EASA Proposed CM-SWCEH-001 Issue 1 – Development Assurance of Airborne Electronic Hardware – 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
NR	Author	Section, table, figure	Page						
1	*Cassidian Electronics*	General	None	General statement: The document: Filename "Proposed CM-SWCEH-001 Issue 01" Document title: Notification of a proposal to Issue A Certification Memorandum , Subject: Development Assurance of Airborne Electronic Hardware We could easily find out that the CRI-F08 (A400M) and CRI-F32 (A400M) (or CRI-F09 (A380), CRI-F42 (A380)) have been taken as a basis and supplemented and augmented at the relevant sections within the document. This document is as well a big contribution to clarification and some CAST papers have been taken into account. A splendid and very elaborated document!				Noted	
2	*Cassidian Electronics*	9.3.2		Life cycle data The term Life cycle data is interpreted as any descriptive documentation to an Hardware item. The Hardware item could be COTS, complex COTS (includes the complexity variations as defined §9.2), ASICs, PLD (FPGA). If a Hardware item has been developed to DO254, the life cycle data generated for the Hardware Item can be assigned to comply with DO254§ Appendix A, Table A-1. The essential part of DO254§ Appendix A, Table A-1 for this review is the Item DO254§10.3 Hardware Design Data and the items DO254§10.3.2 Hardware design representation data (and the subsequent data items). Comment 1: In the described DO254 context, the term in section 9.3.2 [3]"Design Data" is not quite clear what is meant by "device design data for COTS" in relation to DO254§Appendix A, Table A-1.				Noted	The term "device design data" is generic and not directly linked to the "design data" formalism described in ED80 Appendix A Table A-1.

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3	*Cassidian Electronics*	9.3.2		Comment 2: (first bullet) The point is, are the "requirements" of a COTS device seen as documented in the Datasheets, application notes- or should there be a dedicated requirements document and the datasheet is more seen as a description how the requirements (not visible) have been implemented. If a COTS device (like an ASIC, PLD, FPGA) is already part of a certified Aircraft (e.g A380) and will be re-used (e.g A400M) , the available Life cycle data for the COTS complies with DO254§ Appendix A and the first bullet can be met due to availability of COTS device requirements (DO254§10.3.1).				Noted	It is agreed that for a COTS device, formalism of the data may be different than those described within ED-80. Nevertheless, when design data exists, requirements of the devices should be extracted from the device documentation (e.g. data sheet...).
4	*Cassidian Electronics*	9.3.2		Comment 3: (second bullet) When the design data for COTS are not available for review…Does this mean we do not have any data of the COTS device? or does the available design data not comply to DO254§Appendix A (essential part see above) and therefore a review cannot be performed as stated in the first bullet (see comment 2).				Noted	When the design data are not available, then review of these design data to assess their compliance with the device requirements is not possible. Therefore, other types of data (quality management, manufacturing process, component approval process) should be assessed.
5	*Cassidian Electronics*	9.3.2		Comment 4: Maybe a definition what is meant by "public data", and "private data" should be provided. (Private data are component manufactures intellectual property and they are very reluctant to give anything)				Noted	Public data are available for every one. Private data are only accessible through specific agreement from the manufacturer.
6	*DMAP*	1.3	6	CID has never been described in ED80 or CAST papers. Reference to this document has been found in various CRI (F16, F23) "the applicant should provide a specific PHAC, HAS and CID ", without definition or content. Reference to this document (HCID?) can be found in this memorandum in 4.5.5 table, as a document examined during final certification review "HCID (top level drawing)". This last sentence should be compared with CAST 27 10 b that describes Hardware Configuration Index (HCI) as a part of the Top Level Drawing	A clear definition of these documents (CID, HCI, HCID, top level drawing) should be added, with respect to CAST 27 and CRI-F. Put attention on industrial practices that manage documents named CID with some specific (probably complaint) definition.		Substantive	Accepted	The term CIS was removed.
7	*DMAP*	1.3	6	According to ED80 text, DAL should be used for "Design" Assurance Level when looking at hardware part (in place of Development Assurance Level used for System point of view)	Replace "Development" by "Design" or create a separate acronym (one for Hardware, the other for hardware)	Suggestion		Not Accepted	This wording is maintained and explained within the acronym list.
8	*DMAP*	1.3	8	GAL generally means "Generic" Array Logic, and is a Lattice reserved name. it is rarely used nowadays	Could be suppressed	Suggestion		Accepted	This Certification Memorandum re-uses the PLD definition of ED-80 / DO-254. The acronym GAL was removed.

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9	*DMAP*	2	10	"singly packaged" components examples correspond to "discrete component" regular definition (in contrast with integrated Components)	Could be suppressed	Suggestion		Not accepted	EASA considers that "singly packaged" and the list of component examples is not ambiguous.
10	*DMAP*	2	10	This memorandum does not apply to analog IC: Does it mean that EASA considers analog ICs are outside the DO-254 scope, or just outside the scope of this memorandum?	To be clarify	Suggestion		Not accepted	It is clear that this memorandum does not apply to analog IC.
11	*DMAP*	4.2	12	Code coverage sampling could be a non-sense when assuming a 100% coverage ratio as a target (deviations are drastically limited and can be examined individually) functional coverage and verification means relevance could be a better sampling exercise.	Could be suppressed	Suggestion		Noted	The comment is acknowledged by EASA but no change to the existing text is considered necessary. Indeed it is deemed necessary to perform a sampling on the coverage analysis in order to assess that the method used complies with the one that has been planned. This of course does not alleviate the target of 100% which also has always to be demonstrated.
12	*DMAP*	4.4	13	DOA acronym is not defined	Add definition in dedicated chapter	Suggestion		Accepted	This acronym has been added to the list in section 1.3 of the Certification Memorandum.
13	*DMAP*	4.5.2 a.	15	Hardware Requirement Data are missing in the design data description. Traceability between Conceptual data and "system requirements" is confusing and probably wrong : traceability should be established between HRD and HCD; point1) and 2) describes the Conceptual data (== architecture) Point 3) is confusing : detailed design data should be traceable to conceptual data and/or hardware requirement data (not system requirements)	Add clarification about requirement hierarchy (HRD, HCD, and HDD) and traceability requested between these data.	Suggestion		Accepted	EASA has noticed that some errors have been introduced in this section 4.5.2 that can explain your confusion. This has been corrected in the updated text. In addition, hardware requirements have been added to the Hardware Data list.
14	*DMAP*	4.5.2 a.	15	1) non applicability criteria is not clear : could be due to DAL C ,(traceability not required between design data DO254, appendix A note 6) ? could be due to SEH ? could be due to absence of Conceptual data (DALC optional) ? Could be due to absence of requirements into Conceptual document (feedback to higher level)?	Add some explanation on non applicability criteria	Suggestion		Accepted	We agree that this non-applicability is misleading. As for any guideline in this Certification Memorandum, it is applicable when relevant. The best solution is to remove this statement to avoid any confusion. This has been done in the updated text.
15	*DMAP*	4.5.2 a.	15	3) idem (applicability) plus ambiguity about "and/or"	Add some explanation on non applicability criteria Explain "and/or" cases	Suggestion		Accepted	We agree that this non-applicability is misleading. As for any guideline in this Certification Memorandum, it is applicable when relevant. The best solution is to remove this statement to avoid any confusion. This has been done in the updated text. ED-80/DO-254 section 5.3.1 states that "the detailed design is developed from the hardware item requirements and conceptual design data.", this explains the "and". The "or" implies that someone may develop the detailed design solely from the conceptual design. To avoid this ambiguity, the "or" has been removed in the updated text.
16	*DMAP*	4.5.2 a.	15	4) Here "hardware implementation" stands for result of synthesis and P&R activities (i.e. a netlist). Traceability can't be considered in the same way than for the previous points (a traceability matrix) but another means could be proposed (RTL/netlist equivalence checker?)	Could be replaced by : "equivalence between implementation data and detailed design data has been established"		Objection	Accepted	EASA has noticed that some errors have been introduced in this section 4.5.2 that can explain your confusion. This has been corrected in the updated text.
17	*DMAP*	4.5.2 b.	16	Verification results are not necessary for a design review (verification procedures description is sufficient) Results will be available late in the project schedule (only preliminary result (if exist) could be examined during design review)	Suppress verification results from the input list	Suggestion		Accepted	"Hardware verification results" has been replaced by "Review and analysis results". Consistently, the same change has been performed for the procedures.

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18	*DMAP*	4.5.2 b.	16	Validation activities are missing : this main support activity should be part of the design review	Add validation activities		Objection	Accepted	Validation activities have been added.
19	*DMAP*	4.5.3 a.	16	Test coverage analysis is ambiguous: could be confusing with code coverage analysis which is an additional verification means. Test coverage is probably a short cut for "requirement coverage by verification procedures" or "functional coverage" which is the same signification. Moreover, traceability objectives are missing in teh criteria list (not coherent with design review list). Traceability between design and verification is a part of functional coverage analysis.	Add traceability and functional coverage objectives in maturity criteria list	Suggestion		Partially accepted	The wording "test coverage" has been replaced by "verification coverage analysis" (as defined in ED-80/DO-254 section 6.2.2.4. Traceability analysis has been added to the objective in the criteria list.
20	*DMAP*	4.5.5	18	HLR is not explained	to be added in acronym list	Suggestion		Accepted	The wording "HLR" is improper and has been removed.
21	*DMAP*	4.5.5	19	HDL code vs. Standards audit (compliance with design rules) could be done during design review (consider it as a part of the code review and not a verification procedure)	consider it as a part of the code review and not a verification procedure	Suggestion		Accepted	This activity has been moved to the development review accordingly.
22	*DMAP*	4.5.5	19	note 2 : HVaP is mandatory for DAL C (DO254 table A-1)	Only HPAP is optional for DAL C		Objection	Not accepted	In DO-254/ED-80 table A-1, the note 4 indicated that the HVaP may be accomplished informally.
23	*DMAP*	8.4.2.2	34	second point b (for DAL A and DAL B devices) is not clear : what are the identified requirements ? (Requirements related to implementation, e.g. timing constraints, power, pin out …)?	Add some clarification and definition	Suggestion		Partially accepted	EASA thinks this section is understandable as it is used in current product for many years. The word "identified" has been removed as confusing and replaced by "device".
24	*DMAP*	8.4.3	34	The concept of "detailed functional description" (equivalent to conceptual design) is useless and could be confusing (with detailed design description)	Suppress this concept	Suggestion		Accepted	Sentence confusing and reworded.
25	*DMAP*	8.4.3	34	Second point "Additionally, for Level A and B devices" … and third point "note 6" Traceability activities seem to be almost the same for DALA/B and C . By the way this analysis is compliant with DO254 (when ignoring note 6). The phrasing is confusing	Add clarification and express the final result : additional activities (if any) for DAL A or DAL B	Suggestion		Accepted	Sub-section confusing and reworded.
26	*DMAP*	8.4.4	35	"IP life cycle data may need to be augmented to satisfy the guidance of ED-80/DO-254" is followed by a list of 3 activities to be performeddoes these activities represent the announced supplementary activities (to augment the IP life cycle)? [Ambiguity] or does IP life cycle be similar to a "standard" sub module life cycle?	Add precision	Suggestion		Accepted	Sub-section confusing and reworded.
27	*DMAP*	9.3.6	42	WCET is not described in the acronym list	Add definition in dedicated chapter	Suggestion		Accepted	§1,3 was updated.
28	*DMAP*	9.3.7	42	"sufficient ISE" requirements and "minimum amount of usage" seem in conflict		Suggestion		Not accepted	"Sufficient ISE" and "minimum amount of usage" are 2 different criteria not in conflict.
29	*Mentor Graphics Corporation*	4.2	12	Quality assurance is not DO-254 terminology	Change "quality assurance" to "process assurance" mid way down the page to be consistent with DO-254 terminology	X		Accepted	Agreed. This and a couple of other occurrences in the Certification Memorandum have been updated accordingly in the revised text.
30	*Mentor Graphics Corporation*	4.2	12	Formatting discrepancies (just a style issue)	Bullet items in list should either have or not have ":" following them, for consistency	X		Accepted	Agreed. The ":" have been removed consistently in the revised text.
31	*Mentor Graphics Corporation*	4.4	13	DOA not defined	Define this acronym when it is first used and in section 1.3. Note that in the US, this acronym commonly means "Dead on Arrival" (usually meaning some arrives at a hospital already dead, but can also be used as slang to mean a chip that is dead in the lab) -- so defining it here in its context is a good thing.	X		Accepted	This acronym has been added to the list in section 1.3 of the Certification Memorandum.

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32	*Mentor Graphics Corporation*	4.5	14	Define ETSO	Define ETSO here in its first use. It may not be clear to a US audience.	X		Noted	The acronym ETSO is included in the section 1.3 of the Certification Memorandum. For more information about ETSOs, information material is available on the EASA website. Therefore no change to the existing text is considered necessary.
33	*Mentor Graphics Corporation*	4.5.1	15	Tool assessment and qualification, not just qualification	The last item in the table should read "Tool assessment and qualification plans" to be more consistent with DO-254 terminology	X		Noted	It is agreed that ED-80/DO-254 introduces the notion of tools assessment and qualification. However the results of the tool assessment are generally consigned in the PHAC/HAS. If the assessment result shows the need to qualify a tool, a tool qualification plan is generally produced that contains only elements relative to the tool qualification. For this reason, EASA believes that the wording "tool qualification plans" is adequate in this table and no change is deemed necessary.
34	*Mentor Graphics Corporation*	4.5.1	15	Style change of subheadings occurs at item c	Different styles are used (some italic, some not) on the list items. Be consistent throughout the document on the style.	X		Accepted	EASA will attempt as far as practicable to harmonize the header formats.
35	*Mentor Graphics Corporation*	4.5.2 a.	15	Use of the word "design" is confusing. Should this be "concept" or "architecture"?	Change first sentence to read "…hardware requirements, design concept, hardware design language…"	X		Partially accepted	The term "design" here intends not only to address the concept or architecture but generally speaking the complete hardware design, including the conceptual design and detailed design activities. Therefore the term "hardware design" has been introduced in the updated text.
36	*Mentor Graphics Corporation*	4.5.2 a.	15	Missing word "transition"	The last sentence should probably read "The following are typical transition criteria…" This will make it consistent with other sections also.	X		Accepted	The text has been modified as suggested.
37	*Mentor Graphics Corporation*	4.5.2 a.	16	Tracing to implementation confusing	For a device (e.g., FPGA) complying to DO-254, what does it mean to have the implementation trace to the design? This has always been a confusing point of DO-254, and this serves to continue the confusion. The implementation is either the P&R netlist (which could potentially include traceability links, though it would not be very meaningful) or the chip itself --where all requirements would simply point to the device...? Please clarify what is expected when tracing to implementation, or get rid of this requirement. Note that this comes up again on page 35.		X	Accepted	EASA has noticed that some errors have been introduced in this section 4.5.2 that can explain your confusion. This has been corrected in the updated text.
38	*Mentor Graphics Corporation*	4.5.3	16	Same as comment #36		X		Not accepted	The wording "transition criteria" is already correct in 4.5.3.
39	*Mentor Graphics Corporation*	4.5.3	17	Same as comment #33		X		Noted	It is agreed that ED-80 / DO-254 introduces the notion of tools assessment and qualification. However the results of the tool assessment are generally consigned in the PHAC / HAS. If the assessment result shows the need to qualify a tool, a tool qualification plan is generally produced that contains only elements relative to the tool qualification. For this reason, EASA believes that the wording "tool qualification plans" is adequate in this table and no change is deemed necessary.
40	*Mentor Graphics Corporation*	4.5.5	18	HLR not defined	Define HLR at first use and add to abbreviations in section 1.3	X		Accepted	The wording "HLR" is improper and has been removed.
41	*Mentor Graphics Corporation*	4.5.5	19	SHE should be SHE	Item 3 "Not required for SHE" should be "Not required for SEH" Spell checker probably corrected this for you.	X		Accepted	"SHE" has been replaced with "SEH".

