (for example 4.5.1.c, 4.5.2).Applicant is not appropriate in the following sub-sections (equipment manufacturer would be more accurate): 4.5.1.a, 4.5.1.b, 4.5.1.c, 4.5.2.a, 4.5.2.c, 4.5.3.a, 4.5.4.a, 4.6.a.5, 4.7.b, 4.7.b.7, 4.7.c.3, 4.7.d.4, 7.4.g.1, 7.4.g.2, 7.4.g.3, 7.4.g.4, , 7.4.h, 9.4.b, 9.7, 9.9.a, 10.4.c.1, 10.4.c.2, 10.4.c.3, 10.4.d, 11.4.c.note2, 11.4.c.1.i, 11.4.c.1.iii, , 11.4.c.1.note, , 11.4.c.2.v, 11.4.c.3, 11.4.d.note, , 11.4.e, 12.3.f.4, 12.4.2, 14.2.1.a.4, 14.2.3.c, 14.3.a.6, 14.3.a.7, 14.3.a, 15.2.1, 15.2.1.4, 15.2.1.5, 15.2.1.6, 15.2.2, 15.2.2.1, 15.2.2.2.d, 15.2.2.2.f, 15.2.2.4, 15.2.2.7, 16.9.1, 16.9.1.3.a, 16.9.1.3.b, 16.9.1.3.c, 16.9.1.3.d, 16.9.1.5, 16.9.2.6, 17.1.1st bullet, 17.1, 17.2, 17.5, 17.6, 18.1, 18.2,19.2, 19.2.d, 20.1, 20.2, 21.1, 21.1.1, 21.2, 21.3, 22.2.4, 22.3.1,22.4, 23.1, 23.2.1, 23.2.2, 23.2.2.a, 23.2.2.j, 23.2.3, 23.2.4.1, 23	Clarify all along the document (as referred in the left cell) the responsibilities and who is in charge of the activities: the Authority, Applicant, and Supplier.		X	Not accepted	EASA regulations indicate that the manufacturer is responsible of the safety of the product. However, he can use any supplier data to show compliance with regulations or guidance material. It is up to the applicant to define its process.
304	*Dassault Aviation*	All	All	Several references are done to ARP4754. Scope of this document should be dedicated to SW under scope of DO-178B. System certification documents are not relevant for DO-178 process.	Remove all references to ARP4754 and to system documents. As there is already one document dedicated to SW and another one to AEH, it should be better to address the ARP4754 (if applicable) and system CRI through a dedicated third CM.		X	Not accepted	When appropriate, the Certification Memorandum refers to ED79 / ARP4754 or ED-79A / ARP4574A in order to provide a comprehensive view of the issue and avoid splitting the issue in many instances.
305	*Dassault Aviation*	All	All	Several sections do not refer the DAL of the considered software. It seems that the same requirements are applicable for all software. It should be clarified.	To clarify as much as possible the scope of the requirement depending on the DAL.		X	Noted	The Certification Memorandum is going to be called by a CRI and discussions with the applicants will be done afterwards. During those discussions, applicability per DAL will be discussed. In some instances, a sentence has been added to indicate the SW DAL.
306	*Dassault Aviation*	1.1	6	It should be clarified in the scope if this is only SW or SW + system.			X	Noted	The scope of this Certification Memorandum is the Software domain in relation to ED-12B / DO-178B. However, some aspects related to software are decided or managed at system level, such as Problem Reporting, Safety Assessment and DAL allocation (as mentioned in sections 16 and 17). In addition, in section 23, some activities that are normally conducted at the software level are conducted at the system level instead for some model-based development software life-cycles. In that section, the validation and verification of requirements at the system level has to be performed.
307	*Dassault Aviation*	1.2	6	Add : FAA order 8110.49, notice N8110.110, CAST 15, CAST 17, CAST 19 in a dedicated "referenced document" section		X		Noted	EASA wishes to maintain compatibility with the current EASA document template. This certification memorandum will be discussed within EASA so other references may later be included.
308	*Dassault Aviation*	1.4	9	Verification definition: Definition quite different from the DO178B on: "The evaluation of the results of a process to ensure correctness and consistency with respect to the inputs and standards provided to that process. "idem for validation : "The process of determining that the requirements are the correct requirements and that they are complete. The system life cycle process may use software requirements and derived requirements in system validation."		X		Noted	The definitions of verification and validation have instead been made consistent with the more recent definitions given in ARP4754A.

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309	*Dassault Aviation*	1.4	9	The definition of a software/ software item / software component should be detailed. Is software item/component an executable object code?	Clarify what is considered as a SW item, and its scope.	X		Noted	The term 'component' is already defined in ED-12B / DO-178B, which uses the term 'software component'. The term 'software component' does not appear to be used in this certification memorandum, so we have not defined it.
310	*Dassault Aviation*	1.4	9	Please, define in this section all the words used as for example the following ones: Applicant, supplier, EASA system panel, EASA software panel, SW/CEH panel, SW/CEH expert, SW/CEH group member, manufacturer, developer, and prime.	Define the roles.		X	Noted	Please see the answer to comment 193. Some of the terms mentioned in the comment are no longer used in this document due to changes resulting from other comments.
311	*Dassault Aviation*	2.1	13	Add MEL in § 1.3 : Minimum Equipment List	-	X		Noted	This definition was already there in the draft version.
312	*Dassault Aviation*	4.2	13	Review definition: suggestion to replace "finding" by "evaluating" in the following sentence: "other evidence produced with the intent of finding compliance with ED-12B/DO-178B objectives". In the definition: make the difference between Applicant internal reviews and SOIx reviews the objectives of which may lightly be different. E.g. internal reviews may evaluate compliance with the Applicant referential that may address topics not covered by DO178B objectives.	To be clarified.	X		Not accepted	As indicated in section 4.3.b, the reviews conducted by the applicant should be equivalent to the ones performed by EASA. Therefore no difference should be made between EASA and applicant reviews in terms of "finding of compliance".
313	*Dassault Aviation*	4.3 b.	13	Organization between applicant & supplier and objectives of reviews are the responsibility of the applicant. Nevertheless, if the reviews are performed in the frame of the DOA privileges, equivalent SW reviews will be performed. More over, it should be clarified that the SW review Report is provided when an audit is performed in the frame of DOA privileges.	Replace "The applicant should perform ..." by "When the applicant perform the activities under DOA privilege, he should perform an equivalent SW review process meeting the same objectives" and replace "Review Reports" by "Audit minutes"		X	Partially accepted	In order to clarify the intent of this item b, the following wording has been introduced in 4.3.b: "The applicant should plan and perform his/her own software review process (independently from the EASA LOI defined in the Certification Memorandum section 5); this software review process may be tailored taking into account similar criteria defined in the Certification Memorandum section 5. Indeed, per Commission Regulation (EC) No 1702/2003 and its annex (part 21), a design assurance system should be maintained for the control and supervision of the design [paragraph 21A.239 (a)], and should include an independent checking function [paragraph 21A.239 (b)]. Per GM No. 1 to 21A.239 (a), 'design assurance' means all those planned and systematic actions necessary to provide adequate confidence that the organisation has the capability to design products or parts). As part of its investigations (per 21A.257), EASA may request the reports of the reviews performed by the applicant. In case of a validation project, where the applicant is not DOA holder (or AP to DOA holder), it is expected that the applicant also performs an equivalent set of reviews per the requirements of his/her national equivalent to part 21. Note: the reviews described in this section are basically separate from the software quality assurance (as described in ED-12B / DO-178B section 8). Nevertheless the software quality assurance team may be involved or take an active part to the establishment of the software review reports.
314	*Dassault Aviation*	4.5 a.	15	75% value to be removed. It should be the applicant jointly with EASA who decide if the % of tests and review is sufficient to perform an audit.	Remove this indication.		X	Not accepted	A review is efficient only if the application of the planned process is mature enough. To this purpose, EASA experience shows that below 75% of readiness of the artefacts, the level of maturity is often not sufficient to perform a representative sampling. This is the reason why EASA does not consider necessary to perform a change to this value. Note: having said that, nothing prevents an applicant to perform additional reviews earlier in the process (e.g. through the software quality assurance activity).

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315	*Dassault Aviation*	4.5	15	Those criteria suit well to a V life cycle development process. With an iterative/incremental life cycle software development process, SOI2 and SOI3 may occur very late in the development process and very close. Are the software reviews criteria well defined for iterative/ incremental software life cycle development process?	To be clarified.		X	Noted	The use of an incremental or iterative development process does not alter the need for the reviews described in this section 4.5. If EASA or the applicant judges necessary to perform additional reviews on top of the 4 that are planned, nothing prevents it. As ED-12B, this Certification Memorandum covers a minimum guidance without imposing a specific process. Based on this explanation, no change to the text is deemed necessary.
316	*Dassault Aviation*	4.5	16	Data Required for the Software Planning Review, suggestion to add "tool standards".	-	X		Not accepted	EASA does not understand what "tool standards" is. The understanding is that the TQP contains all plans and standards aspects necessary for tool qualification aspects.
317	*Dassault Aviation*	4.5.1	17	SOI1 transition criteria: OK for configuration management and release but not for archiving (part of objective 4 table A8) SW plans and standards at this step of the project: It is only required at the end of the project.	Remove objective DO-178B A8-4.		X	Accepted	The objective A8-4 has been removed from section 4.5.1.c.
318	*Dassault Aviation*	4.5.2	18	The archive activity should not be required for passing SOI2. Archive activity is generally performed at the end of the project.	Remove objective DO-178B A8-4.		X	Accepted	The objective A8-4 has been removed from section 4.5.2.c.
319	*Dassault Aviation*	4.5.2 c. Table 4-2	19	The objective 3 of table A10 should not be required in the bullet c). The following items are not required for an SOI2 : - Software Life Cycle Environment Configuration Index (test environment) - Software Configuration Index (test baseline)	The following items should be removed from table 4-2: - objective 3 of table A10 - Software Life Cycle Environment Configuration Index (test Environment) - Software Configuration Index (test baseline)		X	Partially accepted	The objective A10-3 has been removed from section 4.5.1.c. EASA does not agree to remove the SECI but a mention "development environment aspects" has been added to limit the scope to the SOI#2 stage. Unlike what you say, the SCI (test baseline) is not mentioned in this table.
320	*Dassault Aviation*	4.5.2 b. Table 4-2	19	Qualification data for development tools to be added.	-		X	Accepted	Tool qualification data have been added.
321	*Dassault Aviation*	4.5.3 b. Table 4-3	20	Qualification data for verification tools to be added.	-		X	Not accepted	The table in section 4.5.3.b already contains a line "Tool qualification data" which includes verification tools.
322	*Dassault Aviation*	4.5.3 c. Table 4-3	20	SAS, SECI, SCI are generally not issued for SOI3, consequently Table A10 Objective #3 can't be fulfilled. No formal SCI is issued for test baseline during development.	remove the reference to Table A10 Objective #3 in subsection c and the reference to SAS, SECI and SCI in table 4-3		X	Accepted	The objective A10-3 has been removed from section 4.5.3.c.
323	*Dassault Aviation*	4.5.3	20	Bullet c) : It is not the purpose of the verification review to verify Tables A-1 (objective 3) : "Software life cycle environment is defined." But it is its purpose to verify if SW plans and standards are correctly applied.	To be clarified.		X	Accepted	The objective A1-3 has been removed from section 4.5.3.c.
324	*Dassault Aviation*	4.5.3	20	Do you confirm "complete" for A-5 (objective 7)?	To be clarified.		X	Noted	In the absence of a concrete suggested resolution, EASA does not know what to add as a clarification. Therefore the text is not modified.
325	*Dassault Aviation*	4.5.3	20	Clarify the transition criteria. The criteria for passing SOI3 should be clearer.	To be clarified.		X	Noted	In the absence of a concrete suggested resolution, EASA does not know what to add as a clarification. Therefore the text is not modified.

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326	*Dassault Aviation*	4.5.3	20	Same comment than above regarding "archiving" for SOI3.	Remove objective DO-178B A8-4.		X	Not accepted	At SOI#3 stage it is expected that the life-cycle data are all archived, as the software loads are usually embedded for verification activities, including for flight tests.
327	*Dassault Aviation*	4.5.4	20	Replace "the software complies" by "that the software have been developed in conformity with the accepted plans and standards and that the software complies with its requirements, …	Replace "the software complies" by "that the software have been developed in conformity with the accepted plans and standards and that the software complies with its requirements, …	X		Partially accepted	It is agreed that the wording "the software complies" is imprecise. This wording has been improved in "the software life cycle data complies with software plans and standards". Note: it is generally not the purpose of the software conformity review to ensure that the software complies with the requirements but this activity is rather checked during the software verification review. Therefore the second part of your proposed wording has not been implemented.
328	*Dassault Aviation*	4.5.5	22	75% value to be removed. It should be the applicant jointly with EASA who decide if the % of tests and review is sufficient to perform an audit.	Remove this indication.		X	Not accepted	A review is efficient only if the application of the planned process is mature enough. To this purpose, EASA experience shows that below 75% of readiness of the artefacts, the level of maturity is often not sufficient to perform a representative sampling. This is the reason why EASA does not consider necessary to perform a change to this value. Note: having said that, nothing prevents an applicant to perform additional reviews earlier in the process (e.g. through the software quality assurance activity).
329	*Dassault Aviation*	4.5.5	22	Add in table the tool qualification data for development tools (audit 2).	-		X	Noted	Your comment is understood but it is difficult to be prescriptive on the stage where all life-cycle data for a development tool are available. Therefore, EASA prefers to request the Tool Qualification Data at SOI#3 stage, to remain consistent with the FAA Order 8110.49.
330	*Dassault Aviation*	4.5.5	22	Add in table the tool qualification data for verification tools (audit 3).	-		X	Noted	Your comment is understood but it is difficult to be prescriptive on the stage where all life-cycle data for a development tool are available. Therefore, EASA prefers to request the Tool Qualification Data at SOI#3 stage, to remain consistent with the FAA Order 8110.49.
331	*Dassault Aviation*	4.5.5	22	In table, column "items to be reviewed" Move "Coverage of tests (integration / validation)" from audit 4 to audit 3.	-		X	Partially accepted	This text has been simply removed from SOI#4.
332	*Dassault Aviation*	4.5.5	22	Inconsistency between 4.5.5 * and 4.7; 10 or 15 working days?	-	X		Accepted	15 working days has been introduced in section 4.5.5 to be consistent with section 4.7.
333	*Dassault Aviation*	4.7	23	Agenda will be sent 1 month before audit even if schedule is discussed much earlier with EASA.	Replace 6 weeks per 4 weeks.		X	Accepted	EASA agrees that 4 weeks is sufficient and that it corresponds better to current practices.
334	*Dassault Aviation*	5.1	26	These activities have a meaning only for TC	Clarify that these activities are due for TC.	X		Not accepted	It is difficult to restrict this to a TC as it can be obviously also necessary for a STC and a comprehensive major change or even for a comprehensive ETSO. For a smaller project the level of formalization may of course be lower. Therefore EASA does not believe it is possible to enter in more details. However it is common sense that the level of formalization of the LOI depends on the size of the certification project.
335	*Dassault Aviation*	5.2	26	Why don't you call it panel10? Furthermore it should be SW/AEH.	Clearly name the panel regrouping the SW/AEH experts. SW/CEH should be replaced by SW/AEH.	X		Partially accepted	The complete section 5 has been reworked to introduce the notion of Panel 10.

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336	*Dassault Aviation*	5.3.3 b.	30	It should be clarified that the SW review Report is only provided when an audit is performed in the frame of DOA privileges.	Replace "The applicant should report to EASA about their own monitoring as follows…" by "The applicant should report to EASA about their own monitoring for activities performed under DOA privilege as follows..." and replace "Software Review Reports" by "software audit minutes"		X	Not accepted	In order to clarify the intent this item 5.3.3b has been reworded. In addition, additional clarifications have been added in section 4.3.b.
337	*Dassault Aviation*	5.3.3 c.	31	Categories are not in line with the DASSAULT programs.	-	X		Noted	This is only an example. Each applicant can of course keep the own categorization.
338	*Dassault Aviation*	5.3.3 c.	30	System certification plan is out of the scope of this document.	Remove the references to system certification plan		X	Accepted	This sentence has been removed in the updated Certification Memorandum.
339	*Dassault Aviation*	7.4	33	Clarify the milestone for the FLS procedure approval (e.g. Is it included in the data reviewed in a SOI #4?)	Indicate when the procedure should be submitted.	X		Noted	This section has been made as similar as possible to the FAA material. The section says that all the ED-12B / DO-178B objectives must have been met. This is normally only possible at the end of a program, which is the stage equivalent to SOI#4 anyway.
340	*Dassault Aviation*	9.4	38	bullet c : replace "interfere" by " affect"	Bullet C: replace "interfere" by "affect".	X		Noted	This text is common with the FAA material, so the wording was kept the same.
341	*Dassault Aviation*	9.7	39	What is the exact definition of a SW component: a binary? Is the "intentionally" of the following sentence confirmed? "The protection integrity should be such that it can neither be breached accidentally or intentionally." Is it a common practice?	To be clarified.	X		Noted	Section 9.4 b says that 'A user-modifiable software component is that part of the software within the airborne system that is designed and intended to be changed by the user'. The protection against intentional breaches is from text that is common with FAA Order 8110.49. The intention appears to be to ensure that a user that modifies the software cannot deliberately affect parts of the software that users should not be able to modify. EASA considers that this helps to ensure that there are no undesirable effects on the rest of the software.
342	*Dassault Aviation*	9.9	39	Should not bullet a) be in 9.8?	-	X		Not accepted	No, this paragraph is intended to be in section 9.9
343	*Dassault Aviation*	10.2	41	It should be more clearly identified that the above objectives are only applicable to modified or new functions.	It should be only applicable to modified or new functions.		X	Not accepted	This section does not contain the words new or modified at all, so the comment is not understood by EASA and no change has been made.
344	*Dassault Aviation*	10.3 b. & 10.3 c.	42	LLR and design are not necessarily developed for equivalent LEVEL D (for example DO-178A software). Same thing for reviews. It should be balanced with the fact that (text incomplete in PDF file provided by Dassault Aviation)	It should be only applicable to modified or new functions.		X	Not accepted	This section does not contain the words new or modified at all, so the comment is not understood by EASA and no change has been made.
345	*Dassault Aviation*	11.4	51	Bullet d) (1) For a verification tool ii) : the following sentence is ambiguous "an analysis of what tools will not do and what is required to cover that shortage (e.g., extensions to checklists, test cases). "It may be difficult / dangerous to define what is not done by the tool. Please, define more precisely what is required by the analysis.	To be clarified.	X		Not accepted	This paragraph begins 'A definition of the tool's operational environment, including operating system and any other considerations'. This makes it clear that the aspects that have to be covered are to do with the tool's operational environment and are not part of the tool itself. For the correct operation of the tool, it must be ensured that the operational environment in which the tool runs works correctly. These are the aspects that may require additional checklists or test cases and as the text says, there may be hardware requirements on processors, test equipment or interfaces. EASA considers that this paragraph is self-explanatory and does not require further elaboration.

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346	*Dassault Aviation*	12.4	57	Table 12.1 : Is it confirmed that a DO178A level 3 is not equivalent to a DO178B level D? (see §10 p64 FAA order 8110.49)It could be "Possibly YES after Analysis".	To be clarified.		X	Not accepted	The contents of Table 12.1 are exactly the same as the contents of Figure 10-1 of FAA Order 8110.49 so there is no equivalence between Level 3 and Level D in the FAA Order. In addition, DO-178A states in paragraph 6.2.3.3 that for Level 3, no assurance is required. This means that Level 3 is the equivalent of Level E of DO-178B and therefore it is not equivalent to Level D.
347	*Dassault Aviation*	12.4	57	Bullet b : The following sentence is ambiguous : "a different aircraft or engine where ED-12B / DO-178B is not required, then the original assurance process and associated data submittals may be accepted. This is only true if the system is being used in exactly the same way as originally installed in a certified product". A verification should check that the unmodified SW fits the system needs (e.g. The SW of inertial guidance system that was unchanged between Ariane 4 and Ariane 5 and used exactly the same way).In case of modified aircraft, an analysis should be performed in order to demonstrate that the SW is able to take into account the system needs.	Sentence has to be rewritten in order to avoid ambiguities and misinterpretation.		X	Not accepted	EASA fully agrees with the intent of the comment, however the sentence 'This is only true if the system is being used in exactly the same way as originally installed in a certified product' provides enough confidence that the unmodified software will behave as intended in the same environment (The Ariane example showed that the environment of the new installation was different from the old one. Section 12.4 e should have been applied in the Ariane case.)
348	*Dassault Aviation*	12.4	57	Bullet e : same comment than above for the sentence "When the operational use is significantly different from the original certification basis"	Sentence has to be rewritten in order to avoid ambiguities and misinterpretation.		X	Not accepted	The kind of difference in the operational use is explained immediately above this phrase in the same paragraph, so we do not consider that there is an ambiguity here.
349	*Dassault Aviation*	14.1	60	Is not it "Development Assurance Level" instead of design?	To be corrected.	X		Not accepted	This text is the same as in FAA Order 8110.49, which does not use the term Development Assurance Level; it uses instead the term 'software level'. When it mentions the same level of design assurance, we take it to mean the same level of confidence, rather than the same DAL.
350	*Dassault Aviation*	15.2.1	63	Explain the following sentence: "The applicant should create oversight plans and procedures that will ensure all suppliers and sub-tier suppliers will comply with all regulations, policy, guidance, agreements, and standards that apply to the certification program."	To be clarified.		X	Not accepted	Areas for clarification are not presented by the reviewer. From EASA reading (and from other reviewers), the presented text have an adequate level of clarity.]
351	*Dassault Aviation*	15.2.2	64	Bullet 1: What is the definition of "prime"? Use always the same words for the same concepts.	Definition of prime to be added.	X		Partially Accepted	EASA does not consider necessary to include a specific definition for that. Nevertheless, following other comments, the "prime" term has been changed by "main" for the sake of clarity.
352	*Dassault Aviation*	15.2.2	64	The applicant should address the following concerns in a supplier management plan… , Certification specialists should review the plan(s) ... : Clarify who are involved in these roles. Furthermore, this plan is not required in the frame of DO-178B.	-	X		Accepted	Clarification introduced taking into account the feedback and proposals from other reviewers on this Cert Memorandum and on the HW Cert Memo. The second sentence is substituted by "The plan(s) should address the following areas".
353	*Dassault Aviation*	15.2.2	64	The bullets 1-7 are already addressed within the existing PSAC and SW plans.	-	X		Not accepted	EASA considers that subcontractors management and, in particular, the subcontractor oversight, may have, if not properly performed, a negative effect on the design assurance of the resulting hardware in which both main supplier and subcontractors contribute. Then, specific information should be included in the planning documentation and it is necessary to confirm that, depending on the industrial organisation, the information is presented in a new or existing plan.

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354	*Dassault Aviation*	16.2	66	Bullet 1: What is the definition of "equipment supplier"?	Clarify the definition.	X		Partially Accepted	In this Certification Memorandum, EASA does not define words that are commonly used in the industry (equipment supplier, sub-tier supplier etc.). Some of the other definitions are already in Part 21, ED-12B / DO-178B etc. However, EASA agrees that both terms in the same sentence "equipment supplier" and "equipment manufacturer" were confusing, therefore the "equipment supplier" was replaced by "equipment manufacturer".
355	*Dassault Aviation*	16.4	67	Ditto: Deviation from the rules: is this definition a direct copy from DO254 (reference to HAS)? If it has to apply to SW, please modify it.	To be clarified/corrected.	X		Accepted	Comment accepted and section amended.
356	*Dassault Aviation*	16.6	68	Ditto: remove "in this CRI".	To be corrected.	X		Accepted	Comment accepted and section amended.
357	*Dassault Aviation*	16.8	69	This SCS is not applicable to DO-178B process. System certification documents are not relevant for DO-178 process.	To be removed.		X	Not Accepted	EASA is requesting for the OPR section 16.9 of this Certification Memo: "The System Certification Summary or an equivalent certification document should describe:" As an EASA "System Aspects linked to Software and Airborne Electronic Hardware" Certification Memorandum does not exist at the moment, EASA considers that this aspect should be addressed in this Certification Memorandum. Section 16.9 might then be amended if a Certification Memorandum "System Aspects linked to Software and Airborne Electronic Hardware" is released.
358	*Dassault Aviation*	16.9	69	System Configuration plans are not applicable to DO-178B process.	To be removed.	X		Not Accepted	EASA is requesting for the OPR section 16.9 of this Certification Memo: "The System Certification Summary or an equivalent certification document should describe:" As an EASA "System Aspects linked to Software and Airborne Electronic Hardware" Certification Memorandum does not exist at the moment, EASA considers that this aspect should be addressed in this Certification Memorandum. Section 16.9 might then be amended if a Certification Memorandum "System Aspects linked to Software and Airborne Electronic Hardware" is released.
359	*Dassault Aviation*	16.9	69	At which level is dedicated this section? SW level or system level?	Scope to be clarified.		X	Noted	The problem reporting process starts at software level; however the impact could be at system level or aircraft level. The oversight activities depend on the product and the industrial organization between the applicant, its supplier and sub-tier supplier. Therefore compliance with ED-12B / DO-178B, section 11.20(j) is requested. The SW OPRs should be analysis and their assessment should be feedback to system level to determine any potential safety or functional impact.

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360	*Dassault Aviation*	17.5	74	Bullet description: Configuration Files could be considered as part of the software (source code or LLR). It is possible with the current DO178B definition of software to consider that configuration files are part of the software. An important point is, how are defined, justified, verified the values of the configuration files? Do these values fulfil the needs of the above requirements? Are these values compatible with the validity domains of the executable object code? For the above reasons, it is important to consider configuration files as part of the software (source code or LLR) and to be able to trace each part of these Configuration Files to their above requirements in order to demonstrate that the selected values implement correctly their allocated requirements and are within the validity domains of the software e.g. The choice of the action to perform depends on the type of the fault. Most of the time, this choice is performed at system level and sometimes implemented thanks to CF at SW level.	-	X		Noted	EASA agrees with the intent of the comment and thinks it is covered in the Certification Memorandum.
361	*Dassault Aviation*	17.5	74	Bullet validation : Validation is not addressed in section 5 of DO178B	-	X		Partially accepted	The wording "validation" applies to CF when they are directly defined from system requirements. However, in order to avoid any misinterpretation, the wording "validated" has been replaced by "reviewed and analyzed".
362	*Dassault Aviation*	17.5	74	Bullet deactivated code: What is the meaning of this sentence?	Replace the following sentence "The activation or deactivation of a function, through the parameter values in the configuration files, should not affect the behaviour of any other function (see also ED-12B/DO-178B section 2.4.e)."by "The activation or deactivation of a function, through the parameter values in the configuration files, should not have unexpected behaviour for any other function (see also ED-12B/DO-178B section 2.4.e)."	X		Accepted	Comment accepted and section amended.
363	*Dassault Aviation*	18	76	Intent is not clear. Substantiations are requested too early to be complete and reliable in the plans, as for instance differences between final HW and the verification environment. If tools/environments automate and/or reduce DO-178B, they should fall under qualification requirements. Thus unless they need to be qualified they are out of scope of the DO-178B. This section should not be applicable. Overviews of dev. and verif. environments are requested in the plans. At least, substantiations showing the representativity of the environment could more appropriately added in the SECI or in the SAS.	This section should be removed or clarified.		X	Not accepted	Section 18 was introduced in order to harmonize the EASA documentation with that of the FAA, as EASA considered that the FAA material was a useful addition. EASA does not agree that substantiations are requested too early to be complete and reliable. ED-12B / DO-178B has always called for the Software Verification Plan to provide "A description of the equipment for testing, the testing and analysis tools, and the guidelines for applying these tools and hardware test equipment (see also paragraph 4.4.3, item b for guidance on indicating target computer and simulator or emulator differences)." Even at the start of a project, the developer and verifier should know what their target environment is intended to be and should ensure that the verification environment they choose will be representative enough to enable the ED-12B / DO-178B objectives to be met. Any differences between the target and test environments need to be considered by the supplier and EASA should be informed of any such differences that might affect the ability of the supplier to comply with ED-12B / DO-178B objectives. This section provides some clarifications in this area and asks for the verification environment to be configuration controlled and for problem reporting system to be available to users of the tool environments. EASA therefore considers this section to be useful and does not wish to remove it.

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364	*Dassault Aviation*	18.2	76	SW development Environment should be described in the SDP.	This section should be removed or clarified.	X		Not accepted	The objectives referred to in this section are verification objectives, so the means to comply with those objectives should be in the Verification Plan, which is what the text states.
365	*Dassault Aviation*	18.2.3	76	What is intended by "system SW supplier" ? System development should be out of the scope of this document.	This section should be removed or clarified.	X		Not accepted	There can be more than one software supplier for a system, as some components may be developed by separate suppliers. The phrase 'system software suppliers' refers to the software suppliers for a given system.
366	*Dassault Aviation*	19.2	78	At what DALs is it required? Such details are usually not required for a DAL D.	-		X	Noted	This information is not planned to be included in the Certification |Memo. This will be addressed in the cover CRI for each Certification project, depending on the particular characteristics.
367	*Dassault Aviation*	19.2	78	The requests are very technical and detailed! As far as possible, the objectives should not depend too much on the technology used! These ones are dedicated to OOT. Comment: Similar problems may also occur in a C program: What about the tables of function pointers or tables of pointers of pointer of function ... the index value of which may be defined at run-time? Why not dedicated rules for C++, Ada95…	Scope and intent have to be clarified.	X		Noted	This section of the Certification Memorandum is intended to address the use of Object Oriented Techniques in the design and coding phases. The text is based on the EASA CRI that has been and is currently applicable in many certification programs. Then, this level of detail is already accepted by many air framers. Nevertheless, EASA agrees that there will be other topics for which specific guidance could be necessary (as the example presented by the reviewer concerning the indexation of the pointers). Most of these aspects are covered through the company coding standards but we can assess the possibility of including specific guidance on this issue if found necessary (to be done in next releases of this document and in case that mature criteria can be presented).
368	*Dassault Aviation*	20.2	83	It is assumed that this section is dedicated only to DAL A SW. Nevertheless, the first bullet of 10.2 is ambiguous because it refers DAL A and B SW. Moreover, some bullets contain very detailed questions/topics. When is it required to answer these questions/topics?	Scope and intent have to be clarified.	X		Accepted	Comment accepted and paragraph amended. "The approach should generate the same minimum number of test cases as that required for MCDC coverage."
369	*Dassault Aviation*	22.2.1	88	ditto : 2 successive "that"	-	X		Accepted	The additional "that" has been removed in the revised text.
370	*Dassault Aviation*	23	93 to 98	The wording "formalized" seems incorrect. Maybe it was "formal" which was expected. Formal makes the §23 applicable to formal specification language (not graphical model based). Formalized would make the §23 applicable for many processes usually covered by the core doc.	Intent has to be clarified.		X	Accepted	The word 'formalized' has been replaced and the word 'model' is now used.
371	*Dassault Aviation*	23.1	93	ditto: please, use the same word for formalized : "formalised" in the title and "formalized" in the core doc.	-	X		Noted	The comment is noted but is superseded by a change of terminology to avoid using the word 'Formalized' or 'Formalised'.
372	*Dassault Aviation*	23.1	93	Are validation activities under the scope of DO178B? (see last sentence of §23.2.3)Validation activities should be addressed at system level as ARP-4754 (See comment #2).	Scope and intent have to be clarified.		X	Noted	As described in this section of the Certification Memorandum, when some of the software life-cycle activities are carried out by system engineers, the activity that would be called verification in ED-12B / DO-178B is called 'validation' in ED-79 / ARP4574. Those activities still need to be conducted, so we have used the term 'validation' when the life-cycle involves this activity being conducted at the system level.

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373	*Dassault Aviation*	23.2.1	93	What is the rational for the following sentence "Formalized Requirements should neither contain Software design nor Software architecture details."? see DO178B:§5.1:bullet 1 The high-level requirements should not describe design or verification detail except for specified and justified design constraints. What are the definitions of "Software design" and "Software architecture details"? When at systems level, it is decided to used an ARINC 653 RTOS and which partitions have to run above that RTOS, these system choices allocated to SW may be formalized thanks to a formalized language for defining, for example : - the partitioning requirements, - the SW architecture built from system requirements allocated to SW.	-		X	Accepted	The terminology has been changed to refer to formalized requirements as a Specification Model. The text has been altered so as to state that the Specification Models should not contain Software Design details such as aspects of the Software Architecture.
374	*Dassault Aviation*	23.2.1	94	Higher level requirements: what about the safety requirements in addition to functional and performance requirements? Are they included in the functional requirements?	Clarify how the safety requirements should be considered.	X		Accepted	The word 'safety' has been added in the definition of higher-level requirements.
375	*Dassault Aviation*	23.2.2	94	The bullets c) and h) mix software and system aspects. It is very uneasy to give two different answers in terms of compliance.	System aspects should be removed.		X	Not accepted	As explained in this section, depending on the life-cycle that is used to develop software, some activities that would normally be conducted within the software engineering processes have to be conducted within the system engineering processes instead. Those activities have to be conducted thoroughly and according to guidance, so we have specified that those activities should be conducted as system activities under ED-79 / ARP4574.
376	*Dassault Aviation*	23.2.2	95	The bullet i) about tools and qualification seems to be applicable for software but also systems activities. It means that tool qualification is applicable to system and ARP activities? Is it planned for PLM?	System aspects should be removed.		X	Not accepted	Some of the tools used in model-based development life-cycles are used by both the system and software engineers. For instance, SCADE may be used by both system and software engineers for different parts of the process and this is a qualifiable development tool. Some of the tools that are used by system engineers therefore have to be qualified when ED-12B / DO-178B objectives are satisfied by use of those tools without the output of the tools being verified.
377	*Dassault Aviation*	23.2.2	95	Is the bullet j) about A6 table objectives (integration of the EOC) or is it also applicable to model verification A4 table? It is ambiguous.	Clarify the requirement.		X	Noted	The requirement is that whichever ED-12B / DO-178B objectives are to be satisfied by the use of a simulator or emulator, the applicant should make this clear to the certification authority in the plans. The use of simulation is described in a separate sub-section. The objectives related to each of the activities are listed in each sub-section. It is also clearly stated that the hardware / software integration must be conducted with the EOC loaded onto the target.
378	*Dassault Aviation*	23.2.2	95	Bullet j: The following sentence is ambiguous: "which will be used for development and verification of their formalized system / software components".	It should be clarified in order to clearly address only system tools that are directly implied with the inputs of the SW process. They should be addressed at system level.		X	Accepted	The text of the sub-section has been reworded to mention the system and software planning process so as to be consistent with the title of the sub-section. Where tools are part of the system processes, they can be described in system level plans.

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379	*Dassault Aviation*	23.2.4.5	98	In this § (and in the similar ones 23.2.5.4 …) the required activities are not dependent on DAL whereas they should. Requirement for independence is an example.	Clarify what is required for each DAL.		X	Accepted	We have included a note in 23.2.3 that the activities should be tailored according to the DAL.
380	*Dassault Aviation*	23.2.5	99	For type #2b, Formalized Design covers both system and software processes. If "Formalized Design," is performed "either by the system development processes or by the software development processes" this is out of the scope of DO-178B (see comment #2)	Remove type #2b		X	Not accepted	Although a Design Model may be produced by the system engineers, it is then used to produce source code to be approved as part of a system under ED-12B / DO-178B. If the processes used to produce the Design Model are inadequate or missing, experience shows that the Design Model is likely to contain some functions with poor designs, unintended functionality, untraceable functionality, and to have functionality missing. In order for the software produced from the Design Model to be compliant with ED-12B / DO-178B, we have to ensure that the requirements from which the model was produced are adequate and have been validated. (These processes have been covered by EASA CRIs for several years.)
381	*Dassault Aviation*	23.2.5.2	99	What is the definition of "Simulation of Executable Formalized Designs"?	Add the definition.	X		Noted	This is explained in section 23.2.8, which is the section that provides the details of the activities to be performed.
382	*Dassault Aviation*	23.2.5.3	100	Objectives of the table A6 depends on the DAL. Objectives 3 and 4 are not required for DAL D. Are all objectives always required for formalized design independently of the DAL?	Clarify which part of this section is applicable to which DAL (as it is already defined in table A6). e.g some objectives of table A6 are not required for a DAL D.		X	Accepted	A note has been added in section 23.2.3 saying that 'The validation and verification activities called for in this section should be tailored according to the DAL of the software as described in ED-79 / ARP4574 and ED-12B / DO-178B.'
383	*Dassault Aviation*	23.2.5.3	100	What is the definition of "element", "design element"?	Add the definitions	X		Accepted	A definition has been added.
384	*Dassault Aviation*	23.2.5.4	100	What is the definition of a non functional requirement? Is it different from derived requirement?	Define what is a non functional requirement.	X		Accepted	The text of paragraph 23.2.10.3 has been altered to define this term.
385	*Dassault Aviation*	23.2.6.2	101	The sentence is ambiguous. It does not clearly take into account DAL for the objectives of the table A3. Objectives of table A3 depend on DAL. Please, clarify the sentence in order to clearly require only the applicable objectives of the table A3 depending on DAL for the formalized requirements.	Clarify what is required for each DAL.		X	Partially accepted	A note has been added in section 23.2.3 to state that the validation and verification activities called for in this section should be tailored according to the DAL of the software as described in ED-79 / ARP4574 and ED-12B / DO-178B.
386	*Dassault Aviation*	23.2.6.5	102	The sentence is ambiguous. It does not clearly take into account DAL for the objectives of the table A6. Objectives of table A6 depend on DAL. Please, clarify the sentence in order to clearly require only the applicable objectives of the table A3 depending on DAL for the formalized requirements.	Clarify what is required for each DAL.		X	Partially accepted	A note has been added in section 23.2.3 to state that the validation and verification activities called for in this section should be tailored according to the DAL of the software as described in ED-79 / ARP4574 and ED-12B / DO-178B.