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42	*Mentor Graphics Corporation*	4.5.5	19	At what point is the system level testing audited?	Since in-system testing is a requirement of the verification objectives, at what point does this get audited? I do not see this explicitly called out in any of the reviews.		X	Accepted	The implementation verification is performed during the Hardware Verification Review. In order to clarify this, "component verification" has been replaced by "implementation verification" in section 4.5.5, to be consistent with the section 8.4.2.1.
43	*Mentor Graphics Corporation*	4.7 a	20	The term "manufacturing inspector" is confusing.	The text here describes someone knowledgeable about hardware process assurance and configuration management. I would think this would be the "Process Assurance" representative. To call this a "manufacturing inspector" is very confusing.		X	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.
44	*Mentor Graphics Corporation*	5.3.3 a.	25	Use of "c.f. b." not understood	I do not know what this stands for, and couldn't find a definition online. I suspect it is perhaps a French (or EU flavoured English?) notation. You should probably remove this so as not to confuse an international audience.	X		Noted	Actually it is written "cf. b." and not "c.f.b." "cf." an abbreviation for the Latin word "confer" and is used to refer to other material or ideas which may provide similar or different information or arguments. "b." is simply referring to the item "b." below the table.
45	*Mentor Graphics Corporation*	6	28	SEU should be SEE	The descriptive text actually defines SEE not SEU. Suggest changing to "A Single Event Effect (SEE) occurs when a bit is flipped in the hardware due to, among other causes, the effects of ratiation on microelectronic circuits. SEE may be transient (typically non-destructive errors that cause a temporary change on combinational logic, called single event transients or SETs) or permanent (typically destructive errors that cause a change in a memory cell value, called singe event upsets or SEU)." And then change SEU to SEU in the remaining text.		X	Accepted	§6 was modified as proposed.
46	*Mentor Graphics Corporation*	7	29	ARP 4754 or 4754A?	Suggest changing ARP 4754 to ARP 4754(A) as this new revision is published and will be invoked as policy later this year.		X	Accepted	ED79/ARP4754 is now referenced at version A.
47	*Mentor Graphics Corporation*	8.1	30	ETSOA not defined	Define this acronym when it is first used and in section 1.3.	X		Partially accepted	ETSOA acronym is suppressed.
48	*Mentor Graphics Corporation*	8.2	30	Simple ASIC not likely	I understand you may want to put ASIC in the second bullet, but I cannot picture a simple ASIC.	X		Noted	Some manufacturer claim that some ASIC are simple in term of functionality and we had to introduce this. However, in any case the questions related to the simple/complex criteria need to be answered.
49	*Mentor Graphics Corporation*	8.4.1	31	"The specification" could be clearer	May consider changing text to "The specification (i.e., requirements allocated from the system)…".	X		Accepted	Sentence confusing and reworded.
50	*Mentor Graphics Corporation*	8.4.2.1 f)	33	Synthesis checks not called out	Checking for how a design will be synthesized is one of the most significant set of checks that could/should be done on HDL code, in support of preventing downstream errors. Perhaps the 3rd bullet on this page is intended to specify this, but I'd suggest calling this out more strongly with a specific bullet such as "The need to ensure the design will synthesize properly"	X		Accepted	Bullet added.
51	*Mentor Graphics Corporation*	8.4.2.1 g.	33	"complete verification coverage" not guaranteed by code coverage	Code coverage can only indicate if HDL elements/constructs have been exercised -- not that they have been "completely" verified. This is something that is not well understood unless you are a verification expert. I'd suggest changing the wording to "…obtaining 100% code coverage." If you want a more complete metric of verification coverage, an assertion-based approach can offer this (though this is not yet a practice followed in the mainstream).	X		Accepted	Sentence confusing and reworded.

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52	*Mentor Graphics Corporation*	8.4.2.1 g.	33	State coverage should be included for FSMs	FSM coverage includes state coverage and transition coverage. I'd recommend requiring both for complete FSM coverage.	X		Partially accepted	The sentence for state machine starts by "additionally" which means that state coverage should be achieved anyway and decision coverage for level A.
53	*Mentor Graphics Corporation*	8.4.2.2 a)	34	This paragraph is confusing	8.4.2.1 g talks about code coverage. This is currently the most common mechanism used to support an Elemental Analysis approach. But here elemental analysis is brought up and described as a bottom up approach. I have no idea what this means or how one would do this beyond the code coverage metrics which today are acceptable. And then the description of Analysis of Implementation is also confusing. Besides running an equivalency check on the place and routed netlist -- which can find any parts of the design that are "new" or "different" from the HDL code you thoroughly verified previously -- I know of no other way of doing this on the implementation. If there is some real example of a way to do this, you should state it as an example.		X	Accepted	Sub-section confusing and suppressed.
54	*Mentor Graphics Corporation*	8.4.4	35	Functional robustness verification at isolated IP level is confusing	It seems like the robustness of IP should be tested as it is used in the chip -- to ensure nothing bad happens in the chip context, so stating that "functional robustness verification should be performed at the isolated IP level" is confusing. Suggest changing to "...performed at the chip level."		X	Accepted	Sub-section confusing and reworded.
55	*Mentor Graphics Corporation*	8.4.5	35	TLD/HCI descriptions not clear	I have found mention of TLD in DO-254 quite confusing when you try to use it in the context of a device. It would be very good to actually explicitly define what is meant and needed for a TLD for device level compliance. Also, compare or contrast this with the HCI and HECI. This would be a great place to clarify all this.		X	Partially accepted	EASA agrees that ED-80/DO-254 is not clear around the area of TLD. The Certification Memorandum tries to clarify this but cannot redefine comprehensively those items as some companies strictly adhere to ED-80/DO-254.
56	*Mentor Graphics Corporation*	8.5	36	Saying "sequential" state machines may be limiting	You may want to just say "Finite state machine" and not limit it to sequential ones. Otherwise you may give people a loophole here.	X		Accepted	EASA already identified this inconsistency but wanted to use as far as possible the FAA AC20.20152. As the Industry is not happy with that, the word "sequential" has been removed.
57	*Mentor Graphics Corporation*	8.5	36	Extra "that"	Change "…specified criteria and that are complete" to "…specified criteria and are complete".	X		Accepted	Word "that" suppressed.
58	*Mentor Graphics Corporation*	9.3	39	The word "outcome" may be confusing	I do not believe that the actual outcome of these activities will be known at the time the PHAC is written. Do you mean HAS document? Or do you mean just that the intended activities (not their outcome) be documented in the PHAC?	X		Accepted	The sentence was updated like this: "A summary of the outcome intended activities of these activities should be documented in the PHAC. A summary of the outcome of these activities should be documented in the HAS. "
59	*Mentor Graphics Corporation*	10	47	"performing" should be "perform"	Change "It may be impractical to performing…" to "It may be impractical to perform…".	X		Accepted	The word was replaced as proposed.
60	*Mentor Graphics Corporation*	11.2.2	54	Use of "responsible" and "responsible(s)" is odd	Usually we would say "responsible parties" or "those who are responsible for …" I'd suggest changing the wording. This occurs at several places on this page.	X		Accepted	To update Section 11 using "responsible parties" instead of "responsible".
61	*Mentor Graphics Corporation*	12.1 & 12.2	56	Reference to 21A.XX confusing	The description in 12.1 Background is confusing because it is full of references to 21A.XX. It might help to add this to the Regulatory references in 1.2, but also consider cleaning up and clarifying this section. Even just saying it as "CS Part 21, Subpart D, paragraph 21A.91 proposes...”	X		Partially accepted	EASA would like to keep the Part21 background section which is here to introduce only the subject.
62	*Mentor Graphics Corporation*	13.4	58	Error vs. fault	Is an error that makes it into the hardware a fault? If so, you might want to say that explicitly. The use of the word "flaw" as opposed to "error" introduces another term.	X		Partially Accepted	As indicated in the "fault" definition, a fault is a manifestation of an error or a random event.

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63	*Airbus Military*	1.4	8	In the Integrated Circuit definition:- 1st bullet states that Digital integrated circuits are typically microprocessors, whilst integrated can be really much simpler, such as quad AND gate. Please reconsider this statement.- Replace "cores" with "processing cores". A core is a term used for IP that do not have to be necessarily a microprocessor or "processing core".- In the last paragraph remove the comma in the piece of text "highly complex, COTS Microcontroller".	As indicated in comment summary	Suggestion	Substantive	Accepted	Text was improved as proposed.
64	*Airbus Military*	1.4	9	In the Simple Electronic Hardware (SEH) definition clarify whether it refers to Simple ASIC or PLD only or it refers as well to COTS devices, bus controllers, flip-flop, multiplexers, converters, memories, gates, PCBs, discrete components, passive components, ...	Area of concern/should require further and detailed discussion.	Suggestion	Objection	Not accepted	The definition introduces the hardware device in general, thus this definition may be applicable to ASIC, PLD and COTS components.
65	*Airbus Military*	4.5.4 a. (4)	17	Include HECI also in this point or in a (5) one. But please remember that this is part of the TLD.	As indicated in comment summary	Suggestion	Substantive	Accepted	HECI has been added to item (5).
66	*Airbus Military*	5.3.1 a. (1)	23	Replace "He" with "He/she"	As indicated in comment summary	Suggestion	Substantive	Accepted	The text has been updated as suggested.
67	*Airbus Military*	5.3.2 a.	24	Here and along the document can be found certain inconsistencies when referring to AEH or CEH.	To be discussed with each applicant in the frame of PID discussions.	Suggestion	Substantive	Accepted	The wording "EASA SW/CEH Panel" has been changed to "EASA Panel 10".
68	*Airbus Military*	5.3.3 b.	26	Meaning of "Action Devices" should be clarified.	Area of concern/should require further and detailed discussion.	Observation	Substantive	Accepted	The erroneous wording has been corrected to "Action Items".
69	*Airbus Military*	5.3.3 c.	26	In the table, "PHAC" column / "Low" row, the information there "For information (in cases of no EASA involvement)" should not be there but in the "None" row, as this cell is for the case of Low EASA involvement and not for the case of NO EASA involvement.	As indicated in comment summary	Suggestion	Objection	Accepted	The mention (in cases of no EASA involvement)" has been removed.
70	*Airbus Military*	6	28	MBU should be mentioned for comprehensiveness. SEU term does not include the MBU case and this is as much as important (even the more difficult to tackle with the latest technology).	As indicated in comment summary	Suggestion	Objection	Accepted	§6 was modified as proposed.
71	*Airbus Military*	8.4.1	32	Penultimate paragraph: Indicate the exact ED-80/DO-254 paragraph in which is defined how the requirements validation processes should be documented as required by the hardware control category.	As indicated in comment summary	Suggestion	Objection	Accepted	The sub-section 8.4.1 has been improved to indicate the reference in Table A-1.
72	*Airbus Military*	8.4.1	32	Last paragraph: Indicate the exact ED-80/DO-254 paragraph in which independence FOR THE VALIDATION PROCESSES is defined, IF ANY. I'M AFRAID independence IS NOT DEFINED FOR THE VALIDATION PROCESSES.	As indicated in comment summary	Suggestion	Objection	Partially accepted	EASA fully agrees with the request to indicate in the appropriate section number in the Certification Memorandum but it is a clarification and therefore the section does not exist.
73	*Airbus Military*	8.4.2	32	The distinction between: - Verification of the design description stands for verification of the design at code level (e.g. HDL) and thus before Place & Route. - Verification of the implementation stands for verification after Place & Route, comprising timing simulation, and verification with the component itself. ... is very interesting, But "after Place & Route" netlist is still a model. I would recommend performing verification at every stage of the actual practices of PLD/FPGA/ASIC/SoC design.	As indicated in comment summary	Suggestion	Objection	Partially accepted	The intent is really to request that some verification activities need to be done when the device is placed and route and the 2 sentences have been written in that sense. The following sub-sections clarify this request.
74	*Airbus Military*	8.4.2.1 e)	32	Verification independence should be enhanced. The verification processes independence for level A & B defined in ED-80/DO-254 is very weak. Everyone today agrees that for a critical design the verification spec should be written by a person different to the design author.	As indicated in comment summary	Suggestion	Objection	Not accepted	The independence concept is well defined in ED-80/DO-254 and trying to precise it beyond the standard may create confusion.

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75	*Airbus Military*	8.4.2.1 f)	33	At the very end, replace: with.	As indicated in comment summary	Observation		Not accepted	Not understand the comment, all instances of ":" are correct.
76	*Airbus Military*	8.4.2.1 g)	33	If it is accepted that the HDL code coverage is measured at sub-function (block) level to alleviate the HDL code coverage measurement at device level, it should be at least clearly indicated that both, very especially the one at sub-function (block) level is based on requirements. Yet is debatable that code coverage at block level can take into account all situations at device level.	As indicated in comment summary	Suggestion	Substantive	Partially accepted	EASA agrees with the intent but no change as ED-80/DO-254 description is correct.
77	*Airbus Military*	8.4.2.2 For levels A and B devices d)	34	Verification independence should be enhanced. The verification processes independence for level A & B defined in ED-80/DO-254 is very weak. Everyone today agrees that for a critical design the verification spec should be written by a person different to the design author.	As indicated in comment summary	Suggestion	Substantive	Not accepted	The independence concept is well defined in ED-80/DO-254 and trying to precise it beyond the standard may create confusion.
78	*Airbus Military*	8.6.2	37	Never understood why this type of tool should not be assessed, even if it is neither a design nor a verification tool. I believe ED-80/DO-254 Section 11.4.1 item 4 should be made not applicable. Yet the case-by-case policies should be avoided. It is better saying nothing than leaving it to arbitrariness.	As indicated in comment summary	Suggestion	Substantive	Not accepted	EASA thinks the ED-80/DO-254 guidance is correct in that area.
79	*Airbus Military*	9.3	39	Minor cosmetic "finding": There is a very big blank in the text "Simple COTS ICs and Simple COTS microcontrollers" between "ICs" and "and". Revise text editor configuration.	As indicated in comment summary	Observation		Noted	This is inherent to MSWord justify function.
80	*Airbus Military*	9.3.1 [1]	39	In the 1st bullet " Its development assurance level,", in "Note: If the device DAL is lower than the DAL of the equipment in which it is embedded, ED-80/DO-254 Appendix B should be used to justify the DAL assignment." indicate what ED-80/DO-254 Appendix B specific section is referred. It is unclear what this reference refers to.	The reference to ED-80/DO-254 Appendix B should be more explicit.	Suggestion	Substantive	Noted	If the device DAL is lower than the DAL of the equipment, then this device DAL assignment should be justify. One proposed way to justify it is described within the full ED80 appendix B:- perform a failure path analysis at equipment level (ED80 appendix B §2)- take into account architectural mitigation , product service experience and verification methods (ED80/DO-254 appendix §3).
81	*Airbus Military*	9.3.1 [1]	39	On the 2nd bullet, refers definitions in section 1.4.	Consistency between this section and definitions in section 1.4 should be improved.	Suggestion	Objection	Accepted	The wording was improved.
82	*Airbus Military*	9.3.2 [2]	39	User manual, datasheet, device errata sheet and user manual errata sheet, installation manual (including the hardware/software interface and the activation/deactivation of COTS functions) are not Life Cycle Data but Usage Data, or, alternatively Utilization Data, Operational Data or Operational Specifications data. Please correct the section 9.3.2 title and text.	As indicated in comment summary	Suggestion	Objection	Accepted	The title of the section was changed.
83	*Airbus Military*	9.3.5 [9]	41	User manual, datasheet, device errata sheet and user manual errata sheet, installation manual (including the hardware/software interface and the activation/deactivation of COTS functions) ARE NOT Life Cycle Data but Usage Data, or, alternatively Utilization Data, Operational Data or Operational Specifications data. First bullet need to refer to the Usage data. Please refer to the Usage data.	As indicated in comment summary	Suggestion	Objection	Accepted	The wording was updated.