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387	*Dassault Aviation*	23.2.8.3	104	Robustness verification is required for model verification. This topic was previously discussed in WG71 groups. Either it is considered that it is already asked in the core doc, there is no need to ask for it, or it is considered as a new requirement and then why should it be model based specific? Another point is that it leads to ask to perform robustness activities twice: at model level and also at code level. We would prefer not to ask it at model level, and to suggest answering to code level requirement through the model level verification.	Remove robustness verification at model level.		X	Not accepted	EASA considers that robustness in the verification must be achieved at any level where verification is performed. Alleviating this requirement would only diminish the capacity of detecting errors at model level. Therefore EASA does not agree to remove this aspect. Note: For example if a set of tests are written based on a set of textual HLRs, in order to verify the EOC compliance to these HLRs, robustness cases will be taken into account in order to fulfil ED-12B / DO-178B objective A6-2. Now to verify the Design Model from which this same code is produced, it is obvious that the same set of tests (including robustness aspects) will be considered. Therefore the job is not performed twice but really once for both activities.
388	*Dassault Aviation*	23.2.9	105	This section will be difficult to apply independently of the DAL.	Clarify what is required for each DAL.		X	Partially accepted	A note has been added in section 23.2.3 to state that the validation and verification activities called for in this section should be tailored according to the DAL of the software as described in ED-79 / ARP4574 and ED-12B / DO-178B.
389	*Dassault Aviation*	25.3	113	Depending on which detection mechanism is used (e.g. memory pages above the stack with no read/write rights), the memory violation exception may be the event detecting a stack overflow. In such case, the behaviour is defined within the exception handler by describing how to deal with this dedicated exception. The behaviour is not defined by the exception occurrence but by the exception treatment.	-	X		Accepted	This section does not impose this monitoring (see bullet b). The mechanism described in your comment may also be used.

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390	*Avidyne Corporation*	All	All	We are confused by EASA's decision to create a new class of documents (Certification Memoranda) containing compliance requirements directed to all applicants. There are already document types in existence with this purpose - AMCs and GMs. It appears to us that EASA simply wants to be able to create documents with the force of AMCs but without the overhead. (This overhead serves to prevent frequent and capricious changes to compliance requirements, offering applicants some measure of stability. CMs offer no such stability.) Indeed, the "force" applied by CMs acts in only one direction - while we expect EASA to enforce CMs as minimum compliance requirements, they do not even offer the applicant assurance that they constitute acceptable means of compliance! If some of the provisions of this CM respond to issues that only rarely occur in projects or that represent newly emerging technology issues, we would support the use of CMs to separate the technical details of the issues from the administrative details of CRIs, which must necessarily change with every project. Based on the content of this CM, though, we suspect that EASA intends to apply it in all projects with software content without regard to the specifics of the project or of the competence of the applicant or of the degree to which the applicant has taken pains to address its issues proactively. this is an inappropriate use of a CM - the guidance should insted be in the form of an AMC with a promise to applicants that it is an acceptable means of compliance with respect to the issues it covers.	Issue guidance as AMC where appropriate	Suggestion	Objection	Noted	EASA has not created anything new; the way of working has not changed. EASA published the Certification Memorandum for public consultation in order to get Industry view point on specific areas.
391	*Avidyne Corporation*	All	All	As acknowledged by Section 3.1 of the CM, AMC 20-115B promises that DO-178B/ED-12B is an acceptable means of compliance for the software aspects of certification. The cover page asserts that "Certification Memoranda are not intended to introduce new certification requirements or to modify existing certification requirements and do not constitute any legal obligation." This is not consistent with the specific contents of the CM as we expect them to be employed by EASA - as minimum standards of compliance that must be answered point-by-point. This memorandum introduces many specific compliance requirements that go well beyond simple interpretation and clarification of DO-178B/ED-12B and have the effect of undermining the assurance of AMC 20-112B that simple compliance with DO-178B is acceptable. We feel that it is inappropriate for EASA to impose, by a simple administrative action, such broad new requirements in contravention of the AMC's promise.	Clarify	Suggestion	Objection	Noted	Please see section 1 which defines the framework of this Certification Memorandum. Most of the content has been harmonised with the other Certification Authorities, including the FAA (see the FAA order 8110.49).

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392	*Avidyne Corporation*	All	All	If EASA contends that this CM is merely an interpretation of the application of DO-178B/ED-12B to projects with specific technical content, then it should be EASA's burden to trace and justify every provision of the CM to a particular DO-178B/ED-12B objective. Moreover, it should be EASA's burden to establish that the required treatment is minimal with regard to the DO-178B/ED-12B objective(s) to which it traces, not an expanded set of requirements or a preferred treatment for the convenience of the authorities.	Trace content to DO-178B/ED-12B	Suggestion	Objection	Noted	Please see section 1 which defines the framework of this Certification Memorandum. Most of the content has been harmonised with the other Certification Authorities, including the FAA (see the FAA order 8110.49. EASA thinks that the content of each section has justified the background of the each issue (what you call "a justification").
393	*Avidyne Corporation*	All	All	EASA has accepted the proposition that systems developed in advance of the adoption of a particular compliance requirement should remain exempt from that requirement except to the extent that the system is subsequently changed. (See, for example, ETSO-C119c Section 3.1.4). This principle should extend to compliance with the provisions of this CM. Any system developed prior to the adoption of this CM should be exempt from its provisions except to the specific extent that it is subsequently changed. Any system developed under a particular issue of this CM should be exempt from compliance with later issues except to the specific extent that it is subsequently changed.	Add statement exempting systems, and portions of systems, developed prior to adoption of CM from compliance	Suggestion	Objection	Accepted	It is the EASA rule that any Regulations or GM is not applicable to PDS unless safety concerns are present.
394	*Avidyne Corporation*	All	All	EASA's demonstrated mechanisms for use of CMs within a project are contrary to appropriate project management norms. A foresighted, compliance minded applicant who anticipates the issues identified in a CM and incorporates a path to resolution in his compliance plans (certification plan, PSAC, PHAC, etc.) will nevertheless be burdened with the additional step of completing a detailed response to the CMs. It should be EASA's burden to read and understand the applicant's compliance plans and apply CRIs and CMs only where additional issues remain. If it is necessary that a detailed record of CM compliance be maintained for EASA's purposes, then EASA's position established in the CRI should clearly note that the applicant's compliance plan is acceptable in certain areas and should establish the minimum necessary bounds on the additional work required of the applicant. To do otherwise has the effect of placing the CRI/CM compliance activity above compliance with the regulations and with all other established guidance where, in fact, it should merely be a gap filler.	Add statement placing responsibility for determining whether applicant is in compliance with EASA	Suggestion	Objection	Noted	This way of working is used by all worldwide Authorities and is desired by the Industry. All regulations and GM are known at the beginning of the project and the applicant transfers to its suppliers all rules. This way of working is effective and has not been challenged the past years.

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395	*Avidyne Corporation*	All	All	The CM states in Section 2.1 that "The format of this Certification Memorandum in terms of the order of the sections is intended to harmonise this EASA guidance material with the existing FAA guidance material." Merely selecting a format that mirrors FAA guidance, however, does not achieve harmonization. Several of the sections that mirror Order 8110.49 differ enough that they cannot be considered harmonized (in part due to the fundamental difference that Orders are directed at FAA personnel and designees, while the CM is directed at applicants). Notwithstanding this fact, EASA has sometimes waived the requirement for formal response to this material in the case of projects in which Order 8110.49 has been taken into account. The sections that mirror Notice 8110.110 have a substantially different focus and grossly inconsistent content - there appears to have been no pretence whatever of harmonization. And any claim of harmonization in the case of CAST material simply makes no sense. In those cases where compliance requirements of this CM are intended to be fully harmonized with those in FAA guidance, and in those cases where the compliance requirements are not completely harmonized but are sufficiently close, it should be clearly stated that compliance with FAA requirements is acceptable.	Add statements regarding harmonization of individual sections and acceptability of compliance with FAA requirements	Suggestion	Objection	Noted	The recognition of compliance with the FAA requirements is always true and is done on project basis.
396	*Avidyne Corporation*	All	All	While DO-178B/ED-12B modulates requirements by design assurance level (DAL) and AC 23.1309-1D (which is accepted by EASA) further modulates DAL by airplane type, this CM makes no attempt to do so. Thus, except in a few cases where DO-178B/ED-12B make the issue moot (such as MC/DC at DAL B and below), there is an inappropriate "one size fits all" aspect to this guidance. In several sections, this has the effect of reversing the intent of the very guidance it claims to merely interpret.	Add DAL considerations throughout	Suggestion	Objection	Partially accepted	The Certification Memorandum is going to be called by a CRI and discussions with the applicants will be done afterwards. During those discussions, applicability per DAL will be discussed. In some instances, a sentence has been added to indicate the SW DAL.
397	*Avidyne Corporation*	3.2	13	The section's statement that an applicant showing compliance as part of ETSOA or appliance-level type design approval might have to make a renewed showing of compliance (to a different set of requirements) as part of a TC or STC project is unacceptable. All of the issues in this CM relate to DO-178B/ED-12B compliance. Once that compliance has been shown and a particular design assurance level (or levels) has been affirmed for an appliance, issues of DO-178B/ED-12B compliance have been forever settled as long as DO-178B/ED-12B remains in force. It is appropriate to question whether the DAL is appropriate to the installation, whether the equipment has an acceptable status with regard to open problem reports and to insure that an appropriate level of integration testing is performed, but DO-178B/ED-12B compliance does not fall into those categories.	Revise statement of policy to eliminate TC/STC-time compliance activities for ETSOA appliances	Suggestion	Objection	Not accepted	As indicated in regulations, an ETSO approval does not mean that related to areas where EASA has some concerns the installation requirements are met. The Certification Memorandum is also to provide to manufacturer with information.

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398	*Avidyne Corporation*	4.2	14	Sections 4.1 and 4.2 do not appear in this form in FAA Order 8110.49. The definitions of Section 4.2 are drawn from Section 1-7 of the Order. The CM puts them in their rightful context within the guidance material (good). Some of the definitions, however, differ from those given in the Order in significant ways. These include: Sampling: EASA's definition expands on an unfortunate terminology conflict introduced in the Order by using the term "review" in conflict with its previously established definition within this section. The conflict would be minimized by returning to the wording of the Order or by rewording the paragraph. In addition, EASA's use of the phrase "multiple samples" is redundant and tends to make the definition circular, since the basic definition includes "the process of selecting a representative set". Action: This term is defined but not used consistently within the section. Related terms ("corrective action", "action item") are used in the text and "action" is used alone only in the table in Section 4.5.5. This is confusing. In the statement "Action is the description of the activity to be performed by the applicant/supplier in order to resolve a finding or any other deficiency detected by the auditor. By default, actions should be completed and closed before approval." we object to the inclusion of "or any other deficiency". By definition, the purpose of an SOI review is to identify compliance issues (findings) and only non-compliances must be resolved prior to approval. Observation: EASA has omitted a crucial part of the definition contained in the Order: "An observation is not an RTCA/DO-178B compliance issue and does not need to be addressed before software approval."	Correct definitions	Suggestion	Objection	Partially accepted	Regarding the definition of "sampling": the definition has been changed as suggested. Regarding the use of "action": the wording "action items" has been replaced by "actions". However no change to the wording "corrective actions" is considered necessary. Regarding the definition of "action": based on the experience, action items may be raised for aspects that are not direct non-compliances to a standard. This is for example true for an item requesting a clarification in a document or in a plan: such items are not necessarily linked to non-compliance. Therefore EASA does not agree to remove "or any other deficiency detected by the auditor". Finally regarding the definition of observation, EASA accepts to add the second portion of the FAA Order definition.

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399	*Avidyne Corporation*	4.3	15	Item b in this section states that applicants are expected to perform these reviews as a normal part of their development and can be expected to submit review reports to EASA prior to approval. No such requirement exists in the FAA Order or in DO-178B/ED-12B. To require that these reviews and methods be employed is a substantial prescriptive expansion of the DO-178B/ED-12B guidance for SQA activities and required document submittals. It is made without evidence of the inadequacy of applicants' performance under DO-178B/ED-12B as-is. The reviews as described violate the DO-178B/ED-12B recommendation that "The SQA process should take an active role in the activities of the software life cycle processes". SQA activities are most effective and most efficient when accomplished as nearly as possible concurrently with the development itself. The reviews as described in the CM are organized for the convenience of large, external review teams and focus on gross development phases. They are a good match only for "waterfall model" development, a model rarely used in software development today (for good reason).	Remove statement that applicants are expected to perform these reviews	Suggestion	Objection	Not accepted	In order to clarify the intent of this item b, the following wording has been introduced in 4.3.b: "The applicant should plan and perform his/her own software review process (independently from the EASA LOI defined in the CM section 5); this software review process may be tailored taking into account similar criteria defined in the CM section 5. Indeed, per Commission Regulation (EC) No 1702/2003 and its annex (part 21), a design assurance system should be maintained for the control and supervision of the design [paragraph 21A.239 (a)], and should include an independent checking function [paragraph 21A.239 (b)]. Per GM No. 1 to 21A.239 (a), 'design assurance' means all those planned and systematic actions necessary to provide adequate confidence that the organisation has the capability to design products or parts). As part of its investigations (per 21A.257), EASA may request the reports of the reviews performed by the applicant. In case of a validation project, where the applicant is not DOA holder (or AP to DOA holder), it is expected that the applicant also performs an equivalent set of reviews per the requirements of his/her national equivalent to part 21. Note: the reviews described in this section are basically separate from the software quality assurance (as described in ED-12B / DO-178B section 8). Nevertheless the software quality assurance team may be involved or take an active part to the establishment of the software review reports."
400	*Avidyne Corporation*	4.5	16	The quantitative criteria representing readiness for review expressed in items a(2) and a(3) differ from those presented in the FAA Order. The Order indicates that "typically 50%" of the data should be complete and reviewed, while the CM indicates "at least 75%". Conducting the review later in the development process greatly reduces its value as a positive influence on development practices and increases the likelihood of expensive and disruptive rework.	Harmonize with FAA Order	Suggestion	Objection	Not accepted	A review is efficient only if the application of the planned process is mature enough. To this purpose, EASA experience shows that below 75% of readiness of the artefacts, the level of maturity is often not sufficient to perform a representative sampling. This is the reason why EASA does not consider necessary to perform a change to this value. Note: having said that, nothing prevents an applicant to perform additional reviews earlier in the process (e.g. through the software quality assurance activity).
401	*Avidyne Corporation*	4.5.2	19	The Evaluation Criteria listed in Section c differ from those listed in the FAA Order by the substitution of DO-178B/ED-12B Table A-10 (objective 3) for Table A-10 (objectives 1-2). We believe that both are out of scope of this review.	Correct	Suggestion	Objection	Accepted	The objective A10-3 has been removed from section 4.5.2.c.
402	*Avidyne Corporation*	4.5.3	20	The Evaluation Criteria listed in Section c differ from those listed in the Order by the addition of DO-178B/ED-12B Table A-1 (objective 3) and the removal of Table A-10 (all objectives except for objective 3). We believe that Table A-1 (objective 3) and Table A-10 (all objectives) are out of scope of this review.	Correct	Suggestion	Objection	Accepted	The objectives A1-3 and A10-3 have been removed from section 4.5.3.
403	*Avidyne Corporation*	4.5.4	21	The table in Section b references DO-178B/ED-12B Section 11.18 for SQA records. It should be Section 11.19.	Correct	Suggestion	Objection	Accepted	Reference has been corrected.

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404	*Avidyne Corporation*	4.5.5	22	This section does not appear in the FAA Order. The use of a table to summarize the material of the preceding sections is helpful as long as it is consistent with those sections and does not impose additional requirements. The table imposes requirements for transmittal of various life cycle data in advance of each review. With the exception of software plans, this requirement does not appear in the preceding text or the Order and directly contradicts Section 4.7b, Item (5), which indicates that these data are to be made available at the time of the review. The table indicates that System Requirements are to be available during a Software Planning Review. Availability of System Requirements is not indicated in any of the preceding descriptions of the reviews, nor in the Order. The DO-178B/ED-12B objectives that have a dependency on System Requirements are not considered until the Software Development Review, so it would be sensible that the System Requirements would be required at that time, but not before.	Correct/amend	Suggestion	Objection	Accepted	Section 4.5.5 has been updated to take into account each of your comments.
405	*Avidyne Corporation*	4.6 b.	23	Section 4.6b consists of new material not included in the FAA Order. The subject of Level of EASA Involvement is treated extensively in Chapter 5 of the CM. This treatment is referenced in Section 4.4b. As such, we view Section 4.6b as extraneous.	Remove	Suggestion	Objection	Not accepted	Although this item is also linked with the LOI, it is useful information on the way of working of EASA that is directly related with the review process. Therefore it is not agreed to remove it.
406	*Avidyne Corporation*	4.7 a.	23	Section 4.7a states that plans should be sent to the review team members 15 days in advance of the review. This conflicts with Section 4.5.5 and the Order, both of which specify ten days.	Correct	Suggestion	Objection	Accepted	The text has been consistently changed to "15 working days".
407	*Avidyne Corporation*	4.7 f.	24	Section 4.7f makes the applicant responsible for production of the review report and states that it is to be prepared to and agreed upon prior to completion of the review. We agree that completion of a preliminary report and its review prior to completion of the review is a positive change, but we are concerned that assignment of this responsibility to the applicant will greatly slow the review, as the applicant will feel the need to gain agreement on each point as it is recorded. Moreover, we are concerned that the applicant will be required to direct his attention to the review process itself rather than to its development process to an extent that will interfere with the effectiveness of the review. The review process is clearly the responsibility of the certification authority, not the applicant, and this should extend to the production of the report. In the FAA's practice, the preliminary report is generally prepared by the review team in purposeful isolation from the applicant. This is an appropriate process in that it allows members of the review team to exchange observations while generating the report, and is rendered impossible if the applicant is responsible for the report.	Assign responsibility for the review report to the Certification Authority	Suggestion	Objection	Not accepted	The minutes from the review are generally captured by the applicant and reviewed at the end of each day (or alternatively at the end of the review). This ensures that the findings, actions and observation are worded in a way that is understandable by the applicant / supplier. Discussions around findings, actions or observation are necessary to reach this point of common understanding of the deficiency in the process. In case of auditing a supplier of an applicant, then the report is generally prepared by the applicant so the isolation is automatic. In case the applicant himself is audited, an independent person (e.g. from the SQA) is a good candidate for ensuring that the review activities should not be affected by the establishment of the review report. EASA experience show that this is the most efficient way to generate an audit report.