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84	*Airbus Military*	9.3.7 [13]	42	3rd bullet: The criticality of the usage of the component (e.g. involved in a Catastrophic failure path…), is not necessary, what matters is its functionality and performance under the given environmental conditions.	As indicated in comment summary	Suggestion	Objection	Not accepted	In Service Experience gained in critical application will be more appreciate then from non critical application. Thus EASA deemed important to add this attribute of the In Service Experience.
85	*Airbus Military*	9.3.12	45	Sufficient or low ISE is not defined for DAL D. It should be defined it in section 9.3.7, but anyway DAL D should not be addressed, for consistency with the lowest DAL defined for ASIC/PLD.	As indicated in comment summary	Suggestion	Objection	Partially Accepted	Sufficient or Low ISE is suppressed. DAL D column is also suppressed.
86	*Airbus Military*	9.3.13	46	Sufficient or low ISE is not defined for DAL D. It should be defined it in section 9.3.7, but anyway DAL D should not be addressed, for consistency with the lowest DAL defined for ASIC/PLD.	As indicated in comment summary	Suggestion	Objection	Partially Accepted	Sufficient or Low ISE is suppressed. DAL D column is also suppressed.
87	*Airbus Military*	10.1	47	Mid page, correct reference to "Section 7 and section 8 of this Certification Memorandum" to "Section 7 and section 9 of this Certification Memorandum".	As indicated in comment summary	Observation		Accepted	Corrected as proposed.
88	*Airbus Military*	11.2.2 7.	54	Correct reference to inexistent paragraph 13.1.b.	As indicated in comment summary	Suggestion	Objection	Accepted	Typo error. It should say 11.1.b.
89	*Randall Funton*	General		Define all acronyms. WCET, HLR, HVP are used and not defined.				Accepted	WCET definition was added. HLR and HVP were removed from the text.
90	*Randall Funton*	General		Use explicit lists instead of an ellipsis.				Noted	It is not always possible to avoid ellipsis.
91	*Randall Funton*	General	None	Need to clarify how this would apply to programs already one or two years in progress.				Noted	It is not the intent of EASA to make this Certification Memorandum applicable to the projects already in progress.
92	*Randall Funton*	General	None	This document presupposes the use of state machines in PLD designs. State machines are a design technique that may not be reflected in the requirements. Further, state machines often reflect the state of registers or outputs that are not directly observable on device output pins which makes device verification testing difficult. State machines, especially one hot encoded are very susceptible to SEU effects and should be carefully considered for safety critical designs. There are other, more deterministic, designs techniques that would be better suited to safety critical designs.				Noted	This Certification Memorandum does not presuppose the use of state machines in PLD design, but because this type of design exists and was already encountered during Certification projects, EASA clarifies how they should be handled.
93	*Randall Funton*	General	None	The word "conformity" should be reserved for formal system level drawing and hardware checks.				Noted	The word "conformity" is used many times in this Certification Memorandum. EASA does not understand to which "conformity" Randall Funton is referring to.
94	*Randall Funton*	1.4		SEH definition: hysteresis does not seem germane to SEH definitions. Please elaborate on the relevance.				Not accepted	EASA proposes to keep this term" hysteresis characteristic" as it has been used on past projects by some suppliers to demonstrate the simplicity of some components.
95	*Randall Funton*	1.4		SEH definition: number of states in a state machine while important is not as relevant as the observability of the effect or indications of those states on the output pins.				Not accepted	The number of state may be a criteria part of a set of criteria.
96	*Randall Funton*	2		CGPs are not necessarily limited to display systems. Due to the inherent architecture of a CGP, the multiple cores are well suited to any calculation intensive applications. While these may not currently be in aerospace applications, they could soon be attempted.				Noted	EASA will take into account these new application of CGP in due time.

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97	*Randall Funton*	4.2		Under sampling: DO-254 Section 6.2.1 item 2, 6.2.2 item 3 only discuss traceability of requirements, implementation, verification procedures/results. In typical PLD programs, the HDL is the “design” and the tracing is done from requirements to the design (which is the code).Tracing from requirements to the design is not part of DO-254.Tracing from the design to the test cases is not part of DO-254.Test cases, while useful, are also not a part of DO-254.				Noted	What you say is correct if focusing only on the basic ED-80/DO-254. However the section 8 of this Certification Memorandum provides additional clarification on what is expected in terms of traceability. This guidance has of course been taken into account when writing these guidelines on Hardware review process.Therefore no change to the existing text is considered necessary.
98	*Randall Funton*	4.3		Item b – calls for “equivalent software review process”. Not sure why this is in an AEH memo.				Accepted	The word "software" has been replaced by "hardware".
99	*Randall Funton*	4.4		Title of section is “Objectives of the Hardware Review Process” yet no specific objectives are defined.				Noted	The comment is acknowledged by EASA, however in order to keep this section harmonized with the FAA Order 8110.49, no change to the text is considered necessary.
100	*Randall Funton*	4.5		This CM should clearly distinguish between system conformity (for qual test, etc) and configuration management for a PLD.				Noted	The comment is not understandable and is not related to this section 4.5. In the absence of a proposed solution, EASA considers that no change to the current text of section 4.5 is necessary.
101	*Randall Funton*	4.5.2 a. (1)		Tracing conceptual hardware design data is not part of DO-254 objectives. Note too that this would skip right past the actual hardware requirements. Perhaps this section should be discussing the hardware requirements.				Accepted	EASA has noticed that some errors have been introduced in this section 4.5.2 that can explain your confusion. This has been corrected in the updated text.
102	*Randall Funton*	4.5.3 a.		Note that there is no way to directly verify “code” in a hardware design. At best, the simulation can show behavioural performance of the hardware configuration represented by the HDL.				Noted	In the absence of a concrete suggested resolution, the text is not modified.
103	*Randall Funton*	4.5.4 a.		Item (3) in first list and item (1) in second list should clarify between system conformity (for qual test, etc) and configuration management for a PLD.				Partially accepted	The section 8.4.6 has been updated in the Cert Memo in order to better define the Hardware Conformity Review.
104	*Randall Funton*	4.5.5		Wording: “The following table provides a summary of the …”. It does not provide an overview.				Accepted	The text has been updated accordingly.
105	*Randall Funton*	4.5.5		Audit objective 2 in Table: introduces “HLR” which is usually a software concept. Audit objective 2 in Table: cites HVP vs requirements and design. Tracing from test procedures to design is not part of DO-254.				Accepted	The wording "HLR" is improper and has been removed.
106	*Randall Funton*	4.7		Wording: in the title, Documentation should be Documenting.				Accepted	The change has been performed as suggested.
107	*Randall Funton*	4.7 a.		15 working days is not enough lead time to prepare for a planning review.				Noted	EASA received contradictory comments about this figure. No change to the text is considered necessary.
108	*Randall Funton*	4.7 c.		The review should also assess outsourcing and oversight and respective plans for same.				Accepted	An item (5) has been added to cover "Certification authorities’ review of the supplier oversight."
109	*Randall Funton*	5.3.3 b.		Explain “Action Devices”.				Accepted	The erroneous wording has been corrected to "Action Items".
110	*Randall Funton*	5.3.3 c.		Explain relevance of CAT1, CAT2 and CAT3 under the table.				Noted	The reason for this note is to provide an example of categorizations that are commonly used by applicants.
111	*Randall Funton*	7		While this addresses the original intent of DO-254, this will prove problematic for certification programs that have already started. Need to understand how this would apply or impact programs already well under way.				Noted	This Certification Memorandum does impact programs on which Certification basis (including Guidance Material) have been defined.
112	*Randall Funton*	8.3		See comments above on state machines.				Noted	This comment has been answered in the frame of comment 92.

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113	*Randall Funton*	8.3		It will be difficult to determine many of these characteristics in a planning phase to put it in a PHAC.				Not accepted	It is essential to classify device at the beginning of the project to define the development and verification activities and it therefore be documented in the PHAC.
114	*Randall Funton*	8.4.2.1 g)		See comments above on state machines.				Noted	This comment has been answered in the frame of comment 92.
115	*Randall Funton*	8.4.2.1 i)		Review of a design against a conceptual design is not part of DO-254.				Accepted	The sentence has been reworded to avoid confusion.
116	*Randall Funton*	8.4.2.2		Under "For levels A and B devices" (which should be For level A and B devices) -- hardware is often many separate functions combined in one device. This is the case for glue logic between a processor and I/O or any number of hardware applications. Many PLD uses do not involve sub functions or integration of sub functions. There are simply many different functions operating in parallel or even sequentially.				Noted	
117	*Randall Funton*	8.4.3		2nd bullet introduces "high level architecture" and equates the "detailed functional description" to the conceptual design. This is not in alignment with DO-254 definitions or objectives.				Accepted	Wording has been changed to avoid confusion.
118	*Randall Funton*	8.4.5		3rd bullet – Last sentence should probably refer to the HECI, not the CM.				Partially accepted	Sentence changed and refers now to HCI, HECI and TLD to avoid confusion.
119	*Randall Funton*	8.5		3rd bullet – Many caveats should apply; such as controllability of inputs and observability of outputs.				Partially accepted	EASA thinks it is covered in this section 8.5.
120	*Randall Funton*	9.3		2nd bullet – Available should be Availability.				Partially accepted	Replaced by "Device data".
121	*Randall Funton*	9.3.1		3rd bullet – Assumes data processing, when many of the devices have data buses, PWM controllers, I/O decoders, ADC or DAC functions. None of these are data processing.				Noted	It is assume that each device includes data processing. The objective is to identify the "complex" data processing.
122	*Randall Funton*	9.3.6		[12] 2nd bullet – perhaps this should use Failure Modes and Effects Analysis or Functional Failure Path Analysis instead of functional safety analysis.				Accepted	Wording changed to avoid misinterpretation.
123	*Randall Funton*	9.3.6		[12] 2nd bullet – not sure why "used configuration" is in quotes.				Accepted	Wording changed as "• Ensure that the programmed configurations which is used (e.g. the register programming status) actually configure the device as expected."
124	*Randall Funton*	9.3.11 & 9.3.12 & 9.3.13		Add introductory text to explain the intent of this section.Call out the tables from the text.				Accepted	Introductory text has been added.
125	*Randall Funton*	10.1		CGP usage may not be restricted to display, they are ideally suited to computation intensive applications.				Not accepted	Up to now, CGP were only encountered in display systems.
126	*Randall Funton*	10.1		CGPs are often hardware accelerators, especially for a graphics pipeline.				Not accepted	Without suggested resolution, the comment was not accepted.
127	*Randall Funton*	10.1		1st bullet – CGPs consist of multiple ALU cores that usually operate synchronously. They need to sit on the address/data bus and typically walk through large blocks of memory. This needs to be synchronous, asynchronous would not allow the memory accesses needed. CGPs often exceed hundreds of millions of gates, far exceeding 100M transistors. These devices may or may not make their way in to aircraft applications since they are usually needed for 3D graphics.				Not accepted	Whatever the CGP include precisely, they are considered complex components.
128	*Randall Funton*	10.1		4th bullet – there are many CGPs well suited to displays that have been around for several years.				Not accepted	The subject of this section is to address the CGP. Other microprocessors are addressed somewhere else.

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129	*Randall Funton*	10.1		3rd para: this should refer to CGP instead of COTS microprocessors.				Accepted	The text was corrected.
130	*Randall Funton*	10.1		Under a. -- there are many CGPs well suited to displays that have been around for several years. Note that the design techniques for CGPs are the same as those used for processors. The risk is typically due to the cutting edge fabrication techniques, especially for large complex CGPs.				Not accepted	Without suggested resolution, the comment was not accepted.
131	*Randall Funton*	10.1		Under e. -- there are many CGPs well suited to displays that have been around for several years.				Not accepted	Without suggested resolution, the comment was not accepted.
132	*Randall Funton*	10.1		Under h. – it would be more appropriate to use FIT (failure in time) calculations derived from HTOL (high temperature operating life) tests.				Not accepted	Certification requirements are using the term "component failure rate", which is re-used here.
133	*Randall Funton*	10.2		This section should also discuss the use of device qualification test data.				Not accepted	EASA doesn't understand what is intended by "device qualification test data".
134	*Randall Funton*	10.3		Item f – this does not seem practical, even for software and microprocessor based display.				Accepted	EASA agrees. This is the reason why following information is added into item f: "EASA is aware that it would be extremely problematic to show that a CGP, or any other very complex COTS microprocessor device, does not contain any "undocumented functionality". EASA does not expect the applicant to provide 100% assurance of this point. However, the expectation is that the applicant will have a program that will test the device extensively, and one that will include a large amount of robustness testing, above and beyond the functionality that is expected to be provided by the device. A thorough program of this nature will be taken as evidence that the applicant has made a "best effort" to determine whether the CGP contains any undocumented features or functions that could affect the final design of the display system." No change of the text is proposed.
135	*Randall Funton*	10.4		Clarify whether this is referring to the display system cert plan or a PHAC.				Noted	The identification of the CGP should be done in the Certification Plan and the means selected by the applicant to cover the certification issues should be written into the Certification Plan or another document (e.g. PHAC).
136	*EADS Deutschland GmbH*	8.4.2.2	34	For Level A and B devices: hirarchical approach for verification of the implementation is a extremely high effort compared to the benefit of this approach.				Noted	The approach to capture, validate and verify the requirements in a top-down is developed in ED-80/DO-254.
137	*EADS Deutschland GmbH*	8.4.2.2	34	For Level A and B devices: "point b) An analysis of the internal implementation of the device should assess whether the verification against the identified requirments is sufficient to ensure the behaviour of the implementation of the device" What is the meaning of "internal implementation"?				Noted	The principle is to ensure that functional verification performed on the device in not invalidated by improper synthesis, place and route.
138	*EADS Deutschland GmbH*	8.4.3	35	third bullet: "This means that for DAL C devices, traceability should be established between requirements, the detailed design, the implementation and the verification procedure and results." what exactly is now the difference of the traceability data between DAL C and DAL A? in bullet two (traceability for DAL A and B) describes exactly a traceability for the HDL Code. Why is then for DAL-C the HDL Code is not explicitly stated?	Suggestion: a table which shows the required traceability for DAL-A and B for DAL C and for DAL D devices whould be helpful. For example: column 1 list all possible traceability path colomn 2 DAL A and B (Yes/No) column 3 DAL C (Yes/No) column 4 DAL D (Yes/No)			Partially accepted	The Section 8.4.3 wording has been improved to avoid confusion.