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408	*Avidyne Corporation*	5 and subsections	26 and following	This section begins by stating in Section 5.1 that it is informational only, but later proceeds to state process requirements that are levied on the applicant. Many of these requirements go beyond the minimum requirements of DO-178B/ED-12B	Remove applicant-directed requirements	Suggestion	Objection	Partially accepted	We agree that this introduction is misleading but it should not be removed as suggested. It has been reworded as follows: "The main purpose of this section is to present the role of the EASA Panel 10 and of the applicant, in the determination of EASA Panel 10 level of involvement (LOI) in a certification project, as well as the relations with the other EASA system panels. In addition, the applicant's involvement may be tailored considering similar criteria as described in this section, nevertheless taking into account the procedures already defined at company level (e.g. DOA procedures)."
409	*Avidyne Corporation*	5 and subsections	26 and following	The section seems to take the view that the applicant is not the software developer and, perhaps, not even responsible for development of the system that contains the software. As a result, some of the information and processes assigned to the applicant are satisfied by ordinary information flow in a DO-178B/ED-12B-based project. This should be clarified so as to avoid the introduction of additional, redundant responsibilities on the applicant.	Clarify	Suggestion	Objection	Noted	EASA confirms that this section is written in the view of an applicant, no matter if he/she is the system or hardware developer. These considerations of the industrial organization and the relationship with suppliers do not affect the responsibility of the applicant to present the adequate information to the Cert Authority for the determination of its level of involvement. No specific change is considered necessary.
410	*Avidyne Corporation*	5.3.3 b. & 5.3.3 c.	30	This section creates a new documentation item, Software Review Reports, not required by DO-178B/ED-12B. In addition, Item (c) requires their submittal in most projects.	Remove	Suggestion	Objection	Not accepted	In order to clarify the intent this item 5.3.3b has been reworded. In addition, additional clarifications have been added in section 4.3.b.
411	*Avidyne Corporation*	13.1	59	This section states that the classification of changes as major or minor is regulated by Part 21 Subpart D. While this is true for articles manufactured under a type design approval, it is not true for ETSOA appliances. In the latter case, classification of changes as major or minor is regulated by 21.611(b). The section should be modified to acknowledge this case.	Correct	Suggestion	Objection	Accepted	Section 13.1 and 13.2 have been updated to include ETSO articles changes.
412	*Avidyne Corporation*	14	60 and following	This section is unchanged from the corresponding material in the FAA's Order. It is clearly directed at the certification authority and does not form a good basis, as written, for use by an applicant. At best, if used as a sort of checklist, it will be hopelessly inefficient for both the applicant and EASA in typical cases of reuse.	Remove	Suggestion	Objection	Not accepted	This section should not only be of use to EASA but also to companies considering the reuse of software, as such companies will understand from reading this section whether their proposed reuse is likely to be accepted by EASA and what documentation they should provide to EASA for any proposed reuse. For example, 14.3 (7) states what a PSAC should contain for reuse, and a supplier will know from this what they should cover in a PSAC. The fact that this material is common with the corresponding material in FAA Order 8110.49 and that this material has been accepted and unchanged since 2003 leads EASA to conclude that the material is mature and useful and that EASA should keep this material in common with the FAA Order.
413	*Avidyne Corporation*	15.2.2	64-65	In the FAA's Notice, the text that became Item 3 deals with FAA Designees. EASA has adapted it by merely editing out references to designees and substituting "responsible persons". This makes no sense. The last sentence of item (3), in particular, has no basis in EASA certification practice.	Remove	Suggestion	Objection	Partially Accepted	Last sentence has been reworded as follows "It should also identify the parties involved in the review and assessment of software life cycle data as necessary for the applicant compliance demonstration."

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414	*Avidyne Corporation*	16	66-71	Section 2.1 claims that this section "corresponds" to material in FAA Notice 8110.110. The section in the CM, however, seems to have little correspondence other than the title. This section imposes numerous prescriptive requirements that have no basis in DO-178B/ED-12B. Many of its provisions are completely arbitrary and have no foundation in established regulations or guidance. A careful reading of the FAA's Notice will show that it is really focused on the applicant's management of suppliers and sub-tier suppliers. The CM includes these considerations, but expands the scope of the section to include the applicant's own problem reporting system.	Remove all of Section 16	Suggestion	Objection	Not Accepted	Section 16.5 reflects the fact that the proposed categorization by EASA is one possible way to classify OPRs that is acceptable. Section 16.6 reflects as well the fact that an equivalent typology to the one defined is also acceptable for EASA. Therefore EASA disagrees with the statement: *"This section imposes numerous prescriptive requirements..."*
415	*Avidyne Corporation*	16.4	67	The last two items in the section contain references to the HAS and to airborne electronic hardware, apparently as a result of editing errors.	Correct	Suggestion	Objection	Accepted	Comment accepted and section amended.
416	*Avidyne Corporation*	16.5	67-68	This section presents "One possible way to classify OPRs that is acceptable to EASA". Based on EASA's past practices in applying materials such as this, we suspect that every applicant will be required to adopt exactly this classification method or show that its method of classification equates to the one offered in the CM. Indeed, the very next section states that "All OPRs should be categorized according to the typology of problems defined in this CRI, or an equivalent typology. If an equivalent typology is proposed, any new type(s) should correspond to only one of the types (0, 1, 2 or 3) as defined in this section of this Certification Memorandum", in effect requiring adoption of EASA's classification method without deviation. There is no DO-178B/ED-12B requirement for a problem classification system with these specific characteristics or with this granularity of classification and it is more than simple interpretation to prescribe such a system.	Remove	Suggestion	Objection	Not Accepted	Section 16.5 reflects the fact that the proposed categorization by EASA is one possible way to classify OPRs that is acceptable. Section 16.6 reflects as well the fact that an equivalent typology to the one defined is also acceptable for EASA.
417	*Avidyne Corporation*	16.6	68	The costly and intrusive requirement that a root cause be determined for every problem has no basis in DO-178B/ED-12B. There is no objective basis for a requirement that minor problems (i.e., problems that can be deferred) that can reasonably be judged to be contained should, in every case, be the subject of a root cause determination. The only justification for universal determination of root cause is to insure that no more serious manifestation of a given problem exists. This can often be determined by consideration of the characteristics of the problem as observed, the architecture within which the failing function is implemented and the history of the software (whether under test or, if applicable, in the field).	Remove	Suggestion	Objection	Not Accepted	In section 16.6 it is stated that: "EASA considers that, as far as possible, a root cause analysis should be performed for all OPRs, except in exceptional cases where a root cause analysis is not feasible." In such cases only a justification of the infeasibility is demanded by EASA. EASA considers as well that performing the root cause analysis can reveal a need for re-classification of the associated Open Problem Report and therefore it is necessary.

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418	*Avidyne Corporation*	16.6	68	The CM states: In order to avoid decreasing the assurance of the quality of the airborne software to be certified due to an increasing number of OPRs, the following objectives should be taken into account and acted upon: - Limitations should be removed at the earliest opportunity. - Conformity with the specifications should be restored at the earliest opportunity. - Any OPR should be rectified within a time period compatible with its assessed consequences. There is no reason to believe that the existence of any particular problem, or set of problems, bears any relationship to the overall safety of the software (the only meaningful measure of its "quality"). The safety of the software can only be determined by considering the specific characteristics of the problems, singly and in combination, and applying judgment to those characteristics. Moreover, the first two bullet points are incompatible with the third. The first two suggest that every problem must be corrected "at the earliest opportunity", while the third suggests that some deferral might be appropriate based on consideration of the problem's characteristics. We would suggest that there are many problems that have no significant operational consequences whatsoever. These problems may represent "customer satisfaction" issues but have no influence on safety. No rational process based in DO-178B/ED-12B (which are, of course, means of compliance with safety regulations) can determine a timeframe in which these problems "must" be addressed. Indeed, to correct such problems would itself lead to the possibility of new problems being introduced. To be sure, there are classes of problem that should be corrected prior to release. There are also classes of problem that, should they be discovered in fielded software, would require a new release specifically for there correction. But just as surely, there are some problems that need never be fixed.	Remove	Suggestion	Objection	Not Accepted	There are Open Problems which are entirely related to HW, certain to SW, others to HW & SW, certain of these Open Problems may have a potential impact at System Level. Therefore the Certification memo is suggesting an assessment of Potential effects at the system level and, if necessary, at the aircraft / engine level and if required the appropriate limitations should be defined in order to ensure there are no adverse effects on safety. It is the understanding of EASA and the FAA (see related FAA IP) that OPRs may challenge aircraft safety when inappropriately considered. According to EASA there is no incompatibility between the first two bullets and the third one: • Limitations should be removed at the earliest opportunity. • Conformity with the specifications should be restored at the earliest opportunity. • Any OPR should be rectified within a time period compatible with its assessed consequences. The 2 first bullets are talking about the potential causes of the OPR and the last bullet is talking about the OPR itself. When the OPR is type O, the deferral you are talking about may be not accepted.

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419	*Avidyne Corporation*	16.7	69	As stated previously, we believe that the statement that "a large number of type 2 or 3 OPRs … [is a] general indicator of a lack of software assurance" is, without consideration of the specific characteristics of the individual OPRs, without foundation in regulations, guidance or DO-178B/ED-12B. We believe that there is no justification for a universal requirement as a precondition on software approval that "action plans for the closure of type 2 and 3 OPRs" be presented.	Remove	Suggestion	Objection	Not Accepted	Section 13.7 states: "*Although a limited number of type 2 or 3 OPRs should normally not prevent certification, a large number of type 2 or 3 OPRs, or a lack of action plans for the closure of type 2 and 3 OPRs are general indicators of a lack of hardware assurance. The EASA team may reject a request for certification if the number of remaining OPRs is too high, or if there is no evidence of an adequate action plan to close the OPRs*" This statement is not a universal requirement as a precondition on Hardware approval as Open Problems vary depending on the projects and products. On the front page of the Certification Memorandum it is stated: *"EASA Certification Memoranda clarify the Agency's general course of action on specific certification items. They are intended to provide guidance on a particular subject and, as non-binding material, may provide complementary information and guidance for compliance demonstration with current standards. Certification Memoranda are provided for information purposes only and must not be misconstrued as formally adopted Acceptable Means of Compliance (AMC) or Guidance Material (GM). Certification Memoranda are not intended to introduce new certification requirements or to modify existing certification requirements and do not constitute any legal obligation.* *EASA Certification Memoranda are living documents into which either additional criteria or additional issues can be incorporated as soon as a need is identified by EASA."*
420	*Avidyne Corporation*	16.8	69	The requirement that certain OPRs be described in the system-level documents is an unnecessary and undesirable contribution of overhead to the project and its documents. The OPR list in the SAS must, for its own purposes, include consideration of the system-level and aircraft-level issues associated with each OPR. The SAS is a required submittal; any EASA engineer who needs access to the list of open OPRs can simply be given access to the SAS. Duplicating the list leads to the possibility of error and the necessity of duplicate document modifications.	Remove	Suggestion	Objection	Not Accepted	EASA does not simply request a duplication of the OPRs list but is interested by the assessment at AC or engine level of the type 0 or 1 OPRs raised at SW level. Given the experience got, EASA thinks it is really necessary as the supplier may have a partial view of the OPR impact at product level.
421	*Avidyne Corporation*	16.9.1	69	The requirement that EASA's classification system be used is overly prescriptive and not based in DO-178B/ED-12B. It should be removed.	Remove	Suggestion	Objection	Not Accepted	As per ED-79 / ARP4754 section 9.2.2, problem reporting should be managed at the system level especially for Type 0, Type 1A, Type 1B and Type 2 OPRs (see section 16.6). A Certification Summary or Equivalent Document at system level is already requested; therefore it is not an additional request at the SW Level. Furthermore, the SAS is actually a SW level Accomplishment Summary and it's intend is not necessary to include the identification of all system OPRs and the description of their impact at the system level or aircraft / engine level (including, any associated operational limitations and procedures). The Certification Memorandum request in this section is therefore not an unnecessary and undesirable contribution of overhead to the project and its documents.

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422	*Avidyne Corporation*	16.9.1	70	As previously stated, we believe that the establishment of limits on the number of OPRs and universal time limits for the correction of OPRs are without foundation in regulations, guidance or DO-178B/ED-12B. These requirements should be removed.	Remove	Suggestion	Objection	Not Accepted	As previously stated, section 16.7 states: "*Although a limited number of type 2 or 3 OPRs should normally not prevent certification, a large number of type 2 or 3 OPRs, or a lack of action plans for the closure of type 2 and 3 OPRs are general indicators of a lack of hardware assurance. The EASA team may reject a request for certification if the number of remaining OPRs is too high, or if there is no evidence of an adequate action plan to close the OPRs*" This statement is not a universal requirement as a precondition on Hardware approval as Open Problems vary depending on the projects and products. On the front page of the Certification Memorandum it is stated: *"EASA Certification Memoranda clarify the Agency's general course of action on specific certification items. They are intended to provide guidance on a particular subject and, as non-binding material, may provide complementary information and guidance for compliance demonstration with current standards. Certification Memoranda are provided for information.*
423	*Avidyne Corporation*	16.9.2	70-71	While the majority of this chapter is directed at the applicant, this section appears to be directed at the certification authority. Its contents are largely inapplicable to applicants except in a very general sense. We would recommend that it be removed, not rewritten.	Remove	Suggestion	Objection	Partially Accepted	Subsections 16.9.1 and 16.9.2 have been updated to avoid any misinterpretation.
424	*Avidyne Corporation*	17	72-75	Section 2.1 of the CM states that "Sections 15 – 18 of this Certification Memorandum correspond to chapters 1 – 4 of FAA Notice 8110.110", implying at least some similarity of content. The same section subsequently states that "Section 17 [of the CM] on Embedded Software Configuration Files differs from chapter 3 of Notice 8110.110, which is entitled Assuring System Databases and Aeronautical Databases." In fact, the difference goes well beyond the title – Section 17 of the CM is completely unrelated to Chapter 3 of the FAA's Notice. We believe that this "false mapping" is illadvised and misleading. Section 17 should, instead, be reserved and the content moved to a new section for which no basis in FAA guidance is claimed. The situation is further confused by the introduction of various references to "databases" within the section, necessitating the awkward disclaimer in Section 17.1 that "Aeronautical Databases are not covered in this Certification Memorandum." It seems likely that this terminology conflict was introduced in an attempt to align the CM with the FAA's order, at least on a superficial level, while the contents are completely unrelated. We would recommend that the use of "database" in Section 17 be eliminated, as it adds nothing but confusion.	Move section and remove "database" references	Suggestion	Objection	Partially Accepted	Comment partially accepted and Section 2.1 is amended: "Aeronautical Databases are not covered in this Certification Memorandum".

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425	*Avidyne Corporation*	19	78-81	The introduction of this material at this time is inappropriate due to the expected release of the DO-178C/ED-12C supplement on object oriented programming. Interim compliance with these requirements will lead to substantial duplication of effort by both applicants and EASA.	Remove all of Section 19	Suggestion	Objection	Not accepted	The presented material in the Certification Memorandum is being applied, in the form of CRI in the EASA certification programs during the last 10 years. Please note that the OOTS aspects were already presented in the Certification Authorities Software Team (CAST) Paper 04 dated on January 2000 and publicly available to the industrial community. EASA understands that significant rework will be necessary in this section once the OOT supplement is available but in the meantime, it is necessary to use the currently applied guidance on this particular topic.
426	*Avidyne Corporation*	19	78-81	One could imagine a minimal description of the applicability of DO-178B/ED-12B to an object oriented development. This section is not it. The numerous prescriptive requirements go well beyond the requirements of DO-178B/ED-12B. The many requirements that are duplicative of basic DO-178B/ED-12B will require a specific response from each applicant even when they're adequately covered in pre-existing compliance documents, adding tremendous unnecessary overhead for both the applicant and EASA.	Remove all of Section 19	Suggestion	Objection	Not accepted	The presented material in the Certification Memorandum is being applied, in the form of CRI in the EASA certification programs during the last 10 years. Please note that the OOT aspects were already presented in the Certification Authorities Software Team (CAST) Paper 04 dated on January 2000 and publicly available to the industrial community. During these years, all the applicants and suppliers have agreed and shown compliance against the presented information.
427	*Avidyne Corporation*	19.2 (a)	78	This section raises concerns unrelated to OOT, observing that modern software development often follows "a new vision of the classical waterfall process." (We would observe that the process models cited in the following text are not really new visions of waterfall, but are alternatives to it.) DO-178B/ED-12B does not require or recommend use of a waterfall process. It requires the applicant to describe the process in the required software plans (especially the PSAC, SWDP and SWVP). Thus, this section is redundant and should be eliminated.	Remove	Suggestion	Objection	Partially Accepted	As identified by the reviewer, EASA concurs that the word "new" could be source of confusion. Word "new" has been replaced by "alternative".
428	*Avidyne Corporation*	19.2 (a)	78	Along with the section itself, Items 1, 2 and 4 are nothing more than restatements of existing DO-178B/ED-12B requirements. Item 3 is a prescriptive approach to DO-178B /ED-12B-compliant documentation in an object oriented environment and, as such, is merely a trivial interpretation of the relationship between OOT design elements and the more abstract design elements described in DO-178B/ED-12B. Item 5 is so vague as to be useless in practice. We recommend that all five Items in Subsection (a) be eliminated.	Remove	Suggestion	Objection	Not accepted	The presented material in the Certification Memorandum is being applied, in the form of CRI in the EASA certification programs during the last 10 years. Please note that the OOT aspects were already presented in the Certification Authorities Software Team (CAST) Paper 04 dated on January 2000 and publicly available to the industrial community. There is a general consensus about the need of this specific material and EASA does not support the rationale presented by the reviewer.

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429	*Avidyne Corporation*	19.2 (b)		Subsection (b) introduces specific traceability requirements to particular features of OO systems. To the extent that these traces are from requirements to elements of the design (other than low level requirements), this represents a major expansion of scope beyond DO-178B/ED-12B, since traceability from requirements to design is not an objective. To the extent that these traces are from requirements to code, they fall under an existing DO-178B/ED-12B objective and need no further elaboration. We are also sceptical of the statement that the use of use cases or other diagrams is "a possible means… but not the only means" of addressing this purported problem. Such suggestions usually become the only de facto acceptable technique, or at least a detailed technique against which all others will be judged for equivalence. Given that the context of this whole discussion is traceability, it falls well outside the scope of DO-178B/ED-12B and cannot be regarded as simple clarification. Items 6, 7 and 8 all fall within this category. Lastly, Item 9 seems wholly unrelated to the section that contains it.	Remove	Suggestion	Objection	Not accepted	The presented material in the Certification Memorandum is being applied, in the form of CRI in the EASA certification programs during the last 10 years. Please note that the OOT aspects were already presented in the Certification Authorities Software Team (CAST) Paper 04 dated on January 2000 and publicly available to the industrial community. There is a general consensus about the need of this specific material and EASA does not support the rationale presented by the reviewer.

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430	*Avidyne Corporation*	19.2 (c)	80	Subsection (c) claims to be about test coverage assessment but draws in many unrelated topics and establishes numerous requirements that go beyond those of DO-178B/ED-12B. The subsection uses "functional coverage" in an unconventional and confusing way. "Functional coverage" is commonly used to mean "coverage of functional requirements", where functional requirements deal with high level descriptions of system and software behaviour. In this subsection "functional coverage" appears to refer to software functions in the architectural sense – i.e., program units that are the subject of calls. As written, the section is, at best, unclear. We believe that the use of the term "functional coverage" is ill advised and should be eliminated. The subsection introduces flow analysis and timing analysis in the context of test coverage assessment. Neither activity falls within this context in DO-178B/ED-12B. The subsection discussed OOT encapsulation and "implementation hiding" and repeats the ridiculous claim that "Programmers that implement a class have no access to the internal data of the class and may exercise unintended functionality if the description of the class is incompletely documented." OO systems are no different from any other system in this regard. If a programmer relies on inadequate documentation, he may make mistakes. If a programmer requires access to lower-level source code to supplement the documentation, he has it. "Implementation hiding" implies only that the software itself is prevented from unauthorized access to lower-level constructions (code and data), not that the programmers can't read the code! The issues identified with respect to this item are routine and have no basis in OO; the paragraph and bullet points should be removed. Items 10-14, too, are completely routine and no different in OO than in any other software environment. To respond to these items as somehow "special" represent unnecessary overhead for the applicant and EASA. They should be removed.	Remove	Suggestion	Objection	Not accepted	The presented material in the Certification Memorandum is being applied, in the form of CRI in the EASA certification programs during the last 10 years. Please note that the OOT aspects were already presented in the Certification Authorities Software Team (CAST) Paper 04 dated on January 2000 and publicly available to the industrial community. There is a general consensus about the need of this specific material and EASA does not support the rationale presented by the reviewer.
431	*Avidyne Corporation*	21	84-87	It is our view that this section describes an EASA preference for the organization of the applicant's life cycle data. While this preference is understandable, the compliance concerns are overstated. Every applicant understands that the organization of the life cycle data does not alter the applicable DO-178B/ED-12B objectives with which he must comply at a particular design assurance level. The content and organization of the life cycle data must support compliance with these objectives. Whether it does so in a manner that EASA sees as particularly efficient is irrelevant. This section should be removed.	Remove	Suggestion	Objection	Not accepted	EASA does not concur with the proposed solution because we consider that some cautions should be taken into account by the applicants in order to ensure the compliance with respect to ED12B / DO178B in case that the HLR and LLR are merged and managed at the same level. As explained in the introduction section, it is necessary to ensure that, despite that they are combined in the same document (organisation of the life cycle data referred by the comment author), specific caution should be taken by the applicant because HLR and LLR have a different purpose that should not be impacted by the fact that they are presented in the same life cycle data.

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432	*Avidyne Corporation*	22	88-92	In the 15 years since the adoption of DO-178B, the FAA's official position on data coupling and control coupling has been "we don't really know what it means; it's up to the applicant to define it and define a treatment in his process." Various possible explanations for its inclusion in DO-178B/ED-12B were offered, including that the data and control coupling coverage objective was the result of a single applicant's desire to retain management approval for a practice they already conducted. We are sceptical that the collective memory of members of a sub-group of the original DO-178B/ED-12B Special Committee is reliable, especially as regards consensus interpretations of this particular pair of objectives as balloted by the full Committee. We believe that an applicant must be allowed to trust the actual text of DO-178B/ED-12B in determining its minimum compliance requirements. The simple fact is that DO-178B/ED-12B mentions data coupling and control coupling in only three contexts. One is in the definitions at the end. One is the context of these specific structural coverage objectives. The third is in the context of partitioning. There are numerous references to data flow and control flow in other contexts, but only those three to data coupling and control coupling. We believe that the difference in terminology is no accident – that DO-178B/ED-12B regards data coupling and control coupling as different from data flow and control flow. Based on these factors, we believe that minimum compliance with the objectives of DO-178B/ED- 12B requires only that the applicant (1) establish an acceptable definition of data coupling and control coupling in his plans, (2) state the methods by which the coverage objectives will be met, consistent with these definitions, and (3) compile accomplishment data to show that the methods have been employed in the project It is critical to note that there is no independent DO-178B/ED-12B objective for any analysis or documentation of data coupling or control coupling relationships. Any such requirement only exists in support of the two structural coverage objectives. Neither is there any DO-178B/ED-12B requirement for consideration of data coupling or control coupling as part of the design activity. All of these may be desirable, but none of them are DO-178B/ED-12B compliance requirements – and cannot be made so by any CM purporting merely to interpret DO-178B/ED-12B.	Remove	Suggestion	Objection	Partially accepted	Your comment is acknowledged but the suggested resolution to remove the section is not accepted. Nevertheless EASA accepts to remove the section 22.2.2 which does not bring additional guidelines however it is essential to keep the guidelines introduced in this section 22, in particular in sub-section 22.4.

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433	*Avidyne Corporation*	23	96-108	It appears that this section has been derived in whole or in part from draft DO-178C/ED-12C content under development by RTCA SC-205/EUROCAE WG-71. We believe that issuance of such a preliminary version of an emerging consensus-based standard prior to its adoption by the Special Committee acting in Plenary is inappropriate. For an applicant, having to invest time and effort showing compliance with guidance that is certain to change soon represents an exposure to costly duplication of effort. The same applies to EASA – the development and issuance of guidance at this time seems likely to lead to confusion and duplication of effort. e recommend that this section be removed in its totality.	Remove	Suggestion	Objection	Not accepted	See answer to comment 21.

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434	*Avidyne Corporation*	24	109-113	One of the greatest failings of DO-178B/ED-12B is its lack of precision in the definition of high- and low-level requirements. It defines low-level requirements only as "Software requirements derived from high-level requirements, derived requirements, and design constraints from which source code can be directly implemented without further information." It offers no examples or criteria for judging the adequacy or organization of low-level requirements. This leaves it to the applicant to determine for himself what form and format to use. EASA concedes that code can be readily developed from pseudo-code. Therefore, pseudo-code meets the DO-178B/ED-12B definition of low-level requirements. We share EASA's concern over the possibility that an applicant using pseudo-code as low-level requirements may develop "bad" low-level requirements that contribute little to the robust verification of the software. We believe it equally possible, though, that an applicant could do the same using text-form low-level requirements. The key question is not whether the low-level requirements are written in one form or another, but whether they are good or bad low-level requirements. And, even more importantly, the only compliance question is whether the low-level requirements are so bad as to be non-compliant with DO-178B/ED-12B. The problem with this section of the CM is that it presents a concern without clearly articulating a compliance issue or specifying criteria. It is likely to have the effect of prohibiting outright the use of pseudo-code as low-level requirements rather than presenting guidelines whereby that practice, as used by a particular applicant, can be judged as "good" or "bad", as compliant or non-compliant with DO-178B/ED-12B. We have no quarrel with EASA's desire to publicize this concern and seek well-considered means by which it can be properly addressed by the certification community, but this CM is not the place or way to do it. We recommend that this section be removed.	Remove	Suggestion	Objection	Noted	We have rewritten this section.

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435	*AIRBUS*	General		Within software certification area, DO-178B/ED-12B is a guidance material while DO248A/ED94-A contains "no new or additional guidance material" compared to DO-178B/ED-12B (refer to DO248 section 1.1 Purpose). According to the first page this CM is said at the same time to be "intended to provide guidance" and "not intended to introduce new certification requirements or to modify existing certification requirements"; in consequence the intent of this CM is not clear: is it at the same level as DO178 or at the same level as DO248? At several places, this doc clearly introduces new requirements - cf comments towards paras 15, 17, 18, 19, 21, 23, 24; in particular paras 17,19 and 23 involve new requirements which are discussed within on-going DO178 revision process	area of concern/should require further discussion			Not accepted	This Certification Memorandum does introduce new requirements (see section 1) and the way of working is still the same. The Certification Memorandum will be attached to CRI and will be discussed with the applicant taking into account the specificity of the project.
436	*AIRBUS*	General		At several places, the content of this doc doesn't fit with the declared intent which is "CM are not intended to modify existing certification requirements" - cf comments towards paras 9.5, 9.6				Not accepted	Section 9.5 and section 9.6 have been introduced to ease concurrent Certification / Validation of program. It was a request for the Industry. Like on past project, the applicant may answer that this question is answered by any other specialist, it is written and the FAA SW expert who handles this question, can see the answer.
437	*AIRBUS*	General		The text several times refers to system level requirements, documents and processes - cf comments to paras 9.5, 9.6, 15, 16				noted	
438	*AIRBUS*	General		According to the CM preamble, the CM, which is identified as "guidance", has to be considered like the DO248 (information data). Nevertheless, in D0248, DP and FAQ are not guidance.				Noted	The Certification Memorandum content is defined in section 1.
439	*AIRBUS*	3.2		As this cert memo is provided for information only it should not be required to make reference to it.				Noted	
440	*AIRBUS*	4.5 a. & 4.5.5	16 & 22	From A350 experience the completion level of 75% required for SOI2 & SOI3 is too high. The objective for both the applicant and EASA should be to gain agreement earlier.	"75%" should be deleted because the qualitative objective is adequately expressed in paragraph b ("data should be sufficiently mature…").			Not accepted	A review is efficient only if the application of the planned process is mature enough. To this purpose, EASA experience shows that below 75% of readiness of the artefacts, the level of maturity is often not sufficient to perform a representative sampling. This is the reason why EASA does not consider necessary to perform a change to this value. Note: having said that, nothing prevents an applicant to perform additional reviews earlier in the process (e.g. through the software quality assurance activity).
441	*AIRBUS*	4.5.1 c.	18	Safety assessment, failure conditions and software level are part of Systems panels meeting and not treated in software Plans review	The paragraph should be modified and the reference to Safety assessment, failure conditions and software level in software Plans review should be deleted.			Accepted	This sentence has been replaced by "Additionally, the proposed software level(s) and the justification provided by the system safety assessment process, including potential software contributions to failure conditions should be assessed."
442	*AIRBUS*	4.7 g.	25	CRI preparation follows a specific process independent from the software reviews process and not software specific	The paragraph g should be deleted and the CM should refer to general procedures for CRI			Not accepted	This section 4.7 item g of the Certification Memorandum is identical to the FAA order 8110.49 section 2-9 item g. Also, this wording is already included in CRIs on projects going-on for years now. Therefore no change is considered necessary.

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443	*AIRBUS*	5.3.3 c. Table	30	The title of the table is not appropriate: only PSAC, SAS and CID are certification documents	The word "certification" should be deleted in the title of the table.			Accepted	The word "certification" has been removed accordingly.
444	*AIRBUS*	5.3.3 c. Table	30	"Other soft plans" and "software review reports" should not be sent according to last certification programmes PID.	The status of these documents should be changed to "not sent". EASA should have to change explicitly the LOI to get these documents.			Accepted	EASA understands that you comment is oriented towards a "NONE" LOI. For NONE involvement, "on request" has been changed to "not sent".
445	*AIRBUS*	5.3.3 c. Table	30	The text for LOI LOW :"(in case of no EASA involvement)" is misleading.	The text between brackets should be deleted.			Accepted	The mention (in cases of no EASA involvement)" has been removed.
446	*AIRBUS*	9.5 & 9.6	38	The requirements expressed in these paragraphs, copied from FAA orders, have already been discussed with AIRBUS twice: as part of A380 and then as part of A350 CRIs discussions; it was agreed between AIRBUS and EASA to suppress them. The Certification memo does not sufficiently give consideration to past or current certification exercises and introduces some reversions compared to what has already been mutually agreed.	The two paragraphs should be deleted.			Not accepted	EASA wishes to maintain traceability with the FAA Order and has to deal with other manufacturers than just Airbus.
447	*AIRBUS*	12.3 f.(5)	56	Compared to FAA order and to A350 CRIF9, the text has been changed and is now more restrictive: the previous text allowed considering the entire software as DO178B compliant as soon as the change (done in compliance with DO178B while the rest of the software could be DO178A compliant) had been approved.	The CM should revert to previous text which allows a straightforward process for legacy software.			Partially accepted	New text for this sub-section has been added which is closer to the text of the FAA Order and which allows the software to be considered ED-12B / DO-178B compliant. The text that was in 12.3 f 5 is now in 12.3 f 6, which is where it should be.
448	*AIRBUS*	12.1	57	Different wordings are used for the same purpose.	The wording "NO/analyse" should be changed to "Possibly YES after analysis".			Not accepted	These two are not the same. As it says on the previous page 'For example, if the legacy system's software is RTCA / DO-178A Level 2 software, it can be considered "equivalent to" Levels C, D, or E for an installation requiring RTCA / DO-178B '. However, Level 2 software cannot be considered equivalent to DAL B. This is why the table shows 'No / Analyze' for this case.
449	*AIRBUS*	15.2	63	This paragraph needs clarifications: it requires additional documents compared to DO178B. It should be clarified that "Processes" can substitute to "Plans".				Not accepted	Comment is not well understood by EASA and no suggestion is proposed by the reviewer. From EASA viewpoint, "Processes" should be documented in the "Plans" (or any other document like procedures or manuals, to be referred in the plan) and, hence, it is not possible to compensate plans with processes. No modification is implemented in the document.
450	*AIRBUS*	15.2.2	64	The CM introduces a new requirement for a "supplier management plan".	The text should not require additional documents compared to ARP4754. The CM should refer to ARP documents.			Not accepted	EASA view is that the intent of the text in the Cert Memorandum is not covered by ARP4754. Our understanding that the presented text is intended to address the risk in the assurance coming from the industrial organisation. This aspect is not specifically addressed by the ARP. This is the reason that some additional material is necessary. Nevertheless, as suggested in the text, the information can be included in one of the existing planning documents.

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451	*AIRBUS*	15.2.2	64	The integration of system components is outside the sofware certification scope.	The text should not require additional documents compared to ARP4754. The CM should refer to ARP documents.			Not accepted	EASA view is that the intent of the text in the Cert Memorandum is not covered by the ARP4754. Our understanding that the presented text is intended to address the risk in the assurance coming from the industrial organisation. This aspect is not specifically addressed by the ARP. This is the reason that some additional material is necessary. Nevertheless, as suggested in the text, the information can be included in one of the existing planning documents. Please also note that the purpose is not to define the integration activities but to clearly identify the responsibilities of the different integration levels among all the different suppliers. This may change depending on industrial organisation.
452	*AIRBUS*	15.2.1	63	"The applicable publications include … Certification Memoranda": "Certification Memoranda" should be referred as "reference docs" and not "applicable docs" according EASA declaration that they "do not constitute any legal obligation".	The reference to Certification Memoranda should be deleted from the list of applicable publications.			Agreed	Certification Memoranda is removed.
453	*AIRBUS*	15.2	63	The list of documents doesn't provide a clear view on the content	A summary of the documents should be provided.			Noted	Text has been significantly reworded as result of other comments.
454	*AIRBUS*	16.8 & 16.9	69	The text refers to system level documents and processes.	The text should not require additional documents compared to ARP4754. The CM should refer to ARP documents.			Not Accepted	EASA is requesting for the OPR section 16.9 of this Certification Memo: *"The System Certification Summary or an equivalent certification document should describe:"* As an EASA "System Aspects linked to Software and Airborne Electronic Hardware" Certification Memorandum does not exist at the moment, EASA considers that this aspect should be addressed in this Certification Memo. Section 16.9 might then be amended if a Certification Memorandum "System Aspects linked to Software and Airborne Electronic Hardware" is released.
455	*AIRBUS*	17	72	The text involves requirements currently discussed in the context of DO178C definition.	Each time this is relevant, the text of the CM should be replaced by the related text of DO178C which will provide a text accepted by the whole expert's community.			Not Accepted	Once ED-12C / DO-178C has been published and recognized as guidance, EASA intends to also publish a separate ED-12C / DO-178C version of the Software Certification Memorandum that will take into account the differences between ED-12B / DO-178B and ED-12C / DO-178C along with its supplements. It is anticipated that some sections or sub-sections of this ED-12B / DO-178B Software Certification Memorandum will no longer be needed in the ED-12C / DO-178C Software Certification Memorandum because they will be superseded by ED-12C / DO-178C and its supplements.
456	*AIRBUS*	18.2	76	The list identifies valuable questions that the software developer should ask to himself but the text requires additional explanations and justifications compared to DO178B to be detailed in the SVP. This result in additional requirements compared to current standards.	Even if the paragraph lists all the questions that the applicant has normally to answer, the requirements should not lead to the mandatory writing of additional justifications compared to those requested by the DO178.			Not accepted	Section 18.2 lists specific items which should be documented in the SVP as they are part of verification activities and procedures requested by ED12B / DO178B section 11.3. In other words, it is a clarification of detailed items already requested in a general way.

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457	*AIRBUS*	19	78	The text involves requirements currently discussed in the context of DO178C definition.	Each time this is relevant, the text of the CM should be replaced by the related text of DO178C which will provide a text accepted by the whole experts' community.			Noted	The presented material in the Certification Memorandum is being applied, in the form of CRI in the EASA certification programs during the last 10 years. Please note that the OOTS aspects were already presented in the Certification Authorities Software Team (CAST) Paper 04 dated on January 2000 and publicly available to the industrial community. EASA understands that significant rework will be necessary in this section once the OOT supplement is available but in the meantime, it is necessary to use the currently applied guidance on this particular topic.
458	*AIRBUS*	21	84	The text involves requirements currently discussed in the context of DO248C definition.	Each time this is relevant, the text of the CM should be replaced by the related text of DO248C which will provide a text accepted by the whole experts' community.			Noted	The presented material in the Certification Memorandum is being applied, in the form of CRI in the EASA certification programs during the last 10 years. Please note that the OOTS aspects were already presented in the Certification Authorities Software Team (CAST) Paper 04 dated on January 2000 and publicly available to the industrial community. EASA understands that significant rework will be necessary in this section once the OOT supplement is available but in the meantime, it is necessary to use the currently applied guidance on this particular topic.
459	*AIRBUS*	23	93	The text involves requirements currently discussed in the context of DO178C definition.	Each time this is relevant, the text of the CM should be replaced by the related text of DO178C which will provide a text accepted by the whole experts' community.			Not accepted	See answer to comment 21.
460	*AIRBUS*	24	109	The text involves requirements currently discussed in the context of DO248C definition.	Each time this is relevant, the text of the CM should be replaced by the related text of DO248C which will provide a text accepted by the whole experts' community.			Accepted	We have rewritten this section to be compatible with a text proposal for FAQ #82.
461	*Rockwell Collins France*	3.2	13	In the context of reused ETSO, is compliance demonstration to this CM required?	Specify clearly that this CM will not apply in the context of reused ETSO or modified ETSO when the aircraft certification basis remain unchanged		substantive	Partially accepted	For reused ETSO, Certification Memoranda are not necessarily applicable and it depends whether the ETSO is reused in the same context or not; it is a case-by-case basis.
462	*Rockwell Collins France*	4.2	14	"Actions should be completed and closed before approval": If the auditor is the only person who can close an action, a rule should be proposed to provide the applicant with the action status after a reasonable delay following his answer.	Add following recommendation: "It is recommended to process the actions by the applicant and the auditor in appropriate delays."	observation		Partially accepted	The definition of "action" has been updated to mention "Actions should be closed before a mutually agreed closure date."
463	*Rockwell Collins France*	4.5.3	20	Tool qualification data available for SOI#3: TAS should be submitted to SOI#4 rather than to SOI#3.	Table 4-3: Add "except TAS for development tool" close to "Software Tool Qualification Data" Table 4-4: add TAS for development tool	observation		Not accepted	There is no point in delaying the production of a TAS to the SOI#4 where the tool is used to reduce, eliminate or automate some portions of the development or verification activities. Therefore, the "Tool Qualification Data" have been kept in the tables 4-2 and 4-3.
464	*Rockwell Collins France*	4.5.5	22	3: Add Software Tool Qualification data 4: Add Software Life Cycle Environment Configuration Index	see comment	suggestion		Accepted	Both life cycle data have been added as suggested.
465	*Rockwell Collins France*	4.7	23	"15 working days": it is 10 working days in §4.5.5 (note *)	Make delays consistent between sections 4.7 and 4.5.5	suggestion		Accepted	The text has been consistently changed to "15 working days".