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139	*EADS Deutschland GmbH*	8.4.3	35	Traceability in the implementation is not possible				Accepted	Sentence has been deleted.
140	*EADS Deutschland GmbH*	8.3	31	Insert bullet after the second bullet with the content "Assessment of the complexity of the device".				Accepted	Sentence reworded as proposed.
141	*EADS Deutschland GmbH*	8.3	31	Delete second bullet "Service Experience" because a re-used component (ASIC/PLD) is considered as COTS.				Not accepted	This sub-section does not talk about COTS at all. A reuse ASIC or PLD component may be previously developed.
142	*EADS Deutschland GmbH*	8.4.2.1	33	(Clearly separate different functions,…)" this part needs more clarification.				Accepted	Sentence reworded.
143	*EADS Deutschland GmbH*	8.4.2.2	34	Unclear how to perform the "analysis of the implementation" on Post Post Place and Route Netlist level.				Accepted	Sentence suppressed.
144	*EADS Deutschland GmbH*	8.4.3	35	Not clear what is meant by "functional elements" because the term is not mentioned in previous sections.				Accepted	Sentence has been suppressed.
145	*EADS Deutschland GmbH*	9.3.2	40	Please define "design data".				Not accepted	The wording "Design data" is reused from ED-80/DO-254 §10,3 Hardware Design Data.
146	*Emcosys GmbH*	General		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	
147	*Emcosys GmbH*	General		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, instruction pipelines etc. Such features can lead to very large jitter of the CPU execution time.				Noted	It is not the EASA intention to explain applicants how to perform a Worst Case Execution Time analysis. It cannot be addressed in detail within this document because it can only be addressed on a case by case basis.
148	*Emcosys GmbH*	General		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.				Not accepted	Regression test should not focus only on the changes but rather on the unintended modifications which may have been performed. The real objective of non-regression test is really to ensure that system behaviour was not wrongly impacted by the change.
149	*Emcosys GmbH*	General		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.				Noted	It is not EASA intent to address this subject.
150	*UK CAA*	9.3	38 39	Was the omission of section 9.3.9 from the list of activities deliberate?				Noted	Section 9.3.9 contains activity n° [16]. This activity is not omitted.

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151	*UK CAA*	9.3	39	Section 9.3 (COTS AEH) contains the following sentence: "A summary of the outcome of these activities should be documented in the PHAC". I'm not quite sure of the intent of this sentence because the summary of the **outputs** of an activity would usually be placed in the HAS or a verification report. Did you mean to refer to the "required outcome" or to the HAS? Justification: The summary of outputs of activities usually goes in the HAS or similar document.	Replace reference to the PHAC with a reference to the HAS.			Accepted	The sentence was reworded: "A summary of the intended activities should be documented in the PHAC. A summary of the outcome of these activities should be documented in the HAS."
152	*UK CAA*	11.2.2	54	The final paragraph of section 11.2.2 refers to "paragraph 13.1.b". Was this intended to refer to paragraph 11.1.b?				Accepted	Typo error. It should say 11.1.b.
153	*Parker Aerospace Central Engineering*	4.5 a.	14	The change for reviews to be done at 75% will create a lot of rework if there are process issues. By doing the reviews at 50% you can evaluate the process and make corrections before too much work has been done.	Change to 50%.		YES	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 process assurance activity).
154	*Parker Aerospace Central Engineering*	4.5.5	18	Section 7 of the document requires DO-254 at the LRU level but section 4.5.5 deals with DO-254 only at the PLD level. More detail needs to be given on how to handle the specifics of DO-254 at the LRU level.			YES	Accepted	The guidelines introduced in this section 4 are meant to be generic. The specific approach at board/LRU level has been defined in section 7. In addition, the following wording has been introduced in the scope (section 4.3): "At board/LRU level, The hardware review process should follow the considerations introduced in section 7."
155	*Parker Aerospace Central Engineering*	7	29	There is not enough detail in this section to give guidance on how DO-254 should be used at the LRU level.	Remove requirement or provide more details about what is acceptable.		YES	Accepted	Section 7 has been improved to explain what EASA expects for LRU/CBA wrt ED-80/DO-254 compliance.
156	*EADS/APSYS*	General	None	A specific section for "exotic components "such as "IspPac" should be added considering that the implemented design could classified as Complex, even if few logical gate or node are used. (The number of test cases could be combinations). In this case, the structural coverage could not be performed by the available tools.	The Certification Memo should recommend specific design limitation to avoid the COMPLEX classification. The applicant should demonstrate that the implemented design is fully (all internal states and transition) tested by physical tests.			Noted	This Certification Memorandum addresses both complex and simple devices. Moreover Complex/simple classification should be agreed by EASA Thus there is no need to recommend specific limitation.
157	*EADS/APSYS*	8.2	30	There is a discrepancy between chapter 8.2 and 8.5 concerning activities requested against the assurance level for simple component (DAL D)	Certification memo should be updated to clarify the application for component DAL D.	Observation		Accepted	Section 8.1, 8.2 and 8.5 have been improved to avoid confusion.
158	*EADS/APSYS*	8.3	31	Quantitative criterion should be clearly identified to secure the classification for SEH and CEH.	Table of DO254 working group could be used as a baseline.	Suggestion		Partially accepted	EASA agrees that numbers could be provided here but those numbers are not harmonised among all manufacturers and suppliers, the DO254 list will be considered in the future.
159	*EADS/APSYS*	7	29	The certification Memo requires the DO254 compliance for LRU and CBA. But how is assess the classification (Complex or Simple) for LRU and CBA.	The certification Memo should describe the expected activities for LRU and CBA against to DO254 objectives with regards to the possible LRU/CBA classification.	Suggestion		Noted	There is no classification simple/complex for board, they are all considered simple by this Section.
160	*EADS/APSYS*	4.5	14		This paragraph defined the expected criteria to conduct the SOI audits. For SOI2 and SOI3 audit it would be preferable to precise that safety requirements are enclosed int the the expected 75% of progress.	Suggestion		Noted	We agree that these 75% should be a representative set of data, including some safety requirements. However as the goal of these reviews is to assess an overall process that is applicable to any type of requirement, EASA does not consider necessary to add a statement here.

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161	*EADS/APSYS*	4.5.2	15		The criteria to perform the SOI2 audit are defined in part a. The SOI2 audit aims to assess the activities conformity with the hardware plans, hence it would be preferable that the SO1 actions (hardware plans updated) are closed.	Suggestion		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).
162	*Eurocopter*	General & 2 & 3.1 & 3.2		This certification memo addresses topics beyond hardware aspects related to ED80/D0254: A lot of activities described in this CM are also strongly linked to Aircraft / system / software aspects for which ED80-ARP4754 is more adequate than ED80-DO254. Additionally some activities are covered by the applicant's DOA as required by part 21. For Example: - SEU topics need to be addressed from the Component to aircraft level. Especially the Single event rate should be integrated in safety analysis such FTA & SSA. - Hardware development assurance at Equipment and CBA need to be addressed correctly with system (HW&SW) perspective when the LRU & CBA contain SW. For example for a CPU CBA the allocation between HW and Basic software requirements package is a system activity outside the scope of ED80/DO254 - COTS AEH and Graphical processor need to be correctly addressed at equipment/system level but also by an appropriate SW integration - Problem report management affects HW part, system and aircraft - Properly overseeing supplier activities are already covered through responsibilities of the applicant having a DOA.	It should be stated that this CM gives guidance on how to address the hardware and system/equipment aspects of certification for compliance with ED80/DO254, ED 79/ARP 4754 and part 21.		Substantive	Noted	What EC mentions is already in the Certification Memorandum in various places when relevant.
163	*Eurocopter*	2.1		In the CM "Software Aspects of Certification" section 2.1 EASA made a comparison between the content of the CM and the content of existing FAA orders and notices. Such a comparison considering FAA Order 8110.105 should point out the similarities and major and minor differences as well.	Add a section addressing the comparison between the CM and FAA orders.		Substantive	Accepted	Chapter 2.1 was added.
164	*Eurocopter*	General	None	In today's programs, some applicants and/or hardware developers intend to reuse Previously Developed Hardware (PDH) from legacy systems in newly-designed or updated airborne electronic systems. Eurocopter consider that it should be relevant to add some clarifications on activities and data to be produced regarding this specific case.	Add a specific section related to previously developed HW (PDH) aiming at clarifying the ED80 section 11.1 and subordinate paragraph. Following suggestions could be considered for PDH: 1. Submit an assessment and analysis to ensure that the PDH is Valid and that the compliance shown by the previous aircraft Type certificate or TSOA was not compromised by: - Modification to the PDH for the new application, - Change to the function, use or failure condition classification of the PDH in the new application, - Change to the design environment of the PDH. 2. CEH, SEH devices that are unchanged, and used in exactly the same way, and at the same or equivalent DAL as in the previously approved system, require no additional design assurance. However a service experience analysis will be done to consolidate the design assurance. 3. CEH, SEH that are changed; a change impact analysis shall be done in order to determine which credit can be claimed on previous design assurance activities. For newly development activities the guidance of this CM should be followed.	Suggestion		Noted	EASA agrees that the ED80 section about PDH needs details and clarifications will be incorporated in future HW Certification Memorandum updates. EASA encourages EC to request Eurocae to reopen ED80 as well.
165	*Eurocopter*	1.3	6	The following acronyms are missing: LOI, TC, STC, CRI	Add missing acronyms	Suggestion		Accepted	These abbreviations have been added.

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166	*Eurocopter*	1.4 & 8.3 & 8.5 & 9.3.1	9 31 36 39	The classification simple/complex is not consistent within the whole document and could conduct to non-harmonized interpretation. Indeed it seems that there is a mix of ways to classify a component simple/complex either by design analysis, or exhaustive testing capabilities or both. For example according to design analysis based on the criteria given in section 8.3 and 9.3.1, HW functions like Adder/Multiplier, RAM controller, FLASH/RAM memory, RS/ARINC BUS controller, Local bus controller Compact flash... can be considered simple although the ability to verify by test on physical devices all requirements in all configurations can never be achieved.	Eurocopter suggest to classify complex/simple component according to only design criteria given in section 8.3. Based on this classification, 2 options can be proposed to design assurance : - 1st option: To consider the section 8.5 based on exhaustive verification of all requirement for all HW configuration - 2nd option: To apply a development process reduced to ED 80 -- section 5: Hardware design processes -- section 6: Validation and verification process -- section 7: Configuration management -- section 8: Process assurance For simple COTS to apply ED80 11.2, 11.3 and section 9.3.11		Substantive	Partially accepted	The criteria to define a component complex were improved.
167	*Eurocopter*	2	10	It should also be mentioned that the certification memorandum provides guidelines for single event upsets and provide clarification for change impact analysis.	Eurocopter suggest to add in the last paragraph: "This Certification memorandum: - Provide guidelines for single event upsets - Provide specific guidance for change classification as major or minor".	Suggestion		Accepted	The text was changed as proposed.
168	*Eurocopter*	3.2	11	For ETSO, the applicant needs to consider this CM in a similar way as for TC/ STC holder since the development assurance is mainly gained during the development of the ETSO equipment and not only during the development of the aircraft. Indeed it will avoid some trouble when Aircraft intend to install ETSO equipment without formal status regarding this CM. Thus, the TSOA letter shall state about the level of compliance with this Certification Memo.	Eurocopter suggest to remove the first sentence of third paragraph of section 3.2 " For ETSO, the applicant may decide …", and reword the preceding sentence (section 3.2, second paragraph) as follows: "For TCs, STCs and ETSOs, applicants should ensure they use the appropriate version of the certification memorandum."		Objection	Partially accepted	For ETSO, the Declaration of Design and Performance can be used to mention compliance to any Certification Memorandum.
169	*Eurocopter*	4	12	It is mentioned that "the section provides guidelines for conducting reviews during the hardware development life cycle of airborne system…" It is not clear if the review will be performed also during TSO equipment approval process.	Eurocopter suggest to add and clarify hardware review process which will be performed during ETSO approval process .		Substantive	Not accepted	The guidelines for the review process are not specific to a given type of EASA approval. They are to be applied in any case and also when auditing a piece of equipment in the frame of an ETSO project. Therefore it is not necessary to introduce this notion in this section.
170	*Eurocopter*	5.3.3	25	Could EASA described more precisely what are the processes and expectations of a desktop review (data to be delivered, comments form, acceptable schedule for data delivery and comment feed back..)	Eurocopter suggest to add clarification on the desktop reviews process. The following information could be included: - Data to be provided and schedule - Comments forms & format - Liaison for agreement	Suggestion		Partially accepted	The following text has been added to 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.
171	*Eurocopter*	5.3.3 b.	26	It is not clear what kind of EASA activities are expected when documents are submitted for agreement and for information. The Eurocopter interpretation is: - "For agreement" means: Formal EASA comment & Formal acceptation of the Data - "For information" means: Sent to EASA but no formal comment and no formal acceptation - "On request" means: On-site information at applicant facilities	Eurocopter suggest to clarify: - What are the differences between for information, for agreement and on request. - what kind of EASA activities are expected for data submitted for information or for agreement.		Substantive	Noted	EASA believes that these three terms are self-explanatory and confirms that Eurocopter interpretation is correct except for "on request" where the notion of on-site availability is not adapted (a document may be requested for desktop review). "On request" simply means that the document was not initially planned to be delivered but is finally necessary to support EASA assessment. No change to the Certification Memorandum text is considered necessary at this stage.
172	*Eurocopter*	5.3.3 b.	26	According to Type certification practices, certification data are either submitted to EASA for approval (Cat 1), for agreement (Cat 2) or accepted by EASA without further verification (Cat 3) after their approval by the applicant under DOA procedures. Eurocopter consider that similar classification could be applied.	Eurocopter suggest harmonizing the certification documents categorization with the categorization used at TC level.	Suggestion		Noted	As indicated, this classification is only an example used in several TC projects. The intent is not to harmonize with all possible classifications but the tailoring is made at project specific documentation (PID) level.