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466	*Rockwell Collins France*	4.7	23	Following roles are introduced in section 4.7: a: responsible certification engineer b: responsible certification authority representative g: PCM Explain these roles? Do they belong to the applicant, supplier, and authority? Ensure consistency with section 5.	Harmonise the terminologies used for the certification roles between sections 4 and 5.	observation		Accepted	This section 4.7 has been reworked extensively in the updated Certification Memorandum in order to harmonize the terminologies used for the certification roles.
467	*Rockwell Collins France*	7.4 g.	34	Does "proper loading" mean "software approved" and "software not corrupted" as addressed in 7.4f?	Clarify the objectives beside the words "proper loading"	suggestion		Accepted	The subsection has been updated to reflect the FAA order 8110.49.
468	*Rockwell Collins France*	7.4 g.(1)	34	The wording could lead to misinterpretation: is paragraph 7.4 an alternate means of compliance?	Use the wording from the FAA Notice 8110.49 section 5.2.g.(1)	suggestion		Accepted	The subsection has been updated to reflect the FAA order 8110.49.
469	*Rockwell Collins France*	7.4 i.	34	Is Software change impact analysis required for user modifiable software?	if no, add a note as in FAA Notice 8110.49 s	suggestion		Accepted	Text modified as suggested.
470	*Rockwell Collins France*	7.4	34	No consideration on "Inadvertent enabling of the field loading function"? It is addressed in DO-178B and FAA Notice 8110.49 section 5.2.j	Complete this section accprding to FAA Notice 8110.49 section 5.2.j.	observation		Accepted	Text added for this aspect as per FAA Order.
471	*Rockwell Collins France*	10	41	Alternative means that can be used for Level D PDS are not described in this section.	Complete this section with a description of the alternative means that can be used in the context of Level D PDS.	suggestion		Not Accepted	The purpose of this section is not to suggest alternative means of compliance for level D PDS but to clarify the application of the DO-178B objectives in this case. If an applicant wishes to suggest an alternative means of compliance, they should demonstrate to EASA how that MOC complies with the objectives of ED-12B / DO-178B. This section is common with the corresponding section of FAA Order 8110.49 and EASA would prefer only to change the text of this section if any aspects are found that are actually incorrect. This comment does not point out any such aspects.
472	*Rockwell Collins France*	13.2	59	GM 21A.91 is not dedicated to software change classification. In general, this section 13 does not describe the software change impact analysis process as indicated in section 13 title "oversight of software change impact analysis...'. FAA Notice 8110.49 section 11 content is more relevant.	Report the FAA Notice 8110.49 section 11 content or modify title section 13.	suggestion		Not Accepted	This comment is similar to comment 152 from the FAA, to which we have provided the following answer - EASA appreciates that the material in chapter 11 of FAA Order 8110.49 is helpful to companies performing change impact analyses and that many companies follow the FAA text in this respect. However, it is not currently EASA policy to add material to the requirements of Part 21 in respect of major / minor change determination so EASA does not wish to alter the text of section 13 of this Certification Memorandum at this time.
473	*Rockwell Collins France*	14.3	62	Typo: Include the last sentence in a bullet b.		suggestion		Accepted	Text altered as suggested.
474	*Rockwell Collins France*	16.6	68	Second paragraph: this "CRI"	Replace "CRI" by "this section" as per SW-CEH-01	suggestion		Accepted	Comment accepted and section amended.
475	*Rockwell Collins France*	17.5	74	Description There are 2 levels of description for CF: the CF structure and the final content: data values. This implies 2 levels of validation. Usually, these 2 levels are not managed by the same processes/teams.	Add considerations on CF final content description and validation	suggestion		Partially Accepted	EASA agrees that there are 2 levels of description and verification. However, EASA should not precise company organisations as there are lot of variations.

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476	*Rockwell Collins France*	21.1.1	85	Compliance with A-4 ... objectives weakened: Not really because, as said in DO178B section 5, HLR are considered as LLR so these objectives are applicable. When HLR and LLR are merged, justification should be provided. Nevertheless, there is no reason to propose "alternate means of compliance" as all DO178B objectives should be satisfied. What is beside the term "alternate means"?	Remove reference to A-4.	suggestion		Accepted	It is understood that there is a potential misunderstanding with the fact that ED12B is already a means of compliance against CS requirements. It is changes "alternate means of compliance" by "specific verification activities".
477	*Rockwell Collins France*	21.2	85	"There are different verification approaches and objectives for HLRs and LLRs. For example, many of the HLRs should be verified by the system level and hardware-software integration verification; whereas LLRs typically cannot be verified at that level." Do not agree: the most adapted verification means is defined for each requirement whatever level it is (HLR or LLR). There is no link with the merge or not of HLR and LLR.	Remove the sentence.		substantive	Partially Accepted	It is understood that this is the typical case. Typically, HLR are verified at a different level than the LLR because of the different requirements nature. We agree that this is not an exclusive situation but only typical. In order to emphasize that , EASA proposes to add "Typically" at the beginning of the sentence.
478	*Rockwell Collins France*	21.2	86	- in §2 (Note), the practice could be justified when "system-level requirements are directly highly refined", but there may be other cases where the merge is justified, e.g. not complex software - In last sentence, explain what is the link foreseen with FAQ#71.		suggestion		Partially Accepted	The case presented by the reviewer as "non-complex software" corresponds to the case in which there's a single layer of requirements and, in this case, they should be considered as HLR and treated as such. This situation is out of the scope of this chapter. No change. Second part is agreed. It is agreed to remove the reference.
479	*Rockwell Collins France*	23.2.4.4 & 23.2.5.3 & 23.2.6.5	98 100 102	"Compliance with low-level requirements within the formalized design". This means that design test cases could be completely elaborated based on formalized design? Such sentence is inconsistent with section 23.2.9 content: "It should be demonstrated that full coverage of the functions of each Formalized Design is obtained by executing test cases and procedures that are based on the higher-level requirements. Coverage of derived low-level requirements in a Formalized Design may be obtained by the use of test cases based on the Formalized Design itself if full coverage of those aspects cannot be obtained by use of test cases based on the higher-level requirements."	Clarify	observation		Not accepted	The text does not say that test cases can be based solely on the low-level requirements. It says that compliance has to be shown with the high-level requirements and the low-level requirements.

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480	*Rockwell Collins France*	23.2.5	99	These types of formalized design replacing high-level requirements and software design should be discouraged; it raises the same issues addressed in sections 24 and 21: merging 2 separate activities. We can read some inconsistencies with this approach (refer to remarks below)			objection	Not accepted	This situation in which we have proper validated higher-level requirements for Design Models is a significant improvement on the way that some systems were produced when model-based approaches were first used. At first, some suppliers produced only a Design Model with no requirements at all for that model and stated that the model was the set of system and software requirements. These systems suffered from many problems, many of which were due to the fact that there were no requirements against which to review or test the model. EASA and the FAA had to state that requirements were needed for models and that those requirements had to be validated. We have also introduced a note in this section to explain that there may be more than one level of system requirements in order to elaborate them to the level of detail from which a Design Model can be produced. This is what many suppliers do. This situation where we have at least one detailed level of validated requirements for a Design Model and the model can be reviewed and tested against those requirements is not, therefore, a merging of requirement levels, it is an expansion of them to the minimum necessary set of requirements for models.
481	*Rockwell Collins France*	23.2.5.1	99	What about the DO-178B table A-3 objectives? They should be covered by formalized design if "conventional software high-level requirements and a conventional software design are both replaced by a Formalized Design" or they should be covered by System higher-level requirements if they take the place of the software high-level requirements	Add considerations regarding Table A-3 objectives.		substantive	Not accepted	In these life-cycles, activities are conducted to validate the system requirements instead of reviewing (as part of verification) the software high-level requirements, as there are no software high-level requirements in this case.
482	*Rockwell Collins France*	23.2.5.3	100	System higher-level requirements take the place of the software high-level requirements, so it is not in line with 23.2.5 third paragraph: "conventional software high-level requirements and a conventional software design are both replaced by a Formalized Design"	In 23.2.5 replace the sentence: "conventional software high-level requirements and a conventional software design are both replaced by a Formalized Design" by "conventional software high-level requirements are replaced by system level requirements and conventional software design is replaced by Formalized Design".		substantive	Partially accepted	The text has been altered so as to clarify the wording.
483	*Rockwell Collins France*	23.2.5.3	100	Does it mean that in case system tests developed to cover higher-level requirements can be shown to comply with table A-6 objectives, the software tests are not required?	Clarify	observation		Not accepted	No, that is not what the text states. It says that the EOC has to be shown to comply with both the higher level requirements and the requirements in the Design Model. It also says that the HSI testing has to be conducted on the target processor.
484	*Rockwell Collins France*	23.2.8.1 b. & 23.2.8.2 f. & 23.2.8.3	104	Simulation Cases and Procedures should be reviewed: it depends on the level of the SW (DO178B Table A7-1 objective is required for Level A,B,C and with independence only for Level A)			objection	Accepted	The mention "For software level A, B and C" has been added at the beginning of section 23.2.8.3.
485	*Rockwell Collins France*	23.2.8.2 Note	104	Why no credit could be possible from simulation for verification of EOC / LLR (obj 3, 4 table A-6)? It seems not consistent with the Note in §23.2.10.4 where Testing at Formalized Design level is possible.	Remove "partly" in the sentence.		substantive	Partially accepted	EASA agrees that this sentence may lead to confusion. In order to clarify the intent, the sentence has been reworded in the updated Certification Memorandum: "Since simulation cases should be based on the Higher-level Requirements, compliance with objectives 3 and 4 of Table A-6 cannot be wholly or partly claimed based on the use of simulation of the Design Model." In addition, in order to clarify the consistency with section 23.2.10.4,it is important to recall that objective A-7.4 can typically be achieved by means of Design Model Coverage activities (refer to section 23.2.9).

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486	*Rockwell Collins France*	23.2.8.2 a.	104	Use the wording "representative" instead of "identical".	Refer to comment		substantive	Not accepted	EASA sees no justification for having a different model to execute simulation and to produce the code. Therefore the proposed solution is not accepted.
487	*Rockwell Collins France*	23.2.8.2 d.	104	Simulated source code may be different from the source code producing the embedded EOC. But the differences may be analysed as having no impact regarding the objective of test.	Allow source code differences when differences can be justified		substantive	Partially accepted	The wording "If there are any differences, they must be minor and should be justified and a rationale provided for why they are acceptable." has been added to the item d of section 23.2.8.2.
488	*Rockwell Collins France*	23.2.8.2 e.	104	What is the need of such an analysis if - the representativeness of the simulated environment is established - simulation tests are chosen according to the defined perimeter of use of the simulation - formalized design under test is identical to the one used to produce EOC? The obtention of same tests results with the EOC used for simulation and the final EOC should be sufficient.	Remove or modify bullet e.		substantive	Noted	Obtaining the same tests results with the EOC used for simulation and the final EOC may indeed be an acceptable way of showing that there are no differences between the executable object codes. Nevertheless, as it is not a pre-requisite in this Certification Memorandum, the bullet e is necessary and should not be removed.
489	*Rockwell Collins France*	23.2.9	105	It should be substantiated that the coverage of formalized design could also be demonstrated through the structural coverage analysis performed on the source code. As a consequence, the formalized design coverage should not be required for Type#1 systems. Furthermore, according to the 1st sentence, the objective of this coverage is to ensure the absence of unintended function in formalized design. This is also an objective of the design review (ref §23.2.7). So this objective is not only reached with tests as requested in the 2nd sentence.	Add the following: An alternative to performing coverage analysis directly on the formalized design model is to perform structural coverage analysis.		substantive	Accepted	Text has been added to allow this.
490	*Rockwell Collins France*	23.2.10.3	106	What are "non-functional requirements"?	Better describe what are "non-functional requirements"		substantive	Accepted	Text has been added in 23.2.10.3 to explain this term.
491	*Rockwell Collins France*	23.2.10.6	106	Structural coverage in any case: except if the tool generating code is qualified as described in the next §.	Exception to be added	suggestion		Partially accepted	We understand the point raised here. However, the objectives for structural coverage still have to be met, it is just that this may be done by the use of a qualified tool, so the following text has been added – This may be accomplished with the use of an auto-coding tool, provided that the tool has been qualified to the extent that the structural coverage objectives of ED-12B / DO-178B are met by the qualification of the tool (see the next sub-section).
492	*Rockwell Collins France*	23.2.10.7	107	What does mean "the verification of compliance of EOC with respect to the representative input files"? What is the meaning of the 4 bullets? Are these new activities required in any cases when a qualified tool is used to generate the code?				Partially accepted	This text is related to the previous paragraph, as it deals with activities that may be needed when credit is sought against structural coverage objectives of ED-12B / DO-178B. In such a case, the qualification needs to include the operational context of the tool, down to the level of the Executable Object Code. The representative input files are used so that the resulting EOC can be checked for correctness against the inputs. The bullets in this section describe 'aspects to consider' in such a case. Wording has been added to explain that this text applies when credit is sought against structural coverage objectives.

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493	*Rockwell Collins France*	23.2.8.3	104	Same DO-178B objectives are here defined for "simulations cases" which purpose is to test the embedded code (Table A-6 objectives, refer to section 23.2.8.2) and for "simulation cases" which purpose is to verify "the Formalized Design complies with the higher-level requirements" (Table A-4 objectives, refer to section 23.2.8.1). This sentence requires achieving the robustness objectives at formalized design model level in addition to what is already required at the code level. Purpose of DO-178B section 6.4.2 is to apply only to software testing and not to verification/validation of a design. This is additional objective compare to DO-178B objectives.	Remove the reference to section 23.2.8.1 for the second bullet.		objection	Not accepted	EASA considers that robustness in the verification must be achieved at any level where verification is performed. Alleviating this requirement would only diminish the capacity of detecting errors at model level. Therefore EASA does not agree to remove this aspect. Note: For example if a set of tests are written based on a set of textual HLRs, in order to verify the EOC compliance to these HLRs, robustness cases will be taken into account in order to fulfil ED-12B / DO-178B objective A6-2. Now to verify the Design Model from which this same code is produced, it is obvious that the same set of tests (including robustness aspects) will be considered. Therefore the job is not performed twice but typically once for both activities.
494	*Rockwell Collins France*	23.2.10.4 Note	106	"The use of test at the Formalized Design level instead of tests based on higher-level requirements may be less effective because less of the overall functionality in context will be tested". Such sentence is inconsistent with section 23.2.9 content.	Remove this sentence.	suggestion		Not accepted	We disagree that this text is inconsistent with the earlier section that you mention, as that section requests tests based on the higher-level requirements. It says - It should be demonstrated that full coverage of the functions of each Design Model is obtained by executing test cases and procedures that are based on the higher-level requirements.
495	*THALES Avionics SA*	General	None	Thales Avionics appreciate the EASA initiative to create such material on generic issues and to give industry the opportunity to comment prior to any potential deployment for a new certification project. Thales Avionics concur with EASA that these Certification Memoranda are not intended to introduce new certification requirements or to modify existing certification requirements, and do not constitute any legal obligation or be a vehicle to promote evolution of regulations or Interpretative Material (IM) in anticipation of the official rulemaking process. However, experience has shown that, as soon as such material is available, EASA certification teams and technical experts had tendency to rely exclusively on it and in fine may request formal industry compliance with those policies.				Noted	
496	*THALES Avionics SA*	General	None	As a general comment, Thales Avionics refute the terms of "Guidance" used in these documents and consider they propose acceptable practices, which are subject to adaptation, evolution or alternatives on future projects.				Noted	The Certification Memorandum content is defined in section 1.

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497	*THALES Avionics SA*	General	None	Regarding the content of the CM, the different subjects addressed fall in several categories that should be split in dedicated CM or documents, presuming that the detailed comments provided by Thales Avionics in the review sheets are incorporated: - Chapters mainly related with part 21 regulation and addressing Certification Team organisation and processes, for Software or Hardware items, supplier oversight considerations and minor/major changes classification considerations. These topics should be incorporated in a wider process & documentation document, not limited to hardware and software domains, but including also, the EASA organisation and involvement for systems, safety, ... [SWCEH 001 chapters 4, 5, 11 and SWCEH 002 chapters 4, 5, 15 would fall in this category]				Partially accepted	SW and HW Certification Memoranda have been created to answer to the Industry and EASA PCMs who wanted a stand alone document for SW and HW. Part 21 does detail the SW and HW LoI and should not.
498	*THALES Avionics SA*	General	None	- Chapters mature enough to be shared with other Authorities like FAA as agreed practices. They contain data largely unchanged since many certification projects and sometimes shared with FAA or issued from FAA orders or CAST Papers. We suggest that a common text accepted by major certification bodies, be issued in order to reduce the effort of discussion or demonstration for European manufacturers and suppliers and to maintain a fair level of competition when addressing foreign countries authorities [SWCEH 001 chapter 6 and SWCEH 002 chapters 7, 9, 10, 11, 12, 16, 17 would fall in this category]				Partially accepted	SW and HW Certification Memoranda contain material which has been harmonised with other Certification Authorities and they have been created to answer to the Industry and EASA PCMs who wanted a stand alone document for SW and HW.
499	*THALES Avionics SA*	General	None	- Some chapters, could be subjected to FAQ papers when related to acceptable practices, or when too close to specific industrial practices [SWCEH 001 chapter 10 and SWCEH 002 chapters 14, 18, 19, 20, 21, 22, 25 would fall in this category]				Partially accepted	Some sections have been written to deal with specific concerns linked to specific methods or technologies and they are sometimes written as FAQ papers (question then answer then for example analysis to perform or method to define, etc.).
500	*THALES Avionics SA*	General	None	- Some chapters are not mature and require further discussions [SWCEH 001 chapters 7, 8, 9, 12, 13 and SWCEH 002 chapters 23, 24 would fall in this category]				Not accepted	EASA considers those areas mature enough to be introduced in Certification Memoranda in order to be raised by CRIs and finally to be discussed with the applicants.
501	*THALES Avionics SA*	General	All	We also fully concur with EASA that these Certification Memoranda are not intended to introduce new certification requirements or to modify existing certification requirements, and do not constitute any legal obligation or be a vehicle to promote evolution of regulations or Interpretative Material (IM) in anticipation of the official rulemaking process.	THALES Avionics considers that these kind of Certification Memo, even if useful to alleviate discussions on a certification project CRI shall not be applied upfront on the certification basis without possibility for the applicant to propose alternatives via open dialogue with Authority.		Objection	Noted	

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502	*THALES Avionics SA*	General	All	Regarding the content of the CM, we identify several categories of information that could be usefully split in dedicated CM or documents: - Chapters 4, 5, 15 mainly related with part 21 regulation and addressing Certification Team organisation and processes, for Software or Hardware items, supplier oversight considerations and minor/major changes classification considerations. These topics could be incorporated in a wider process & documentation document, not limited to hardware and software domains, but including also, the EASA organisation and involvement for systems, safety, …	EASA to elaborate in a wider process & documentation document, not limited to hardware and software domains, but including also, the EASA organisation and involvement for systems, safety, …	Suggestion	Substantive	Partially accepted	SW and HW Certification Memoranda have been created to answer to the Industry and EASA PCMs who wanted a stand alone document for SW and HW. Part 21 does detail the SW and HW LoI and should not.
503	*THALES Avionics SA*	General	All	Regarding the content of the CM, we identify several categories of information that could be usefully split in dedicated CM or documents: - Chapters 7, 9, 10, 11, 12, 16, 17 seem mature enough to be shared with other Authorities like FAA as common policy. They contain data largely unchanged since many certification projects and sometimes shared with FAA or issued from FAA orders or CAST Papers. We suggest that a common text accepted by major certification bodies be issued in order to reduce the effort of demonstration for European manufacturer and suppliers and maintain a fair level of competition when addressing foreign countries authorities	EASA to provide advisory documentation, jointly validated and referenced EASA & FAA. Such paper could be more easely eligible for EASA CRIs & FAA IPs	Suggestion	Substantive	Partially accepted	SW and HW Certification Memoranda contain material which has been harmonised with other Certification Authorities and they have been created to answer to the Industry and EASA PCMs who wanted a stand alone document for SW and HW.
504	*THALES Avionics SA*	General	All	Regarding the content of the CM, we identify several categories of information that could be usefully split in dedicated CM or documents: - Some chapters, 14, 18, 19, 20, 21, 22, 25, could be subjected to FAQ papers when related to best practices, or when too close to industrial practices	To amend DO248 B with chapters when relevant of best practices, or when too close to industrial practices	Suggestion	Substantive	Partially accepted	Some sections have been written to deal with specific concerns linked to specific methods or technologies and they are sometimes written as FAQ papers (question then answer then for example analysis to perform or method to define, etc.).
505	*THALES Avionics SA*	General	All	Regarding the content of the CM, we identify several categories of information that could be usefully split in dedicated CM or documents: - Some chapters 23, 24 require further discussions		Suggestion	Objection	Not accepted	SW and HW Certification Memoranda have been created to answer to the Industry and EASA PCMs who wanted a stand alone document for SW and HW.
506	*THALES Avionics SA*	General	All	This Memo refers to software topics. All reference with system documents (such as ARP) or system activities must be removed	To remove system consideration and propose a memo dedicated to such activities.	Suggestion	Objection	Not accepted	SW and HW Certification Memoranda have been created to answer to the Industry and EASA PCMs who wanted a stand alone document for SW and HW. EASA recognises that both Certification Memoranda have introduced system considerations. In all cases, EASA thought it was the best way to consider the topic. EASA would like to avoid separating any guidance in multiple Certification Memoranda, it could lead to inconsistency.
507	*THALES Avionics SA*	General	All	Some topics are addressing and anticipating DO178C issues or discussions. These issues should be discussed in DO178C documents or DO248C	To clarify EASA position in this memo regarding DO178C / DO248C issues, whereas discussions are not closed yet. Proposal is to remove such issues from memo.	Suggestion	Objection	Not accepted	Some issues needed to be raised on current projects before the end of the ED12C / DO178C.
508	*THALES Avionics SA*	General	All	To add a precedence of document in this Memo regarding the intent of applicability regarding ED12C/DO178C	ED 12C should prevail on this EASA SW MEMO	Observation	Substantive	Partially accepted	The SW CM will be updated as soon as ED12C / DO178C will be issued to take into account the provided material.