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173	*Eurocopter*	6	28	The wording "component single event upset safety analysis is confusing" because the safety analysis is performed at aircraft level and not at component level. In the scope of this CM, the wording component single event upset sensibility analysis will be more appropriate. This single event upset sensibility analysis will consist in determining the Single Event Rate at Equipment level. The rate will be used in aircraft safety analysis to show compliance with safety objectives at aircraft level.	Eurocopter suggest to write "single event upset sensibility analysis" instead of "component single event upset safety analysis" and add that "this single event upset sensibility analysis will consist in determining the Single Event Rate at Equipment level. The single event rate will be used in aircraft safety analysis to show compliance with safety objectives at aircraft level."	Suggestion		Partially Accepted	§6 was modified as proposed without mentioning single event rate which is not the only output expected from the analysis, but also identification of faults/failures of the components.
174	*Eurocopter*	7	29	The scope of application for DAL D equipment is not consistent with the current FAA/EASA practices that to not consider ED80/D0254 as the recommended means of compliance for DAL D equipment.Furthermore there is inconsistency on activities required for DAL D equipment. Section 7: ED80/DO254 objectives are not requested at LRU, CBA level, although in Section 8 ED80/D0254 objectives are requested for ASIC/PLD, Section 9: ED80/DO254 objectives are requested for COTS, Section 13 (PR): activities are requested for DAL D.	DAL D equipment should not be in the scope of this cert Memo.Suggested resolution: DAL D equipment have to be developed according to internal process by supplier compliant with EN9100.		Objection	Accepted	Section 7 has been improved to explain clearly what DAL levels are concerned.
175	*Eurocopter*	7	29	The demonstration that the ED80/DO254 objectives are met at equipment and CBA level can be difficult to claim for some sections of ED80/DO254: example: Design and verification tools qualification and application to Appendix A and Appendix B for DAL A, B Furthermore ED80/DO254 cannot be relevant to cover system aspects within the equipment.	Eurocopter suggest to restrict a demonstration of compliance with ED80/DO254 objectives at equipment and CBA level to - section 5: Hardware design processes - section 6: Validation and verification process - Section 7: Configuration management - Section 8: Process assurance Eurocopter suggest adding that appropriate system development assurance activities need to be applied at equipment level.		Substantive	Partially accepted	Section 7 has been improved to explain what EASA expects for LRU/CBA wrt ED-80/DO-254 compliance. EASA fully agrees that for most cases Section 5 to 8 would be the applicable sections however in some complex development considerations should be taken from Section 11. Section 9 and 10 are useful to understand the certification liaison and documentation subjects.
176	*Eurocopter*	8.1	30	It is mentioned in the note that "Compliance credit can be claimed for devices from an ETSOA provided that ED80/DO254 objectives are requested in the relevant ETSO." Eurocopter understand that this recognition of compliance allows to not requiring additional evidence of design assurance of ASIC/FPGA for installation. The ETSO equipment installer needs however to ensure correct installation taking into account the claimed DAL and OPR.	The Agency recognize, through ETSOA letter, compliance with ED80/DO254 for a given DAL. The ETSO equipment user needs however to ensure correct installation taking into account the claimed DAL and OPR.	Observation		Partially accepted	The note was not clear and the intent has been clarified.
177	*Eurocopter*	8.1	30	EASA wrote 'With the agreement of the responsible certification authority.....verification and validation at system and equipment level may be sufficient". Considering the objectives which need to be achieved in section 8.4 and 8.5, verification and validation at system or equipment level to cover properly the design of complex or simple ASIC/PLD could be questionable.	Eurocopter suggest to remove the sentence: "With the agreement of the responsible certification authority, for those devices requiring a development assurance level C, verification and validation at system or equipment level may be sufficient".	Suggestion		Not accepted	Section 8 is applicable to SEH as well and this statement may be valid in this case.

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178	*Eurocopter*	8.3	31	There is an inconsistency between section 8.3 and section 8.5 for simple SEH - Section 8.3 "As a result of the assessment of the criteria here above, the ability to verify by test on the physical device all the requirements in all configurations is a prerequisite for the classification of an device as simple" - Section 8.5 " In cases where the previous guidelines and particularly the comprehensive combination of deterministic tests and analysis associated with the test coverage analysis defined above is not feasible or is impracticable, then the applicant can use the approach described in the section 7 related to Development Assurance of Equipment and CBA"	Please refer to comment #165.		Substantive	Accepted	The sentence in section 8.5 was not clear and reworded.
179	*Eurocopter*	8.4.1	31	ED-80/DO-254 Section 10.3.2.1 "conceptual design data," and ED-80/DO-254 Section 10.3.2.2 "detailed design data" do not mention that "derived requirements should be created from the design data and design decisions". In this section it is mentioned only what kind of information needs to contain the conceptual and detailed design data.	Eurocopter suggest to remove the second bullet of §8.4.1.	Suggestion		Partially accepted	It is the understanding that conceptual design data and detailed design data should result in the creation of derived requirements. However the wording has been improved to avoid confusion.
180	*Eurocopter*	8.4.3	34	The 2nd bullet is unclear. - What is the meaning of "system requirements" and "high level architecture"? Do we have to understand system within the devices or aircraft system. If yes it should not be in the scope of this section focusing on ASIC/FPGA - What is the meaning of "hardware design schematic"? Is it the netlist of the ASIC/FPGA ? If yes it will be probably impossible to link requirement to the schematics provided by synthesis tools. - What is the meaning of "functional elements for the design assurance". Do we have to understand that we need to identify all elements of the FPGA which contribute to the allocation DAL A, B. Thus a FFPA will be necessary to determine which HW portions inside the ASIC/FPGA are linked to Failure condition CAT or HAZ.	Eurocopter suggest to reword as follows : "Additionally, for Level A and B devices, the applicant should ensure traceability between requirements, conceptual and detailed design and HDL code".	Suggestion		Partially accepted	System requirements are mentioned in ED80-/DO-254 section 5.1.2. High level architecture has been suppressed. Hardware design schematic and functional elements have been suppressed.
181	*Eurocopter*	9.3.1	39	According to the third bullet of 1st topics section 9.3.1 , the COTS classification as simple and complex is based on design function analysis. In this paragraph EASA do not consider as a pre-requisite to verify by test on the physical device all the requirements in all configurations required for ASIC/PLD. This inconsistency could lead to classify a function simple if implemented in a COTS device and complex if developed inside a FPGA.	Please refer to comment #165.		Substantive	Accepted	This sentence was added: As a result of the assessment of the criteria here above, the ability to verify by test on the physical device all the requirements in all configurations is a prerequisite for the classification of an device as simple.
182	*Eurocopter*	9.3.7	42	Eurocopter considers that the main issue which is to collect service history in a relevant way (number of operating hours in knwon COTS configuration) need to be addressed in the CM. For example, it would be probably possible to get an important number of operating hours for a component which will be used in other configurations intended for an aircraft application. Thus the memo should detail which level of similarity of COTS item usage is expected and what are the clear expectations with regard to ED80/DO254 §11.3.1 item 1.	Eurocopter suggest to clarify what are the expectations regarding the relevancy of the ISE in terms of similarity of hardware item usage with respect to application, function and operating environment.		Substantive	Noted	EASA considers that the clarification requested is already mentioned within the Certification Memorandum: -Operating environment is listed in the 2nd bullet, -Design assurance level is listed within bullet 3 -Applications are listed in bullet 5.

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183	*Eurocopter*	9.3.12	45	Sufficient In-Service Experience has to allow claiming credit on the design assurance of the complex COTS itself. Thus if we get sufficient ISE for complex COTS and highly complex COTS DAL A,B, C, the following activities are not useful - [5], bullet 2. When test activities focus to verify the behaviour of the COTS itself - [6], bullet 2 " … the rate of publication of errata." - [12], bullet 3, 4 - [14] All other activities need to be performed.	Eurocopter suggest reworking the table of the section 9.3.12 and section 9.3.13 regarding the fact that sufficient ISE allow to gain confidence only on the device behaviour itself and that activities of HW&SW integration are still necessary.		Substantive	Not accepted	Activity [5] bullet 2: concerns the validation of the usage domain of the COTS component. Whatever the Service Experience of the component, usage domain should be validated. Activity [6] bullet 2: Maturity of a component and its Service Experience may be de-correlated: Having the same number of hours of experience, 2 different components may not have the same maturity (evolution of new errata publication). Activity [12] bullets 3 and 4: No credit can be taken from the Service Experience of the component to ensure that functional safety analysis and performance assessment takes into account the used configuration of the device. Same thing for the bullet 4. Activity [14]: When the component Service Experience is sufficient, this activity is only requested in case of DAL A highly COTS component. The objective is to improve the stability and maturity knowledge of the component.
184	*Eurocopter*	11	53	The whole section addresses topics which go well beyond Hardware design assurance aspects as it covers integration and system management, roles and responsibilities in Aircraft development process.	Eurocopter suggest to remove this section or to focus only on Hardware design assurance aspects.		Objection	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. Similar approach is being followed by FAA (for software part, please refer to FAA Order 8110.110 Chapter 1)
185	*Eurocopter*	13.6	59	Eurocopter do not agree to address Levels A, B, C, D in the same way. The allocation of a DAL allows to implement different levels of activities to develop a system, HW, SW. It means that a difference should be made between equipment DAL A, B and C. Furthermore a root cause analysis on DAL C equipment could lead to the conclusion that if a DAL A process should have been applied, the problem should not have appeared. Thus this root cause can lead to force DAL C equipment supplier to apply DAL A process. Furthermore there is an unequal treatment between activities of root cause analysis required for FPGA/ASIC and complex COTS for which root cause analysis will be never feasible.	Eurocopter suggest to apply root cause analysis for DAL A,B equipment only. Concerning level C equipment EC consider that a root cause analysis will be performed case by case when such equipment may contribute to CAT or HAZ FC.		Objection	Not Accepted	EASA considers that performing the root cause analysis can reveal a need for re-classification of the associated Open Problem Report and therefore it is not possible to make exceptions for a specific DAL.
186	*Barco*	3.2	11	In an ETSO context, it is important to have as early as possible in the development process the requirements of Aircraft level expressed through CRIs. The latter can may happen lately in development process... As far as this certification memo reflects what to be found in CRIs for AEH, publication of this certification memorandum is facilitating the process from ETSO appliance/approval to final installation into aircrafts.		Observation		Noted	
187	*Barco*	4.5.2 b.	16	In general Hardware verification procedures and results shouldn't be mandatory for Hardware Development Review as far as they don't fulfil Hardware Development review requirements.	Hardware verification procedures and results shouldn't be in the list of table 4.5.2.b.	Suggestion		Accepted	"Hardware verification results" has been replaced by "Review and analysis results". Consistently, the same change has been performed for the procedures.
188	*Barco*	7	29	Applicability of DO-254 at board level isn't very clear when comparing paragraph 2 and 5. Paragraph 2 makes it applicable at board level while §5 exposes the possibility to provide evidence at higher level, including system level.	Propose key DO-254 objectives to fulfill at board level, LRU level such as requirement capture objectives, validation & verification process objectives, design reviews…	Suggestion		Partially accepted	Section 7 has been improved to explain what EASA expects for LRU/CBA wrt ED-80/DO-254 compliance.

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189	*Barco*	8.1	30	Comment on "For Level D components, but the ED-80/DO254 processes are still applicable". According to AC 20-152, DO-254 is not a requirement for DAL D component.	Remove the referred part or propose objectives for DAL-D component: for instance verification objectives to prove requirements are met.	Suggestion		Accepted	Sentence has been reworded to get harmonised with the FAA AC20.152.
190	*Barco*	8.4.2.1 i)	33	HDL design review (detailed design review) in DO-254 § 6.3.3.2 has the objective to prove that requirements are met/covered by the design, and not conducting HDL design review against concept design. In the breakdown activities from requirements to detailed design, it is important in Detailed Design Review to check that output of complete design activity (being HDL code & constraint file) is covering the requirements.	If a Hardware Design Language (HDL) is used, as defined in ED-80/DO-254 §6.3.3.2 a HDL code review (detailed design review) against requirements should be conducted.	Suggestion		Partially accepted	It is the EASA understanding that HDL may trace to conceptual design and detailed design and not only requirements. However, the wording has been improved to avoid confusion.
191	*Barco*	8.4.2.2 a)	34	"Comment is on the following sentence: "The objective of "analysis of the implementation" is to analyse the actual hardware implementation to find potentially unverified hardware that could lead to unexpected behaviour."We understand the importance to find potentially unverified hardware, however this target may appear impractical to realize directly at implementation level, meaning on post-layout implementation or on binary file in target Hardware, with the current tools available.While Elemental Analysis to find potentially unverified hardware can be entirely performed at HDL level, analysis of implementation can ensure that synthesis and Place & Route activity did happen following the correct constraints and is the correct translation of HDL code into physical gates. Verification of post-Place&Route implementation with the same test benches than HDL can also be used as independent assessment of the translation from HDL to post-layout implementation."	- Elemental Analysis objectives should only be mandatory at HDL level- Analysis of implementation shall ensure that synthesis and Place & Route activities are done correctly and in compliance/conformity with HDL Design & implementation constraints requests.	Suggestion		Accepted	Bullet a suppressed.
192	*Barco*	8.5	36	For simple ASICs/PLD there are certification requests for level D while in §8.2, applicability of §8 is restricted to DAL A,B,C devices.	2 possible suggestions: build consistent approach for DAL D level over ASIC/PLD and COTS or remove DAL D requirements.	Suggestion		Accepted	Applicability has changed to avoid confusion.
193	*Barco*	1.4	9	Simple Electronic Hardware definition is based on "comprehensive" testability of device while 'simple' classification is based on simplicity of the functions implemented in the device.	Simple Electronic Hardware should be defined as device implementing simple 'classified' functions.	Suggestion		Accepted	The definition of Simple Electronic hardware was improved.
194	*Barco*	9.2	38	Applicability of §9 is also for COTS DAL D, while section §8 isn't applicable for DALD.	Idem 8.5 '2 possible suggestions: build consistent approach for DAL D level over ASIC/PLD and COTS or remove DAL D requirements.	Suggestion		Accepted	This sentence was added and references to DAL D components was removed: "The objectives of ED-80/DO-254 processes, together with the additional considerations of this section of the Certification Memorandum, will need to be satisfied at the device level for those electronic hardware devices classified in accordance with Table 2-1 of ED-80/DO-254 as requiring development assurance levels A, B or C. For Level D components, the additional guidance of this Certification Memorandum does not apply but the ED-80/DO254 processes are still applicable."

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195	*Garmin International*	1.4	7	The definition for microprocessor does not seem to fit any products available in current times. For example bus controllers, timing processing, memory controller are now standard on every microprocessor. The definition for COTS microcontroller would seem to more closely match today's available products. Separating out different types of microcontrollers and microprocessors would seem to cause confusion and inconsistency with different applicants, in either case the device is not designed by the applicant, not designed for the specific aviation application, and life cycle data will be limited for DO-254 aspects.				Not accepted	It is true that today the used microprocessors are closed to the definition of the microcontrollers. Nevertheless with both definitions the full scope of "processors" is covered.
196	*Garmin International*	6	28	The guidelines for the SEU analysis should be based on DAL, similar to Appendix B of DO-254.	"One resolution is to use the same definitions as FAA Order 8110.105 for custom micro-coded components, COTS devices, and COTS Intellectual Property. Having consistency with that FAA Order would reduce confusion and inconsistency. In Order 8110.105, DO-254 aspects are targeted towards custom micro-coded components and COTS IP; those devices can be adequately addressed within a design assurance process."	Suggestion	Objection	Not accepted	This section asks the applicant to perform an analysis in order to determine the safety impact of such effects. There is no need to link this analysis with the DAL of the component as the safety analysis will already take into account the criticality of component.
197	*Garmin International*	7	29	The guidelines for equipment level and CBA level should be limited to higher criticality, similar to Appendix B of DO-254.	Restrict the SEU analysis to Level A and Level B only, similar to Appendix B of DO-254.	Suggestion	Objection	Not accepted	The SEU section asks the applicant to perform an analysis in order to determine the safety impact of such effects. There is no need to link this analysis with the DAL of the component as the safety analysis will already take into account the criticality of component.
198	*Garmin International*	7	29	There are provisions to use existing equipment level and CBA level processes for design assurance, if the cert authority agrees. If the applicant uses the same process for multiple pieces of equipment, it would seem unnecessary to get this agreement for every cert project.	Restrict the equipment and CBA processes to Level A and Level B only, similar to Appendix B of DO-254.	Suggestion	Objection	Partially accepted	Section 7 has been improved to explain clearly what DAL levels are concerned.
199	*Garmin International*	8.4.2	32	Verification of the design description, i.e. HDL, should be limited to elemental analysis for Level A/B (code coverage, decision coverage, etc.) Verification of the requirements should only be done on the implementation. The additional effort it takes to verify the requirements at both design description and implementation is not warranted.	Rewrite the section for requirements based verification and elemental analysis and what models to use.	Suggestion	Objection	Not accepted	The intent of Section 8 is to ensure that requirements have been validated and verified and that the implementation does not invalid this statement.
200	*Garmin International*	8.4.2.1 & 8.4.2.2	33	Design verification should not rely on simulating the HDL model. Requirements based verification should only be allowed on the implemented design. HDL model should be used only for elemental analysis.	Rewrite the section for requirements based verification and elemental analysis and what models to use.	Suggestion	Objection	Partially accepted	Both ED-80/DO-254 and this Certification Memorandum do not rely only on simulating the HDL and request some verification activities on the component itself.
201	*Garmin International*	8.4.3	34	Traceability should not differ between Levels A, B, C. DO-254 does not define traceability differences based on DAL.	Suggest to add Level C.	Suggestion	Objection	Accepted	Level C added.
202	*Garmin International*	8.4.3	34	Traceability to the high level architecture is listed, it is not clear what this means. Also the hardware design schematic is listed the same as detailed design, this does not seem consistent to DO-254. It is also listed to trace to functional elements, this can get confused with elemental analysis, and tracing to every line of code is not warranted.	"Suggest to trace between the following for levels A,B,C: System requirements, conceptual design (high level block diagram or functional description), detailed design (detailed description of state machines, logic equations, theory of operation), HDL source file (not each line of code/schematic block), and verification."	Suggestion	Objection	Accepted	High level architecture has been suppressed. hardware design schematic and functional elements have been suppressed.
203	*Garmin International*	8.4.4	35	Verification at the isolated IP level will not provide the intended robustness verification. This verification must be done on the implemented netlist in order to provide design assurance.	Include robustness verification of the IP during the device level robustness testing on the implemented netlist.	Suggestion	Objection	Accepted	EASA thinks there is a need to verify (or to get the verification results from the vendor) the robustness at the COTS IP level as it cannot be performed at device level.

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204	*Garmin International*	9.2	38	Complex Microcontrollers and Complex Microprocessors should not be treated differently with respect to this Cert memo. Coming up with a definition to distinguish between the two will be difficult and confusing. Also, the applicant will not have any more life cycle data available for microcontrollers compared to microprocessors.	Both microcontrollers and microprocessors should be out of scope for this CM.	Suggestion	Objection	Not accepted	§1,4 of this Certification Memorandum define which IC should be considered a Microcontroller or a Microprocessor. These definitions are deemed sufficient to avoid ambiguity in their identification.
205	*Garmin International*	9.3	38	All COTS devices should be handled the same way as circuit boards and entire units, existing processes should be able to certify these since they are typically mounted on the same boards and units addressed in section 7. The devices of the highest concern are already addressed in other cert memos, like graphical processors. The data identified in this entire section is not warranted.	Remove this entire section and cover it in section 7.	Suggestion	Objection	Not accepted	Circuit boards are not Commercial off-the shelf. Thus there is no possibility that processes used to handle the boards may be suitable for the COTS components.
206	*Garmin International*	10	47	COTS graphical processors are covered in detail in another cert memo, and most applicants have already addressed it. If this information is included in two different cert memos, dual maintenance will cause inconsistency for applicants.	Remove this entire section as it is covered in another cert memo.	Suggestion	Objection	Not accepted	This hardware Certification Memorandum will replace the old Certification Memorandum. Thus no duplication will be possible.
207	*FAA*	8.4.3	35	The following statement seems to go beyond the intent of the note 6 in appendix A of DO-254 for level C AEH: “Only the traceability data from the requirements to tests is needed” should be considered as not applicable. This means that for a DAL C device, traceability should be established between requirements, the detailed design, the implementation and the verification procedures and results."	Recommend this be deleted		X	Not accepted	It is the EASA understanding that traceability is needed for level C complex devices to ensure a correct behaviour.
208	*FAA*	8.5	36	"This paragraph states the following: ""SEH may be tested at the equipment level to demonstrate the device performs as required. That is, testing of the card, module, or Line Replaceable Unit (LRU) in which the SEH is installed may be used to show that the SEH satisfies the device level requirements with the same test procedures used to verify correct operation of the card, module, or LRU."" Not sure if all the applicant has to do is test the device in the card, module or LRU and not through ""a comprehensive combination of deterministic tests and analyses". I don't see how testing at a higher level will accomplish a comprehensive combination of deterministic test. Is this in addition to the comprehensive combination of deterministic tests?"	Recommend this be deleted or clarified. We only allow a level D simple device to be tested at the card or LRU level.		X	Accepted	Sentence suppressed.
209	*FAA*	9		COTS section introduces extensive new guidance for the approval of COTS. It will be real challenge to obtain and validate the data necessary to satisfy all of the activities.	Recommend we have a CAST telecon to discuss	X		Accepted	The intent of EASA is to discuss all relevant topics during CAST meetings when requested.

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210	*FAA*	9.3.2 [3]	40	Activity 3 states the following: “The applicant should verify that the manufacturer of the component has a deterministic and repeatable manufacturing process, The applicant should verify that the manufacturer of the component applies an internal component approval process (i.e. there are test procedures with detailed acceptance criteria). If the component manufacturer’s public data and training support are not sufficient to address the aspects above, then access to the component manufacturer’s private data should be requested and established.” The COTS manufacturer's manufacturing and design data are very proprietary and access to them would most likely be denied especially with the small relative size aerospace market.	Recommend the quoted text be deleted. Do concur with the other text in activity 3 requiring that the applicant verify that the manufacturer of the component has a documented quality management process	X		Not accepted	We consider that it is important to get the maximum information from the manufacturer. The information requested is not violating the industrial property rights.
211	*FAA*	9.3.5	41	"Activity 9 states the following: “The applicant should verify: That the component manufacturer manages in configuration the component life cycle data”. This statement is confusing. Not sure what is meant by the “manages in “configuration."	Recommend this sentence be clarified.			Accepted	The sentence was improved by referring to Configuration management objectives described within ED-80/DO-254: "That the component manufacturer manages in configuration (see ED-80/DO254 §7.1) the device data".
212	*FAA*	9.3.5	41	Activity 9 states the following: “How component changes implemented by the component manufacturer are controlled.” The component manufacturer may make minor changes that may not be evident and does not result in a part number change. The applicant may need to put in place a screening and acceptance process to ensure that the component still meets the system requirements (e.g. temperature, timing, functional, etc.).	Recommend this be changed to the following: “How component changes implemented by the component manufacturer are documented and controlled. If it can not be determined that changes have been made, the applicant should have a verification process in place to ensure that the component still meets the component's requirements (e.g. functional, temperature, timing, etc)."	X		Partially accepted	The sentence was improved: "How component changes implemented by the component manufacturer are documented and controlled."Nevertheless, there is no need to ask here for addition verification activity as already the activity [11] requests to perform Verification and Validation against the requirements of the component.
213	*FAA*	9.3.7	42	For activity 13, not sure how an applicant would obtain the in service experience from others outside their control (military, nuclear,, space, railway, automotive, bank, etc) and how EASA would validate this in service experience.	It may be better to specify that the component must be in commercial service for x number of years, and have the applicant identify the applications.	X		Noted	Many applicants ask us to detail the EASA acceptable criteria for sufficient Service Experience. These criteria help also to have an equal treatment between all applicants.
214	*FAA*	7	29	Section 7 states the following: "For DAL A, B and C, the ED-80/DO-254 objectives should be met at equipment and CBA level, unless, with the agreement of the responsible certification authority, an acceptable level of development assurance can be justified from the validation at the system or equipment level (e.g. by compliance with ED79/ARP4754 objectives)." The FAA has not required DO-254 at the equipment or circuit board assembly level. This may cause some issue with validations.	Recommend we discuss this at a CAST telecon		X	Noted	EASA agrees that this issue needs to be harmonised with other authorities as soon as possible. However, EASA does not create a new request as compliance to ED80/DO254 is requested by some applicants fro years. In addition, there is a need to deal with the inconsistency due to the lack of Development Assurance requested at system level (covers by ED79/ARP4754) and at item levels (SW cover by ED12B/DO178B and CEH/SEH by ED80/DO254).

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215	*Airbus*	General	None	This AEH Certification Memorandum: introduces several new aspects never discussed with EASA during previous Aircraft certifications (Properly Overseeing Suppliers, Oversight of AEH change impact analyses to classify AEH change as Major or Minor, Oversight of Open Problem Report) that should be addressed at a higher level (company policy, DOA). Introduces several new aspects for which the scope is larger than AEH. SEU and COTS Graphical Processors topics in fact also include software and safety aspects. Enlarges the scope of application of hardware development assurance to equipment, complete hardware including simple devices and DAL D. enlarges the scope of application of OPR management to equipment level. rewords and re-organizes already discussed and agreed applicant positions creating a doubt. Re-introduces some aspects already rejected in the frame of CRI discussions. claims as a responsibility for EASA software / hardware specialist the assessment of DAL allocated to hardware. Some new topics such as ED-80 / DO 254 application at LRU and board level and OPR management at equipment level should be first harmonized between EASA and FAA before being addressed in a Certification memorandum. For all of these reasons and rather than proposing short term "suggested resolutions", several areas of concern that should require further and detailed discussion are identified in the attached comment sheet. These areas should be addressed in the frame of aircraft certification CRI and PID discussions ED-80 /DO 254 being not yet recognized by AMC 25.1309 as a Means of Compliance for Hardware Development Assurance, ED-80 /DO 254 is indirectly mentioned in Aircraft Certification basis via CRI. Further clarifications / detailed discussion regarding this AEH Certification Memorandum should therefore be part of the CRI discussion. Such Certification Memorandum should not be called up in applicable CRI. CRI should remain self explanatory.				Noted	
216	*Airbus*	General	None	This AEH Certification Memorandum introduces several new aspects never discussed with EASA during previous Aircraft certifications (11, 12, 13.9). This AEH Certification Memorandum also enlarges the scope of application (equipment, complete hardware including simple devices), rewords and re-organizes already discussed and agreed applicant positions. For these reasons, several comments are labelled "area of concern/should require further and detailed discussion" without proposing short term "suggested resolution" but are identified as "to be discussed further and in detail in the frame of aircraft certification CRI and PID discussions".	Area of concern/should require further and detailed discussion.		Objection	Noted	
217	*Airbus*	General	None	This AEH Certification Memorandum introduces several new aspects for which the scope is larger than AEH (SEU, CGP).	Area of concern/should require further and detailed discussion.		Objection	Noted	

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218	*Airbus*	General	None	This AEH Certification Memorandum refers to ED-80 /DO 254. However ED-80 /DO 254 being not yet recognized by AMC 25.1309 as a Means of Compliance for Hardware Development Assurance, ED-80 /DO 254 is indirectly mentioned in Aircraft Certification basis via CRI. Further clarifications / detailed discussion regarding this AEH Certification Memorandum will therefore also be part of CRI discussion.	Area of concern/should require further and detailed discussion.		Objection	Noted	
219	*Airbus*	General	None	This AEH Certification Memorandum introduces several new aspects which are not yet harmonized with FAA requirements.	Area of concern/should require further and detailed discussion.		Objection	Noted	EASA and FAA are still in the process of harmonisation through CAST group.
220	*Airbus*	1.2	5	This Certification Memorandum dedicated to development Assurance of AEH, should not be used in conjunction with ED-14E / DO-160E dedicated to environmental conditions. This reference is not used in the text.	This reference should be removed.	Suggestion		Accepted	Reference to ED-14E / DO-160E was removed.
221	*Airbus*	1.4	8	For microprocessor the definition limits the type of component: only central processing unit, without "simple" peripherals such as A/D, D/A, UART, watchdog. This definition is more restrictive than the previously agreed one.	Area of concern/should require further and detailed discussion.		Substantive	Noted	The definitions of microprocessors, microcontrollers and highly complex microcontrollers cover the full scope of "processors" encountered today.
222	*Airbus*	1.4	9	In the Simple Electronic Hardware (SEH) definition clarify whether it refers to Simple ASIC or PLD only or if it refers as well to COTS devices, bus controllers, flip-flop, multiplexers, converters, memories, gates, PCBs, discrete components, passive components...	Area of concern/should require further and detailed discussion.		Substantive	Not accepted	The definition introduces the hardware device in general, thus this definition may be applicable to ASIC, PLD and COTS components and not PCBs.
223	*Airbus*	2	10	The statement that resistors, capacitors etc. are not in the scope is not in line with chapter 7. These components are part of the CBAs that are discussed.	Area of concern/should require further and detailed discussion.		Substantive	Not accepted	EASA confirm that singly packaged components like resistor, capacitor… are not addressed individually by this Certification Memorandum. Section 7 addresses boards' assemblies containing multiple singly packaged components.
224	*Airbus*	3.2	11	Certification Memoranda as introduced on page 1 ("not intended to introduce new certification requirements or to modify existing certification requirements") should not be called up in applicable CRI. CRI should be self explanatory.	Area of concern/should require further and detailed discussion.		Substantive	Not accepted	SW and HW Certification Memoranda will be introduced in product cert basis inside CRIs. This EASA way of working is in place for 3 years now and it will not change. However, with published Certification Memoranda, applicants and suppliers are now aware of the guidelines in advance. Discussion of the Certification Memorandum will take place with the applicant at project level. Also, they are going to be applied consistently worldwide and therefore provide equity between manufacturer and supplier.
225	*Airbus*	3.3	11	This section ("prepared to take EASA requirements into account") is not consistent with the way Certification Memoranda are introduced page 1.	Area of concern/should require further and detailed discussion.		Substantive	Noted	As written page 1: "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. "
226	*Airbus*	4.2	12	The definition for "Finding", referring to "failure to show compliance" with the CM is not acceptable, in particular considering the way the Certification Memorandum is introduced on page 1 ("not intended to introduce new certification requirements or to modify existing certification requirements").	Certification Memorandum should be removed from the definition of "finding".		Substantive	Accepted	The definition of findings has been updated to remove "Certification Memorandum" and add "applicable Certification Review Items (CRIs)" instead.
227	*Airbus*	4.2	12	Definition of "action" should be adjusted as follows. "Actions should be closed before a mutually agreed closure date".	Actions should be closed before a mutually agreed closure date".	Suggestion		Accepted	The proposed text has been added to the revised text.