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509	*THALES Avionics SA*	General	All	EASA already issued another document with the same reference which content is completely different named "Electronic Hardware Development Assurance"	In order to avoid confession, please provide a new reference to the document	Suggestion	Substantive	Partially accepted	The new Certification Memorandum will be used in the future in lieu of the old one you are referring to.
510	*THALES Avionics SA*	General	All	All along the document "Certification authorities" is used in the plural form, but in ED 12B it is used in the singular form	To replace everywhere "certification authorities" by "certification authority"	Suggestion	Minor/Substantive	Accepted	Certification Memoranda have been reviewed to ensure consistency.
511	*THALES Avionics SA*	1.4	9	Typo in definition of "Field-loadable software"	To begin the definition with an uppercase on the first word ("Software" instead of "software")	Suggestion	Minor/Substantive	Accepted	Corrected.
512	*THALES Avionics SA*	1.4	10	Definition of validation precise that the requirements are "sufficiently correct and complete". What are the criteria for sufficiently?	To clarify & define criteria for "sufficiently"	Suggestion	Substantive	Accepted	The definition has been altered to delete the word 'sufficiently'. The definition is then consistent with the definition given in ARP4754A.
513	*THALES Avionics SA*	1.4	10	Validation definition: more than correctness it could precise that the requirement must not be ambiguous	Modify as "correct, complete and non ambiguous"	Suggestion	Substantive	Not accepted	The definition has been altered to delete the word 'sufficiently'. The definition is then consistent with the definition given in ARP4754A.
514	*THALES Avionics SA*	2	11	§ background doesn't introduce some topics such as Pseudo-code or stack overflow	Suppress section not described in the background	Suggestion	Substantive	Accepted	The wording has been improved to remove this inconsistency.
515	*THALES Avionics SA*	2.1 b)	12	The CAST papers seem not equivalent to Notice or FAA order and rather less recognized as guidance. Regarding harmonization US-EC, why is intent of EASA when introducing some discrepancies?	To clarify EASA intent and make guidance equivalent to ease validation or certification with non EU countries.	Suggestion	Substantive	Noted	EASA considered that the material in these particular CAST Papers, which had been developed and accepted by the Certification Authorities around the World, was important enough to be introduced into the EASA guidance material. This material has not yet been included in the FAA material, but it has been accepted by the FAA Representatives attending the CAST meetings.
516	*THALES Avionics SA*	2.1 c)	12	The intention of this memo is to to harmonise EASA guidance toward FAA ones. However, EASA provide additional guidance which are not part of FAA ones (cf. 2.1 c). In addition, Model based was discussed by working group on ED-12C without relevant guidance as output.	To suppress topics when not harmonized with FAA	Suggestion	Substantive	Noted	This Certification Memorandum was intended to incorporate the existing EASA Certification Memoranda into one document. Most of the sections are harmonized with the FAA material. Some additional sections were introduced from CAST Papers, which have been agreed by all the Certification Authorities. The section on model-based development is a replacement of an existing EASA Certification Memorandum on this subject, as the previous document required some clarification for ED-12B / DO-178B projects until ED-12B / DO-178B is published.
517	*THALES Avionics SA*	4.2	14	Definition of sampling: first bullet, traceability shoul be a mean to follow the thread inside the requirements but not the only thing to verify	to rewrite as follows "An inspection of processes application using traceability links from system requirements…."	Suggestion	Substantive	Noted	EASA acknowledges your comment. However in order to remain consistent with the equivalent definition in the FAA Order 8110.49, it is preferred not to modify this wording.
518	*THALES Avionics SA*	4.2	14	The recommendation is indicated as not mandatory prior to approval. Does the recommendation become mandatory after the first approval?	To precise when a recommendation shall be taken into account	Suggestion	Substantive	Noted	An observation is meant to indicate a potential process improvement or an aspect to consider carefully during future projects. While to prepare subsequent development plans, it is recommended that an applicant / supplier does consider addressing observations, as they may potentially lead to findings in a following audit.
519	*THALES Avionics SA*	4.2	14	"Sampling is a process of..." the sampling is rather a method that is used for performing a review process.	Modify as "Sampling method is used for selecting…"	Suggestion	Substantive	Partially accepted	The wording "process" has been removed from this definition.

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520	*THALES Avionics SA*	4.3	15	For the desktop reviews, actions or observations are not formalized as for the on site reviews.	To precise that for each type of reviews (desktop and on site) , the findings and observation shall be clearly identified and formalized	Suggestion	Substantive	Partially accepted	The following text has been added to this section 4.3.c in order to clarify the content of desktop reviews: "Nevertheless, the preparation, performance, and reporting of desktop reviews is similar to on-site reviews". In addition, "desktop review" and "on-site review" wording has been added in the definition of "reviews" in section 4.2.
521	*THALES Avionics SA*	4.3 c.	15	The description of a "desktop review" is not clear. For "on site review", EASA memo provide content, but the difference between "desktop review" and "on site review" may be subject to interpretation.	EASA to provide the content of a "desktop review" with clear definition.	Suggestion	Substantive	Accepted	The following text has been added to this section 4.3.c in order to clarify the content of desktop reviews: "Nevertheless, the preparation, performance, and reporting of desktop reviews is similar to on-site reviews". In addition, "desktop review" and "on-site review" wording has been added in the definition of "reviews" in section 4.2.
522	*THALES Avionics SA*	4.5	16	The criteria for organising the software development review is software development data dependant, "The software development review should be conducted when at least 75% of the software development data …" but should also include the finalisation of the actions raised during SOI#1	To precise a criteria related to the SOI#1 completion for the organisation of the software development and verification reviews	Suggestion	Substantive	Accepted	The wording "all actions from the software planning review (SOI#1) have been proposed for closure" has been added to the sentence 4.5.a (2).
523	*THALES Avionics SA*	4.5 a.(1) & (2) & (3)	16	How to measure "75 %" of a development? For design phase, should 75% only of requirement done or does it covers 75% of requirement, AND 75% of design, AND 75% of code?	EASA to provide the criteria for the percentage and to propose their definition during SOI1 meeting	Suggestion	Substantive	Noted	It is up to the applicant to propose a mean to evaluate 75%. The sentence in 4.5.a (2) means 75% of the requirements along with their associated design and code, including the associated reviews as per tables A3, A4 and A5. This is clearly stated in this section and enhanced by the detailed sections 4.5.2 and 4.5.5, therefore no change to this section is considered necessary.
524	*THALES Avionics SA*	4.5.1 c.	18	The sentence "Additionally, the applicant's safety ....be assessed" is twice written	Delete one sentence	Suggestion	Substantive	Accepted	The 4th sentence has been deleted as suggested.
525	*THALES Avionics SA*	4.5.2 c. Table 4-2	19	ED12B Table A-2 is not related to Software Verification	To replace in lines 6 and 7 of the table "Tables A-2 through A-5" by "Tables A-3 through A-5")	Suggestion	Substantive	Accepted	The text has been modified as suggested.
526	*THALES Avionics SA*	4.5.2 c. Table 4-2	19	For development review, the content of Software Life Cycle Environment Index can be restricted to development environment, as test environment is assessed at the Software Verification Review)	Line 8, to precise "(Development Environment)"	Suggestion	Substantive	Accepted	The mention "development environment aspects" has been added.
527	*THALES Avionics SA*	4.5.2 c. Table 4-2	19	10th line, word "Records" is missing	Line 10: To add the word "Records" after "Software Configuration Management"	Suggestion	Substantive	Accepted	The text has been modified as suggested.
528	*THALES Avionics SA*	4.5.2 c. Table 4-2	19	In order to be able to assess traceability and compliance of software requirements with system requirements, system requirements should be made available for the review	To add system requirement data	Suggestion	Substantive	Accepted	System requirements data have been added.
529	*THALES Avionics SA*	4.5.3	19 & 20	Software Tool Qualification Data are required but no objective is found about the assessment of tool qualification	To add an objective about assessment of tool qualification and to precise in table 4-3 which tool qualification data are required (TAS for SOI#4 should be sufficient)	Suggestion	Substantive	Not accepted	There is no point in delaying the production of a TAS to the SOI#4 where the tool is used to reduce, eliminate or automate some portions of the development or verification activities. Therefore, the "Tool Qualification Data" have been kept in the tables 4-2 and 4-3.

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530	*THALES Avionics SA*	4.5.3.a (3)	20	What does mean an "informal execution of the test cases and procedures" Does it means that there is 1) a record of the results but no applicant's formal verification/review of the coverage objectives and of the results? or 2) no record at all (whatever the support and the form of this record) nor applicant's review on this activity. 3) Some thing else?	To explain the differences between formally and informally	Suggestion	Substantive	Partially accepted	EASA judges that the wording "formally" and "informally" is misleading and has removed it. Indeed, "formal testing" is not defined in ED-12B / DO-178B and therefore does not need to be introduced in this Certification Memorandum.
531	*THALES Avionics SA*	4.5.4 c.	21	TAS is missing	To add "Tool Accomplishment Summary, if applicable" in table 4-4	Suggestion	Substantive	Not accepted	There is no point in delaying the production of a TAS to the SOI#4 where the tool is used to reduce, eliminate or automate some portions of the development or verification activities. Therefore, the "Tool Qualification Data" have been kept in the tables 4-2 and 4-3.
532	*THALES Avionics SA*	4.5.4	21	To define criteria depending on preceding reviews for the verification review	To define criteria depending on preceding reviews for the verification review	Suggestion	Substantive	Accepted	An additional item has been introduced in the updated text to ensure that the preceding reviews have been performed and deficiencies resolved.
533	*THALES Avionics SA*	4.5.5	22	SOI#1 is not consistent with previous chapters	In column "Major Reviewed Devices", to replace "Software tools/tools policy" by "Software tools policy" In column "Documentation available", to remove System requirements and Life Cycle data of qualified tools from SOI#1	Suggestion	Objection	Accepted	Software tools / tools policy" has been replaced by "Software tools policy" "System requirements" has been removed from SOI#1 and moved to SOI#2. "Life cycle data of qualified tools" has been removed from SOI#1 and replaced by "Tool Qualification Plans".
534	*THALES Avionics SA*	4.5.5	22	SOI#2 is not consistent with previous chapters and not internally consistent	In column "Major Reviewed Devices", to fill in the cell as follows: "Software Requirements vs System Requirements and requirement standards" "Software Design vs Software Requirements and Design standards" "Source code vs Design and coding standards" "Software Requirements, design and source code verification activity" "Follow-up of the previously open actions" In column "Documentation available", to add "System Requirements Data"	Suggestion	Objection	Accepted	The two cells have been updated as suggested.
535	*THALES Avionics SA*	4.5.5	22	SOI#3 is not consistent with previous chapters and not internally consistent	In column "Major Reviewed Devices", to fill in the cell as follows: "Software verification cases and procedures vs Software Requirements and Design" "Software tools qualification" "Follow-up of the previously open actions" In column "Documentation available", to add "Life cycle data of qualified tools"	Suggestion	Objection	Partially accepted	All items have been added as you suggested. However the item "Software requirements coverage (correctness and robustness) has not been removed.

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536	*THALES Avionics SA*	4.5.5	22	Description of SOI#4 unclear: "Coverage of tests (integration/validation)" is a system activity, outside of software process; supplier quality actions: which supplier? No TAS is required for verification tools	In column "Major Reviewed Devices", to replace "Coverage of tests (integration/validation)" by "All processes completeness" and to suppress "Supplier quality actions" In column "Documentation available", to suppress "Records" (2nd line); to replace "TAS for development/verification tools" by "TAS for development tools"	Suggestion	Objection	Accepted	Items have been modified as suggested.
537	*THALES Avionics SA*	4.5.5	22	in all the table "process assurance" is used but not compliant with ED12B (this is an ARP4754 terminology)	To replace in all the table "process assurance" by "quality assurance"	Suggestion	Substantive	Accepted	Items have been modified as suggested.
538	*THALES Avionics SA*	4.5.5	22	The entry criteria of the reviews are only given against the software data produced for the corresponding phase. There is no criteria against the preceding reviews	To define criteria depending on preceding reviews for all the reviews	Suggestion	Substantive	Partially accepted	The section 4.5.4 item has been updated to include that the final certification review can be conducted only if the preceding reviews have been conducted. In the table in section 4.5.5 it is not judged necessary.
539	*THALES Avionics SA*	4.7 a.	23	"The responsible certification engineer": this term is used for the first time without any explanation: not very clear to know who he is	To replace "The responsible certification engineer" by "The applicant certification engineer"	Suggestion	Substantive	Partially accepted	This section 4.7 has been reworked extensively in the updated Certification Memorandum in order to harmonize the terminologies used for the certification roles.
540	*THALES Avionics SA*	4.7 a.	23	"a manufacturing inspector": not very clear in the context of software development (more accurate for hardware)	To replace "a manufacturing inspector" by "one person"	Suggestion	Substantive	Partially accepted	This section 4.7 has been reworked extensively in the updated Certification Memorandum in order to harmonize the terminologies used for the certification roles. In particular, the term manufacturing inspector has been removed.
541	*THALES Avionics SA*	4.7	23	This section is related to a "on site review" and nothing is available for conducting a desktop review.	To define guidelines, even if review is not "on-site". To explain either the documents to provide, an efficient way of communication towards the suppliers, …	Suggestion	Substantive	Accepted	The following text has been added to this section 4.3.c in order to clarify the content of desktop reviews: "Nevertheless, the preparation, performance, and reporting of desktop reviews is similar to on-site reviews". In addition, "desktop review" and "on-site review" wording has been added in the definition of "reviews" in section 4.2.
542	*THALES Avionics SA*	4.7 g.	25	Who is the PCM? Used for the first time	To clarify the role of the PCM and to update the glossary/definition (EASA representative?)	Suggestion	Substantive	Accepted	PCM means 'Project Certification Manager" (see acronym in section 1.3). In order to clarify the intent of this section, the wording has been modified to "EASA PCM".
543	*THALES Avionics SA*	5.3.3 a.	29	Definition of "desktop review" is missing	To propose a definition	Suggestion	Substantive	Accepted	The following text has been added to this section 4.3.c in order to clarify the content of desktop reviews: "Nevertheless, the preparation, performance, and reporting of desktop reviews is similar to on-site reviews". In addition, "desktop review" and "on-site review" wording has been added in the definition of "reviews" in section 4.2.
544	*THALES Avionics SA*	5.3.3 c.	30	"CID" is not an ED12b acronym	To replace "CID" by "SCI"	Suggestion	Substantive	Accepted	This change has been performed in the updated Certification Memorandum text.
545	*THALES Avionics SA*	5.3.3 c.	30	Advanced companies own a "development reference system" which contents software plans. For a dedicated project, software project plans are tailored from these reference plans and only the tailored plans are to be submitted to the AA.	Add a note allowing companies to not deliver to AA their development reference plans, and mention "Other SW plans" are for consultable only on site.	Suggestion	Substantive	Not accepted	This is company specific practices that are to be agreed on a case by case basis. Therefore EASA does not consider necessary to modify the Certification Memorandum text.
546	*THALES Avionics SA*	9.4 b.	37	The acronym UMS used here is not defined in §1.3	To add acronym UMS in §1.3	Suggestion	Substantive	Accepted	Text altered as suggested.

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547	*THALES Avionics SA*	11	45	This paragraph concerns the same subject as the IP0056. This paragraph is according to the definition of the tool in the DO178B and not the criteria 1,2 and 3 of the tool in the DO178C	To add on EASA SW MEMO that ED 12C should prevail on this guidance	Suggestion	Substantive	noted	This version of this Certification Memorandum is only intended for use in the context of projects that have ED-12B / DO-178B as their certification basis for software. It is intended that another version of this certification Memorandum will be produced for projects that have ED-12C / DO-178C as their cert basis, and that new version will take into account the new supplement for tool qualification as well as the other new supplements.
548	*THALES Avionics SA*	14	62	Not mature				Not accepted	The text of this section is based on the text of FAA Order 8110.49, which has been publicly available since 2003 and has been the basis of previous EASA CRIs and Cert Memos for several years. Neither the FAA nor EASA has found it necessary to update this section, so EASA considers that the text of this section is mature and does not need to be modified at this time.
549	*THALES Avionics SA*	15.2.1	63	The oversight activities are addressing supplier & sub-tiers suppliers. Is it link with Tier1 & Tier2 definition?	To clarify who is in charge of Tier2 (sub-tier supplier) oversight, the applicant?	Suggestion	Substantive	Noted	The Applicant has the overall responsibility. Nevertheless, the oversight plan should be defined in the supplier management plan or included in one of the existing documents. The purpose of this section is to highlight the need that this process should be documented and it is up to the applicant to propose the oversight approach.
550	*THALES Avionics SA*	15.2.2	63	"Certification specialist" Are they ones identified in DOM (Design Organisation Manual) or equivalent document related to applicant DOA?	To precise "certification specialists" as personnel formally identified by applicant Design Organisation.			Accepted	Text has been reworded as result of this and other comments.
551	*THALES Avionics SA*	16.4	67	Definition of OPR speaks about hardware instead of software	To replace "the airborne electronic hardware" by "the airborne software"	Suggestion	Substantive	Accepted	Comment accepted and section amended.
552	*THALES Avionics SA*	16.5	67	Type 1A, 1B, 3A, 3B seems to be too much detailed	To suppress sub level 1A, 1B, 3A, 3B	Suggestion	Substantive	Not Accepted	EASA is convinced that the level of detail is appropriate taking into consideration the level of complexity of the aircraft / engine systems.
553	*THALES Avionics SA*	16.7	68 & 69	ED12B defines precisely what information is requested about OPR, CAST paper 7 identify same level of information, WG71 when revising ED12 do not raise any concern about this subject, why only EASA need so much information?	To limit content of SAS of what is required by ED12B	Suggestion	Objection	Not accepted	EASA thinks there is a need to get the defined information and ED12C / DO178C will reflect this list.
554	*THALES Avionics SA*	16.8 & 16.9	69	These chapters are outside software processes, that is not the intend of this memo=> risk of forgetting these activities is high	To move this part in a dedicated **system** memo	Suggestion	Substantive	Partially Accepted	EASA is requesting for the OPR section 16.9 of this Certification Memo: *"The System Certification Summary or an equivalent certification document should describe:"* As an EASA "System Aspects linked to Software and Airborne Electronic Hardware" Certification Memorandum does not exist at the moment, EASA considers that this aspect should be addressed in this Certification Memo. Section 16.9 might then be amended if a Certification Memorandum "System Aspects linked to Software and Airborne Electronic Hardware" is released.
555	*THALES Avionics SA*	16.7 & 16.9.1 5) b)	70	A limit in number of OPR has no real meaning; since that depending of the applicant or its supplier working usage, same problems can be grouped in one PCR or dispatched in several ones	To suppress the definition of an OPR number limit	Suggestion	Objection	Not Accepted	EASA has not established a specific limit on the OPRs in this Certification Memorandum; this will be determined case-by-case and project-by-project basis in accordance with the applicant.