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228	*Airbus*	4.3 b.	13	Equivalent software review process meeting adds no value and should be removed since the objectives of the hardware review process are found in section 4.4.	The text dealing with "Equivalent software review process meeting" should be removed.	Suggestion	Substantive	Partially accepted	It seems that the sentence in question has been misunderstood: the guidance 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, a typo has been corrected, replacing the word "software" by the word "hardware" in this item 4.3.b.
229	*Airbus*	4.4	13	EASA makes more stringent the threshold level for development and verification reviews: 75% of HW dev data complete and reviewed, instead of 50% for FAA.	EASA should explain need to explain why such a difference		Substantive	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 process assurance activity).
230	*Airbus*	4.5.1 c.	15	Applicant Safety, failure conditions and hardware levels assessments are out of the scope of this Certification Memorandum dedicated to Development Assurance of AEH. Allocated DAL is an output from the Safety Assessment process and an input to the Development Assurance process.	Area of concern/should require further and detailed discussion.		Substantive	Accepted	This sentence has been replaced by "Additionally, the proposed hardware level(s) and the justification provided by the system safety assessment process, including potential hardware contributions to failure conditions should be assessed."
231	*Airbus*	4.5.2 a.	15	Integration should be clarified.	Area of concern/should require further and detailed discussion.		Substantive	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.
232	*Airbus*	4.5.2 a.	15	Hardware verification process should not be a supporting process to be considered in the frame of Hardware Development Review. Hardware requirements validation process seems more relevant.	Proposed sentence: "They are supported by hardware requirements validation process". Validation being defined by ED-80 / DO 254.		Substantive	Accepted	The text has been modified as suggested.
233	*Airbus*	4.5.2 a.	15	Integral data should be clarified.	Area of concern/should require further and detailed discussion.		Substantive	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.
234	*Airbus*	4.5.2 a. (1)	15	Conceptual hardware design data should be first traceable to hardware requirements.	Area of concern/should require further and detailed discussion.		Substantive	Accepted	EASA has noticed that some errors have been introduced in this section 4.5.2 that can explain your confusion. This has been corrected in the updated text.
235	*Airbus*	4.5.2 a. (3)	16	Detailed hardware design data should be first traceable to hardware requirements.	Area of concern/should require further and detailed discussion.		Substantive	Not accepted	ED-80/DO-254 section 5.3.1 states that "the detailed design is developed from the hardware item requirements and conceptual design data." This explains the "and". The "or" implies that someone may develop the detailed design solely from the conceptual design. To avoid this ambiguity, the "or" has been removed in the updated text.
236	*Airbus*	4.5.2 b.	16	Hardware verification procedures and results should not be considered in the frame of Hardware Development Review.	Area of concern/should require further and detailed discussion.		Substantive	Accepted	"Hardware verification results" has been replaced by "Review and analysis results". Consistently, the same change has been performed for the procedures.
237	*Airbus*	4.5.3 a.	16	To be consistent with ED-80 / DO 254, the sentence “the verification activities confirm that the hardware product that was specified is the hardware product that was built" should be reworded.	The verification process (activities) provides assurance that the hardware items implementation meets the requirements. Ref ED-80 / DO 254 section 6.2.		Substantive	Accepted	The wording has been changed as suggested.

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238	*Airbus*	4.5.3 a.	16	To be consistent with ED-80 / DO 254, the sentence “The product has been sufficiently tested and is the intended product" should be reworded.	Rewording proposal: …will result in the objective evidence that hardware items implementation meets the requirements.		Substantive	Accepted	The wording has been changed as suggested.
239	*Airbus*	4.5.3 a.	16	To be consistent with ED-80 / DO 254, the sentence “and ensure that the hardware requirements, design, code, and integration have been verified" should be reworded.	Rewording proposal: ...and ensure that hardware items implementation meets the requirements.		Substantive	Partially accepted	The wording has been changed to "and ensure that the hardware requirements, conceptual and detailed design and implementation have been verified and that the implementation meets the requirements".
240	*Airbus*	4.5.4 a.	17	Remove the reference to Hardware conformity review, not defined by ED-80 / DO 254.	Refer to ED-80 / DO 254 chapter 8.		Substantive	Partially accepted	The section 8.4.6 has been updated in the Cert Memorandum in order to better define the Hardware Conformity Review.
241	*Airbus*	4.5.4 b.	17	Remove the reference to Hardware conformity review, not defined by ED-80 / DO 254.	Refer to ED-80 / DO 254 chapter 8.		Substantive	Partially accepted	The section 8.4.6 has been updated in the Cert Memorandum in order to better define the Hardware Conformity Review.
242	*Airbus*	4.5.5	18	"Objective 2: column ""Entry criteria"": The term of ""design life cycle data"" is misleading in this context. The term ""design life cycle data"" comprises the whole collection of all data relevant for the development, qualification and certification activities."	Replace "design life cycle data" by "design data" or "development data"	Suggestion	Substantive	Accepted	The wording has been updated to "development data".
243	*Airbus*	4.5.5	19	note (3) typo : "not required for SHE"	not required for SEH	Observation		Accepted	"SHE" has been replaced with "SEH".
244	*Airbus*	4.7	20	The proposed way of working, as it interferes with applicant way of working, should be discussed and agreed why the applicants in the frame of PID discussion.	Area of concern/should require further and detailed discussion.		Substantive	Not accepted	This section 4.7 of the Certification Memorandum is identical to the FAA order 8110.49 section 2-9. Also, this wording is already included in CRIs on projects going-on for years. Therefore EASA does not understand at all why this paragraph becomes suddenly an area of concern.
245	*Airbus*	4.7 a.	20	It is understood that the certification engineer and the manufacturing inspectors are EASA members.	Area of concern/should require further and detailed discussion.	Observation		Noted	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 terms certification engineer and manufacturing inspector have been removed.
246	*Airbus*	4.7 a.	20	The hardware plans identified in ED-80 / DO 254 should be available during the review but not 15 working days prior to the review. Ref above section 5.5.5. To be agreed with the applicant as mentioned between brackets.	Area of concern/should require further and detailed discussion.		Substantive	Noted	The plans and standards documents are necessary to perform the Hardware 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.
247	*Airbus*	4.7 c. (2)	21	Certification Memoranda as introduced page 1 ("not intended to introduce new certification requirements or to modify existing certification requirements") should not be mentioned.	Area of concern/should require further and detailed discussion.		Substantive	Accepted	This formulation is indeed misleading. The wording "or Certification Memorandum" has been replaced by "or applicable Certification Review Items (CRIs)".
248	*Airbus*	4.7 d.	21	Section d (1) - Typo: "A list of the each life cycle data device reviewed to include:"	Replace by: "A list of each life cycle data that was reviewed, including:" or "A list of each life cycle data and device that was reviewed, including:"	Observation		Accepted	Indeed something went wring with this formulation. The text has been updated with the following wording: "(1) A list of each life cycle data item reviewed to include:"
249	*Airbus*	4.7 g.	21	This section g. should not be a sub section of 4.7		Observation		Not accepted	This wording is already included in CRIs on projects going-on for years now. Therefore no change is considered necessary.
250	*Airbus*	5.1	22	Applicant involvement is determined for each system. No Airbus existing plan to issue for EASA concurrence a document that lists embedded hardware in all systems on the aircraft.	To be discussed with each applicant in the frame of PID discussions.		Objection	Partially accepted	A list of embedded hardware is essential for the determination of the LOI and is widely made available by Applicants. Having said that such a document may be generated for smaller sub-groups (e.g. ATA or systems). This precision has been added in the modified section 5.3.2.a of the Certification Memorandum.

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251	*Airbus*	5.3.1 a. (1) ii.	23	No Airbus plan to issue periodically (at least twice a year) the overall of hardware certification activities scheduled.	To be discussed with each applicant in the frame of PID discussions.		Objection	Partially accepted	It is not the intent of this sentence to add unnecessary burden. This information from the applicant to the Panel 10 coordinator is corresponding to the overview that is usually presented during TBMs. This clarification has been added in the Certification Memorandum.
252	*Airbus*	5.3.1 b. (2)	24	Allocated DAL is an output from the Safety Assessment process and an input to the Development Assurance process. It should not be a SW/CEH group responsibility to assess the DAL allocation based on System FHA and any document justifying the DAL allocation.	To be discussed with each applicant in the frame of PID discussions.		Objection	Accepted	This section 5.3.1b (2) has been reworked to better reflect the panel’s responsibilities.
253	*Airbus*	5.3.2 a. (1)	24	EASA should be informed of the airborne electronic hardware devices not through an applicant presentation but through the PHAC delivered to the EASA before the Initial Certification Meeting.	To be discussed with each applicant in the frame of PID discussions.		Substantive	Partially accepted	It is expected that the list of the hardware components, supplier details and associated applicant LOI be provided to EASA in form of a document (ideally at aircraft level). This sentence has been reworded to reflect better this need.
254	*Airbus*	5.3.2 a.	24	Here and along the document can be found certain inconsistencies when referring to AEH or CEH.	To be discussed with each applicant in the frame of PID discussions.		Substantive	Accepted	The wording "EASA SW/CEH Panel" has been changed to "EASA Panel 10".
255	*Airbus*	5.3.2 a. (4)	25	Documentation to be delivered before each audit is as per agreed PID.	To be discussed with each applicant in the frame of PID discussions.		Substantive	Noted	As indicated in the NOTE in section 5.1 of this Certification Memorandum, the PID may extend the description of EASA panel 10 activities, including the details of the documents to be provided prior to an audit.
256	*Airbus*	5.3.3 a.	25	The EASA intention is noted, but should be agreed with each applicant in the frame of PID discussions.	To be discussed with each applicant in the frame of PID discussions.		Substantive	Noted	As indicated in the NOTE in section 5.1 of this Certification Memorandum, the PID may extend the description of EASA panel 10 activities, including the details of the documents to be provided prior to an audit.
257	*Airbus*	5.3.3 b.	25	The first paragraph should be clarified.	To be discussed with each applicant in the frame of PID discussions.		Substantive	Noted	This section 5.3.3.b has been reworded to better reflect the guidance.
258	*Airbus*	5.3.3 c.	26	For the reasons explained above, FHA does not seem to be a relevant example.	To be discussed with each applicant in the frame of PID discussions.	Observation		Noted	This is only an example. It is agreed that detailed discussions on such aspects are project specific.
259	*Airbus*	5.3.3 c.	26	For a "none" involvement, the EASA proposal is not consistent with the latest PID discussion.	To be discussed with each applicant in the frame of PID discussions.		Substantive	Accepted	For NONE involvement, "on request" has been changed to "not sent".
260	*Airbus*	5.3.3 b.	26	Meaning of "Action Devices" should be clarified.	Area of concern/should require further and detailed discussion.	Observation		Accepted	The erroneous wording has been corrected to "Action Items".
261	*Airbus*	6	28	The proposed scope is larger than the scope of this AEH Certification Memo and cannot be simply addressed at this level.	Area of concern/should require further and detailed discussion.		Objection	Not accepted	The scope of this Section is fully in the scope of this Certification Memorandum as it only asks for a Component Single Event Effect sensibility analysis.
262	*Airbus*	7	29	ED-80 / DO 254 application at LRU and board level; should be harmonized between EASA and FAA.	Area of concern/should require further and detailed discussion.		Substantive	Accepted	EASA plans to harmonise this Section with the other Certification Authorities.
263	*Airbus*	7	29	This section is in contradiction with the current requirements which limit the applicability of DO254 to ASIC/PLD (see AC 20-154).	Area of concern/should require further and detailed discussion.		Substantive	Noted	EASA plans to harmonise this Section with the other Certification Authorities.
264	*Airbus*	8.1	30	5th paragraph inconsistency with § 8,5 (no requirements for DAL D ASIC/PLD). Up to now DAL D devices have not been in the scope of any CRI.	Area of concern/should require further and detailed discussion.		Substantive	Accepted	Sentence has been reworded to get harmonised with the FAA AC20.152.
265	*Airbus*	8.2	30	§8 address ASIC/PLD and not CGP. This sentence is unnecessary.	The sentence dealing with CGP should be removed.	Observation		Not accepted	EASA thinks it is beneficial to indicate that GCP and COTS are not in the scope of section 8.
266	*Airbus*	8.4.2 & 8.4.2.1	32	These sections introduce the "verification of the design description” concept compared to ED-80 / DO 254 recommendations. Should be discussed in detail.	Area of concern/should require further and detailed discussion.		Substantive	Not accepted	This section reflects the discussions held with Airbus on past and current programs.
267	*Airbus*	8.4.2.1 d)	32	It is understood that this section is dedicated to partionning within an ASIC/PLD device.	Proposed wording: If partionning within a device is used…	Observation		Accepted	Sentence reworded to avoid confusion.