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556	*THALES Avionics SA*	17.5	74	"validation" is not a term suitable forED12B activities, never used	"validation" to be replaced by "verification"	Suggestion	Substantive	Partially Accepted	Validation is defined in ED12B / DO178B when system requirements are invoked and there is a possibility that CF are directly defined from system requirements. However, to avoid confusion, "Validated" has been replaced by "reviewed & analysed".
557	*THALES Avionics SA*	17.6	75	Same remark as above, avoid the use of "validation", "validate" terms when talking about ED12B activities	To suppress "validated" in the sentence of the second bullet, to suppress "validation" in the paragraph related to CF evolution	Suggestion	Substantive	Partially accepted	It is correct that the EASA team may reject a request for certification if the number of remaining OPRs is too high, or if there is no evidence of an adequate action plan to close the OPRs. The number and safety impact of the OPRs as well as the period and plan to track the progress of the closure of the OPRs, will be dealt on a case-by-case basis depending on the project.
558	*THALES Avionics SA*	22.2.1	88	Third line of second paragraph, one "that" to suppress in the sentence	To replace "to ensure that that the software program functioned correctly" by "to ensure that the software program functioned correctly"	Suggestion	Substantive	Accepted	The additional "that" has been removed in the revised text.
559	*THALES Avionics SA*	22.3.1	91	What means "good design"? This is a value judgement, not factual	To replace "good design" by something else more factual	Suggestion	Objection	Accepted	As there is only one subsection under 22.3, the title "Benefits of good design and integration practices" has been removed in the revised text. In the first sentence, the wording "good design and well-defined integration practices" has been replaced by "well-defined design and integration practices".
560	*THALES Avionics SA*	23.2.2	94	This chapter is written with heavy sentences (from a to j paragraphs), that makes them difficult to understand.	Clarify the sentences by using bullets for each element of the sentences	Suggestion	Substantive	Accepted	We have reworded and broken up several of the sentences so as to make them shorter and we hope they are also more understandable.
561	*THALES Avionics SA*	23.2.3	96&97	first cell of the table is cut on two pages =>difficult to read the table	Put the whole table on the page	Suggestion	Minor/Substantive	Accepted	The tables in this section have been re-entered so that each table is an image and the images of the tables cannot in future be split across pages.
562	*THALES Avionics SA*	23.2.4.5 & 23.2.5.4 & 23.2.6.6	98, 100, 102	granularity of requirements and non-functional requirements are not covered by ED12B	Clarify what is beyond "granularity of requirements" and "non-functional requirements" or suppress these parts	Suggestion	Objection	Accepted	Notes have been added to explain these terms
563	*THALES Avionics SA*	23.2.5	99	"These life-cycles differ considerably from a conventional": the word "considerably" is too strong regarding the real differences between the life cycles. It is reminded here that ED12B do not require any specific life-cycle, so how can we be different from something that is not defined?	To suppress the word "considerably"	Suggestion	Substantive	Not accepted	While ED-12B / DO-178B does not require any particular software life-cycle, the life-cycles shown in Figure 3-1 of ED-12B / DO-178B all include software requirements. The ED-12B / DO-178B objectives include objectives related to software high-level requirements. We think that a software life-cycle that does not include any conventional software high-level requirements and where those requirements are replaced by a model is considerably different from what is described in ED-12B / DO-178B. It is also sufficiently different that a whole new supplement for ED-12C / DO-178C has had to be introduced in order to handle life cycles such as these, which were not adequately described in ED-12B / DO-178B. We therefore think that 'considerably different' is a fair description of the situation.
564	*THALES Avionics SA*	23.2.5	99	Subchapter of 23.2.5 are written to comply with type #2a, but what about type #2b?	To complete 23.2.5.1 and 23.2.5.2 with particular case of formalized design parts that are at system level	Suggestion	Substantive	Not accepted	Section 23.2.5 already covers both types 2a and 2b. It states that the higher-level requirements have to be validated according to ED-79 / ARP4574, and whether the Design Model is originated by the system or the software engineers, ED-12B / DO-178B activities have to be conducted on the Design Model.

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565	*THALES Avionics SA*	23.2.8	103	What about type #2b in this chapter, e.g. the use of simulation to comply with §7 of ARP4754?	To add a sentence about the use of smulation for requirement validation	Suggestion	Substantive	Accepted	A mention of the objectives of ED-79 / ARP4754 section 7 has been added to the section 23.2.8.1 of the updated Certification Memorandum.
566	*THALES Avionics SA*	23.2.8.2	104	"Note: As the formalized design cannot be used to verify itself, compliance with objectives 3 and 4 of table A-6 cannot be wholly or partly claimed based ont the use of simulation": => do not agree; the intend of objectives 3 and 4 are not to verify LLR but the compliance of code to LLR, so provided that simulation is assessed for representativity, the compliance of code can be shown by simulation	To suppress first sentence of the note	Suggestion	Objection	Partially accepted	EASA agrees that this sentence may lead to confusion. In order to clarify the intent, the sentence has been reworded in the updated Certification Memorandum: "Since simulation cases should be based on the Higher-level Requirements, compliance with objectives 3 and 4 of Table A-6 cannot be wholly or partly claimed based on the use of simulation of the Design Model." However it is not agreed to remove it.
567	*THALES Avionics SA*	23.2.9	105	"all the conditions of the logic components": state of the art defines equivalence classes for certain logical components, exhaustive combination should not be required	to replace "all the conditions of the logic components" by "All equivalence classes of the logic component	Suggestion	Objection	Not accepted	Components of a Design Model that contain logic have discrete values or sets of values, such as TRUE / FALSE or a variable of an enumerated type, which may take on one of several defined values. Each of these values has to be tested and each binary variable has to be tested TRUE and then FALSE. This is different from numeric variables, where there are equivalence classes when the value is greater than a decision point or less than it, or is in range or out of range.
568	*THALES Avionics SA*	23.2.10.3	106	Why to highlight here the particular case of non functional requirements?. This point has no particularity linked with the use of formalized requirements or design and is not addressed by ED12B (nor future ED12C)	To suppress this chapter	Suggestion	Substantive	Not accepted	There are some requirements that are not requirements for functions of the system and which therefore should not be traced as part of the tracing of functional requirements. This distinction is necessary and EASA therefore wishes to leave this distinction in the Certification Memorandum.
569	*THALES Avionics SA*	24	109	Could you provide a clear definition of "pseudo code"?	To provide & illustrate what is the definition of "pseudo code"	Suggestion	Substantive	Accepted	We have rewritten this section and provided a definition.
570	*THALES Avionics SA*	24.1 first sentence	109	Why EASA take the position of discouraging the usage of pseudo code, when at the end (24.4 section 2) a guideline is provided for using it?	Remove the first sentence.	Suggestion	Objection	Partially accepted	We have rewritten this section and stated how pseudo-code may be used.
571	*THALES Avionics SA*	24.1 2nd paragraph	109	EASA makes reference to a "normal ED-12B/DO-178B cycle" that is not defined within the standard.	Don't make reference to" the normal ED-12B/DO-178B cycle" or defined it.	Suggestion	Objection	Accepted	We have rewritten this section.
572	*THALES Avionics SA*	24.1 2nd paragraph	109	As source code shall not contain "unspecified function", everything source code line or group of source code lines shall be specified and condition,/decision/criteria shall be specified a an upper level. Then the structure provided within "pseudo code" could be respected (or not ... coding error!!) during coding stage without being a defect in itself. Obviously, a structure specified within the low level has to be implemented.		Observation		Not accepted	This comment does not make any suggestion or point out any deficiency in the text, so we have no way to address it.
573	*THALES Avionics SA*	24.1 3rd paragraph	109	Between low level requirement and source code, there should not exist any level of interpretation. Then the objective of low level is to offer the capability to directly develop the source code. This doesn't prevent pseudo code to be elaborated from high level requirement	To improve the background description	Suggestion	Objection	Noted	We have rewritten this section and stated how pseudo-code may be used.

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574	*THALES Avionics SA*	24.1 3rd paragraph	109	Reverse engineering process between source code and design allows providing an initial set of design data that shall be completed to become low level requirement. As the opposite, pseudo code is not systematically coming from a reverse process without additional cross checked to high level requirement.	To improve the background description	Suggestion	Objection	Partially accepted	We have rewritten this section and stated how pseudo-code may be used.
575	*THALES Avionics SA*	24.1 3rd paragraph	109	In this section, a reference is made to the "normal practice" without providing a clear definition of it.	To define and illustrate what is a "normal practice" or to remove the section	Suggestion	Objection	Accepted	We have rewritten this section and stated how pseudo-code may be used.
576	*THALES Avionics SA*	24.1 4th paragraph	109	This statement is absolutely not substantiated and experience shows reality slightly different. Structural language is powerful to express algorithm. As an example, the interpolation function is impossible to be express with "usual textual language" but it becomes easier with structural language. In addition, please define a "normal cycle" as DO178B doesn't define what is a "normal cycle"	To improve the background description	Suggestion	Objection	Partially accepted	We have rewritten this section and stated how pseudo-code may be used.
577	*THALES Avionics SA*	24.2 1st paragraph	109	This section has an implicit definition of pseudo-code, issuing from reverse engineering. However, pseudo-code is not only poor reverse engineering. It may be come from a good practice, using a structural language to express requirement toward complex algorithm.	To improve this § with enhanced descriptions	Suggestion	Objection	Partially accepted	We have rewritten this section and stated how pseudo-code may be used.
578	*THALES Avionics SA*	24.3	110	It is indicated that the code cannot be developed directly from the high level requirements, and it is indicated a reference to the §21 of the certification memo. In the §21 of the certification memo, its is not indicated that code cannot be developed from a high level requirement, but that low level requirements and high level requirements cannot be mixed into a single data item.	To correct the §24.3	Suggestion	Objection	Partially accepted	We have rewritten this section and stated how pseudo-code may be used.
579	*THALES Avionics SA*	24	110	It is indicated that the pseudo code is not a good way to produce low level requirements. In fact, it is not the pseudo code itself, but the way the pseudo code is used that can be not in compliance with DO178B objectives.	To talk about detail level of low level requirements instead of talking about pseudo code. Pseudo code could be used in a separate file that the source code, with a level compatible with Low Level Requirements, and could be compatible with DO178B.	Suggestion	Objection	Partially accepted	We have rewritten this section and stated how pseudo-code may be used.
580	*THALES Avionics SA*	24.3 2nd to 4th paragraph	110	This section make the assumption pseudo-code don't contain low level requirement. When low level requirement use formal language to be expressed, the statement expressed in the three sections has no sense.	To improve the argumentation	Suggestion	Objection	Not accepted	This section does not deal with the use of formal language to express low-level requirements.

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581	*THALES Avionics SA*	24.4	110	At least, EASA provide guidance to use pseudo-code. However, this document has never defined what a "pseudocode" is. But the 2nd bullet gives advantages of the pseudo-code. The development of the software is done by technical people, and using structural and formal language, as allowed by DO 178 B through "design standard", permits to remove the interpretation intrinsic to textual language.	To improve, review, the EASA position	Suggestion	Substantive	Noted	We have rewritten this section and stated how pseudo-code may be used.
582	*THALES Avionics SA*	25.3	113	"...stack overflow may be not sufficient to ensure…", regarding the arguments above one can guess that it is really not sufficient	To replace "stack overflow may be not sufficient to ensure" by "stack overflow is not sufficient to ensure"	Suggestion	Substantive	Partially accepted	EASA agrees with the intent of your comment but prefers keeping the wording for the benefit of the explanation.
583	*European Space Agency (ESA)*	General	None	The purpose of the CM "to provide specific guidance material to the applicant on various aspects complementary to ED-12B/DO-178B" is understood. However, it seems that this CM is being using the misleading wording of "Software Certification" in several sections of the document. To my knowledge the principle that Software cannot be certified was already fully consolidated within the safety community. In particular in DO-178B this wording had never been used, since e.g. Systems and Equipment Certification are the only items subject to certification (not the SW). I would appreciate if you could better clarify this issue in order to avoid any potential misunderstanding.				Accepted	"Software Certification" has been changed to "Software Approval", which will be the wording used in ED12C / DO178C.
584	*General Aviation Manufacturers Association (GAMA)*	General	None	GAMA Recommends the EASA utilize the infrastructure which exists for commenting on traditional EASA rulemaking materials (CS, AMC, etc.) as this format is limiting and not advantageous to word processing.	Utilize current EASA comment collection system employed for CS/AMC/etc.	Suggestion	Substantive	Noted	EASA will consider your request to use the Rulemaking Tool in order to ease the commenting process fro Certification Memorandum.
585	*General Aviation Manufacturers Association (GAMA)*	General	All	GAMA is supportive of the EASA concept for certification memos (CMs) as they can provide good visibility of detailed methods of compliance which have historically met compliance with the requirements. As EASA states in the CM preamble, it is important that the agency not set new requirements through this material as it is not a rulemaking activity.	None requested.	Observation	Substantive	Noted	
586	*General Aviation Manufacturers Association (GAMA)*	General	All	GAMA believes that some material in this proposed CM set new standards which will be imposed as requirements and therefore this material should be included in a formally published CS/AMC to assure proper alternatives and cost versus benefit are considered for the variety of products and articles the requirements will be imposed on.	Promulgate this particular material in a CS/AMC rather than through a CM.	Suggestion	Substantive	Noted	Those Certification Memoranda do not introduce new requirements, please see section 1.

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587	*General Aviation Manufacturers Association (GAMA)*	General	All	GAMA is supportive of the "living nature" of CMs as they can be used to highlight new means of compliance which meet the minimum existing requirements however GAMA would like to emphasize that this living nature must not be used to preclude the use of previously acceptable methods of compliance when no change to the rules have occurred.	GAMA requests EASA affirm that CMs will not be used to obviate historical methods of compliance simply because new methods are identified.	Suggestion	Substantive	Accepted	SW & CEH EASA Certification Memoranda provide information and clarifications about objectives and activities which might be used to cope with specific development. They are not prescribing and do not invalid any past method already recognized as acceptable.
588	*General Aviation Manufacturers Association (GAMA)*	General	All	GAMA expects that EASA will utilize CM material in project related CRI.	GAMA suggests that EASA clarify how CM material will be applied to specific projects.	Suggestion	Substantive	Noted	Certification Memoranda will be called in projects by CRIs.
589	*General Aviation Manufacturers Association (GAMA)*	General	All	In the context of E-TSO appliances, it is important to clarify that while there may be new ways to demonstrate compliance ED-12B/DO-178B, there may be articles which demonstrated compliance to the standard prior to a recent implementation or change to this CM. In this case, EASA should specify that the article does not need to re-certify compliance to the standard because while the CM may have changed, the standard has not.	GAMA requests that EASA clarify that E-TSO/TSO articles must meet compliance with ED-12B/DO-178B despite the active nature of the CM material and therefore these articles may be utilized in future installations without needing to demonstrate compliance to a particular version of the ED-12B/DO-178B standard again in light of the existence or update of CM material.	Suggestion	Substantive	Noted	It is the understanding that this Certification Memorandum should apply to all products including ETSO products to provide safe flight and landing. Compliance to the Certification Memorandum could be indicated in the Declaration of Design and Performance attached to the Certification Memorandum. Discussions with manufacturers define on case by case which Certification Memorandum is applicable if any.
590	*General Aviation Manufacturers Association (GAMA)*	General	All	EUROCAE ED-12C and RTCA DO-178C are nearing completion and this standards revision was no small task on behalf of the authorities and the industry. GAMA believes the authorities should act quickly after the release of these standards to make a determination of compliance to the applicable regulations and to formally accept the revisions. Many of the issues addressed in this draft CM are contained in the revision to the software standard. EASA should consider whether it is realistic to issue another version of this CM later or if EASA should incorporate that material before this CM is formally issued.	Review the pending ED-12C/DO-178C to determine whether the CM should be held until this material can be incorporated.	Suggestion	Substantive	Noted	The SW Certification Memorandum will be updated as soon as ED12C / DO178C will be issued to take into account the provided material.
591	*General Aviation Manufacturers Association (GAMA)*	General	All	Much of the material contained in this proposed CM is also contained in the FAA's Notice 8110.110 which recently expired. GAMA believes the FAA is planning to incorporate this notice material into Order 8110.49 Change 1. GAMA requests that the FAA and EASA coordinate these documents to assure there is a similar approach to software aspects.	Coordinate with the FAA on the revision of Order 8110.49 Change 1 which includes similar software material.	Suggestion	Substantive	Noted	FAA has not yet issued its rev 1 of Order 8110.49. Both the Certification Memorandum and Order should be harmonised.
592	*General Aviation Manufacturers Association (GAMA)*	General	All	There is in-depth discussion of how EASA will be involved in software compliance verification however that process seems relatively inflexible with a requirement for EASA software panel members. GAMA suggests that there are a multitude of software projects and a formal software panel may not be necessary in a large portion of projects. Further, GAMA is not aware of any requirements in CS21 which would require involvement of a software panel. While such a panel may be helpful, it would be inappropriate for the agency to codify such a panel in this CM.	GAMA suggests EASA write section 5 in a more flexible manner so it fits in with the frame work of CS21.	Suggestion	Objection	Partially accepted	Section defines how the EASA involvement performs the activities and it does not even mean that a SW panel is nominated on all projects. It is decided on a case-by-case basis taking into account the product (the way of working does not change).

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593	*General Aviation Manufacturers Association (GAMA)*	General	All	There is a lack of discussion of the process which will be used to validate software which has been shown to comply with EASA regulations through recognized authority statements of compliance.	GAMA suggests EASA include the proper process for validating software aspects compliance when a recognized authority makes a statement of compliance in this area.	Suggestion	Objection	Partially accepted	EASA recognition of other software approval is done on a project by project basis taking into account the bilateral, working arrangements, etc.