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268	*Airbus*	8.4.2.1 f)	33	The two last sentences should be clarified and are probably not located in the right section.		Observation		Accepted	Sentence pushed to bullet k).
269	*Airbus*	8.4.2.1 g)	33	For statement coverage, the text of this Cert memo is more stringent than the last discussed and agreed CRI.	For level B: Statement coverage.		Objection	Not accepted	The criteria is the same the one used on past and current projects.
270	*Airbus*	8.4.2.1 i)	33	The need for a HDL code review has already been discussed. As a conclusion it has been agreed that the objective is covered by 8.4.2.1.a.	No need to add a HDL code review.		Objection	Not accepted	This section reflects the discussions held with Airbus on past and current programs.
271	*Airbus*	8.4.2.2 a)	34	Code coverage measurement has been recognized as an acceptable solution to achieve the "analysis of the implementation". This text should be the 8.4.2.1.g introduction.	Area of concern/should require further and detailed discussion.		Objection	Accepted	Sub-section suppressed.
272	*Airbus*	8.4.2.2	34	The hierarchical approach proposed for A and B devices, has to be understood as not systematic, but only relevant if the device integrates sub-functions themselves very complex.	Area of concern/should require further and detailed discussion.		Substantive	Not accepted	The approach to capture, validate and verify the requirements in a top-down is developed in ED-80/DO-254. Specific activities have been clarified.
273	*Airbus*	8.4.6	35	The reference to Hardware conformity review, not defined by ED-80 / DO 254, should be removed. ED-80 / DO 254 section 8 is considered sufficient. No need to refer to ED-12B / DO 178 B section 8.3.	Area of concern/should require further and detailed discussion.		Objection	Accepted	Sub-section reworded to avoid confusion.
274	*Airbus*	8.4.5	35	HECI is introduced. Airbus considers it should be covered by the Top Level Drawing (Hardware Configuration Index Document).	This proposal should be promoted.	Suggestion		Accepted	EASA fully agrees and already wrote that if TLD does not cover those aspects a HECI should be issued.
275	*Airbus*	8.5	36	Classification for simple is contradictory with §8,1, for DAL applicability. DAL D should not be mentioned.	The paragraph dealing with DAL D SEH should be removed.		Substantive	Partially accepted	Section 8.1 has been updated.
276	*Airbus*	8.5	36	Airbus considers that the adoption of a simplified structured ED-80 / DO254 approach is the most relevant to assure specific SEH design assurance.	EASA should propose guidance for simple ASIC/PLD structured development.		Substantive	Partially accepted	A reference to section 7 has been made to convey to your proposed simplification.
277	*Airbus*	8.5	36	Replace second bullet: "A test coverage analysis to ensure that the testing and analyses satisfy the specified criteria and that are complete."	Replace by: "A test coverage analysis to ensure that the testing and analyses satisfy the specified criteria and that they are complete."	Suggestion		Accepted	Sentence changed to avoid confusion.
278	*Airbus*	8.6.2	37	This section should be considered only for tools used to develop complex ASIC/PLDs.			Substantive	Not accepted	EASA thinks that a simple device badly developed with tools may be a source of hazards.
279	*Airbus*	9	38	The text has been reworded in several places compared to the last agreed position.	Area of concern/should require further and detailed discussion.		Substantive	Noted	EASA will be please to discuss in the scope of projects.
280	*Airbus*	9.2	38	COTS requirements should be limited to DAL A, B and C.	Applicability for DAL D COTS should be removed.		Substantive	Accepted	This sentence was added and references to DAL D components was removed: The objectives of ED-80/DO-254 processes, together with the additional considerations of this section of the Certification Memorandum, will need to be satisfied at the device level for those electronic hardware devices classified in accordance with Table 2-1 of ED-80/DO-254 as requiring development assurance levels A, B or C. For Level D components, the additional guidance of this Certification Memorandum does not apply but the ED-80/DO254 processes are still applicable.
281	*Airbus*	9.2	38	Embedded cores are not addressed, since they are covered by hardware / software integrations activities recommended by ED-12B / DO178B (same as for COTS microprocessors)	This statement should be added.		Substantive	Accepted	The sentence was modified as followed: "Software and COTS microprocessors are out of scope of this Section. The development assurance of microprocessors and of the core processing part of the microcontrollers and of the highly complex COTS micro controllers (Core Processing Unit) will be based on the application of ED-12B/DO-178B to the software they host, including testing of the software on the target microprocessor/microcontroller /highly complex COTS microcontroller ."

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282	*Airbus*	9.3	38	Activities should not be considered for simple COTS.			Substantive	Not accepted	Even simple COTS components may be subject to failure and thus may have safety impact. A minimum set of activities is therefore necessary.
283	*Airbus*	9.3.1	39	[1]: the last paragraph is already written in the § Definitions	Remove this paragraph	Suggestion		Accepted	The definition was reworked to avoid duplication.
284	*Airbus*	9.3.1	39	it is not mentioned that IEC TS62239 ECMP is an acceptable MoC for some of the 16 topics.	Add the sentence for clarification		Substantive	Accepted	EASA agrees that IEC TS62239 ECMP may be an acceptable means of compliance for some of the 16 activities. Section 9.1 was improved: "ED-80/DO-254 Section 11.2 states that "the use of an Electronic Component Management Process (ECMP), in conjunction with the design process, provides the basis for COTS component usage". The following sections of this Certification Memorandum provide some guidance for an ECMP. Some other guidance exists (e.g. IEC TS62239) which cover part of the activities described below."
285	*Airbus*	9.3.1	39	The first bullet should be reworded.	Its allocated development assurance level.		Substantive	Accepted	The sentence was reworded as proposed.
286	*Airbus*	9.3.1	39	[1]: simple/complex COTS classification may also be based on industrial rules (internal or standard).	It should be mentioned for clarification		Substantive	Noted	Other COTS classification criteria may be of course proposed by the industry as far as they are deemed acceptable by EASA.
287	*Airbus*	9.3.1 [1]	39	In the 1st bullet "Its development assurance level", in the Note "If the device DAL is lower than the DAL of the equipment in which it is embedded, ED-80/DO-254 Appendix B should be used to justify the DAL assignment", it should be indicated what ED-80/DO-254 Appendix B specific section is referred. It is unclear what this reference refers to.	The reference to ED-80/DO-254 Appendix B should be more explicit.		Substantive	Accepted	Reference to the §2 oF the ED-80/DO-254 Appendix B was added.
288	*Airbus*	9.3.1 [1]	39	On the 2nd bullet, refers definitions in section 1.4.	Consistency between this section and definitions in section 1.4 should be improved.	Suggestion		Accepted	The 2 first categories were re worded for consistency with §1,4: o Complex Commercial-Off-The-Shelf (COTS) IC, o Simple Commercial-Off-The-Shelf (COTS) IC,
289	*Airbus*	9.3.9	43	This section should be clarified. In addition, the Certification Memorandum should not refer to several other standards without additional guidance.	Area of concern/should require further and detailed discussion.		Substantive	Noted	EASA considers that the activity [16] is the additional guidance to be taken into account.
290	*Airbus*	9.3.9		Robust partionning is a software concept (DO 178 / DO 248B). EASA should clarify their expectations.	Area of concern/should require further and detailed discussion.		Substantive	Noted	When hardware portioning is used, it should be demonstrated to be robust enough to the Design Assurance Level.
291	*Airbus*	9.3.9	44	Robust partionning is not defined in ED-80 / DO 254.	The reference to ED-80 / DO 254.should be removed.		Substantive	Accepted	Reference to ED-80/DO254 was removed.
292	*Airbus*	9.3.11	44	[2], [6], [7], [15] should not be considered for simple COTS. Simple COTS should be covered through classical activities at LRU level functional tests, environmental qualification DO 160...	Area of concern/should require further and detailed discussion.		Substantive	Not accepted	Even simple COTS components may be subject to failure and thus may have safety impact. A minimum set of activities is therefore necessary.
293	*Airbus*	9.3.12	45	"DAL D COTS should not be considered. [4] and [5] should be considered only for DAL A and B, low ISE. [9] and [10] should be considered only for low ISE. [11] should be considered only for DAL A and B, low ISE. [16] should be clarified."	Area of concern/should require further and detailed discussion.		Substantive	Accepted	This sentence was added and references to DAL D components was removed: The objectives of ED-80/DO-254 processes, together with the additional considerations of this section of the Certification Memorandum, will need to be satisfied at the device level for those electronic hardware devices classified in accordance with Table 2-1 of ED-80/DO-254 as requiring development assurance levels A, B or C. For Level D components, the additional guidance of this Certification Memorandum does not apply but the ED-80/DO254 processes are still applicable.
294	*Airbus*	10	47	The scope of this section (hardware, software, safety) is larger than the scope of this Certification Memo and should not be only addressed at AEH level.	Area of concern/should require further and detailed discussion.		Objection	Noted	As there isn't any resolution proposed, the text is not changed.

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295	*Airbus*	10	47	The scope of application should be clarified as a function of DAL allocated to devices.	Area of concern/should require further and detailed discussion.		Substantive	Accepted	The scope of application of this Section is improved. The CGP which has an allocated DAL A, B and C will be concerned by this Section.
296	*Airbus*	10	47	EASA should clarify why section 9 is considered as not relevant to address CGP.	Area of concern/should require further and detailed discussion.		Substantive	Noted	Section 10 addresses specific concerns related to the use of CGP in display systems such as hazardously misleading information, display system availability, etc. Section 10 has been harmonised with others Certification authorities (CAST paper 29) and therefore EASA would prefer to dedicate this Section 10 only to CGP. EASA will consider merging of Section 9 and 10 in the future.
297	*Airbus*	10.1	47	Mid page, correct reference to "Section 7 and section 8 of this Certification Memorandum" to "Section 7 and section 9 of this Certification Memorandum".		Observation		Accepted	The text was updated as proposed.
298	*Airbus*	11	53	The scope of this section is larger than the scope of this Certification memo and should be addressed at a higher level (company policy, DOA).	Area of concern/should require further and detailed discussion.		Objection	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. EASA concurs that there are some general aspects that can be addressed at upper level (company, DOA) but, in many cases, there are some project specific issues depending strongly in the way of the subcontractor is involved. All this information should be presented in the corresponding plans. Nevertheless, the applicant can use references to existing upper level plans (e.g., DOA) provided that they are available at EASA and they include the level of detail requested in the Certification Memorandum. Similar approach is being followed by FAA (for software part, please refer to FAA Order 8110.110 Chapter 1).
299	*Airbus*	12	56	The scope of this section is larger than the scope of this Certification memo and should be addressed at a higher level (company policy, DOA).	Area of concern/should require further and detailed discussion.		Objection	Partially accepted	EASA will incorporate later some policy around the HW changes and considers useful to introduce it in this Certification Memorandum before.
300	*Airbus*	13.3	57	This text is more stringent than previously discussed OPR CRI covering CEH devices. The enlarged scope of this text is system containing digital equipment.	Area of concern/should require further and detailed discussion.		Objection	Not Accepted	This section did not change from previous Certification Memorandum and current CRIs.
301	*Airbus*	13.3	57	OPR at LRU and board leve should be harmonized between EASA and FAA.	Area of concern/should require further and detailed discussion.			Noted	CAST meetings are the place for harmonisation between the FAA and EASA and we harmonise as most as possible.
302	*Airbus*	13.3	57	OPR management should be reduced to DAL A, B, C for HW.	Remove DAL D applicability for OPR		Objection	Not Accepted	EASA considers that performing the root cause analysis can reveal a need for re-classification of the associated Open Problem Report and therefore it is not possible to make exceptions for a specific DAL (except for DAL E).
303	*Airbus*	13.9	60	The scope of this section is larger than the scope of this Certification memo and should be addressed at a higher level (company policy).	Area of concern/should require further and detailed discussion.		Objection	Noted	Based on past experience, EASA considers that a proper oversight of supplier OPRs is needed and this text is harmonised with the FAA notice 81.110.

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304	*Rolls-Royce plc*	General	1	The definition of a CM on page 1 states that the CM is for information only and it is not intended to introduce new certification requirements. However the CM does seem to be implying a change to certification requirements, rather than just offering guidance. For example the current scope of ED-80 for certification is complex components only and yet the ECM suggests that it needs to be applied to CBAs and LRUs. R-R deduces that although the CM will not alter certification requirements directly, future CRIs may well reference it as a requirement, is this the expected use for this CM?				Noted	EASA intent is to call up this Certification Memorandum through project CRIs.
305	*Rolls-Royce plc*	general	All	This CM seems to be diverging from the FAA guidance (e.g AC 20-152) and there is concern that this will introduce difficulties in managing design assurance to comply to both EASA and FAA requirements. R-R would prefer EASA and FAA to stay aligned.				Noted	EASA and FAA are still in the process of harmonisation through CAST group.
306	*Rolls-Royce plc*	General	All	In a few places EASA have used the word "development" when referring to "design" (in ED-80 terms) I think. For example 4.5.2 Hardware Development Review – should this read Hardware Design Review? And DAL Development Assurance Level when ED-80 defines DAL as Design Assurance Level. Please can EASA clarify.				Not accepted	The wording "Development Assurance Level" is maintained and explained within the acronym list.
307	*Rolls-Royce plc*	General	All	R-R are concerned that, whilst this guidance is of value it may constrain the applicant. One of the best things about DO-254 is that it does not prescribe methods of compliance only the things which must be done. It is important that this CM also does not prescribe methods.				Noted	EASA intention is not to prescribe method rather then to detail the objectives.
308	*Rolls-Royce plc*	1.2		Should now reference ED-79A instead of ED-79				Accepted	The table was updated
309	*Rolls-Royce plc*	3.2	11	Para 2 Minor : TCs and STCs abbreviations are used without explanation and without inclusion in section 1.3.				Accepted	These 2 terms were defined within §1.3.
310	*Rolls-Royce plc*	4.5.2 a. (4)	16	It is unclear how EASA will expect to review traceability down to implementation during the development (design?) review.				Accepted	EASA has noticed that some errors have been introduced in this section 4.5.2 that can explain your confusion. This has been corrected in the updated text.
311	*Rolls-Royce plc*	5.3.1 b. (2)		Suggested text mentions a DAL downgrading justification. Such terminology was deliberately removed from ARP 4754A because it was considered that there was an implication that the system/item was being developed to an insufficient DAL. In reality it was the correct Item DAL (IDAL) to satisfy a higher level Function DAL (FDAL). It would be better therefore to say something like "...including a justification of why the IDAL is a lower level than the FDAL (if applicable)." A more general comment is to consider changing each occurrence of DAL to either FDAL or IDAL as applicable.				Partially accepted	Your point is understood. However, in order to remain generic and avoid having wording specific to ED-79A/ARP4754A, the wording "including a DAL reduction justification (when applicable)." has been introduced in the updated Certification Memorandum.
312	*Rolls-Royce plc*	5.3.2 b.		Choice of the word 'criticality' is questioned. It should be replaced with DAL or FDAL or IDAL. NB there are 2 other instances in the CM.				Accepted	"Criticality Level" has been replaced by "DAL" in the updated section 5 of the Certification Memorandum.
313	*Rolls-Royce plc*	6		This section should refer to Single Event Effects (SEE) rather than just SEU so that it covers all effects of cosmic radiation. SEE is a broader term which covers SEL, MBU, MCU and SEFI (among others).				Accepted	§6 was updated to include this suggestion.

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314	*Rolls-Royce plc*	7	29	The introduction of the new scope of applicability seems to be very brief. We know from this CM and previous EASA CRIs that application of ED-80/DO-254 at component level is not generally adequate to meet certification needs. In fact EASA provide requirements (CRIs) on top of DO-254 for certification of complex components. Are EASA expecting to produce similar guidance for CBA and LRU activities?				Noted	The current Certification Memorandum will be called in CRIs after publication. Also the Section has been improved to cover your concern.
315	*Rolls-Royce plc*	7	29	If DO-254 is to be applied at LRU level, will this prohibit changes to the "simple" (and indeed, passive) components in the box being considered "minor" changes per pt 21?				Noted	No the ED80/DO254 use does not change the Part 21 requirements.
316	*Rolls-Royce plc*	8.3	31	This section expects the complex devices to be declared in the PHAC. DO-254 defines the PHAC for plans only. The effect of this guidance is that the PHAC can not be issued until later in the development lifecycle. It requires part of the lifecycle to be performed (in order to identify the complex components and the design of there functionality) before the planned activities are agreed with EASA and means that if the design changes (e.g. for obsolescence during the development lifecycle) then the PHAC needs to be changed to keep up to date. The risk of producing PHACs later in the lifecycle is that lifecycle data will need to be created without an agreed plan.				Not accepted	It is essential to classify device at the beginning of the project to define the development and verification activities and it therefore be documented in the PHAC. Early communication is expected between applicant and EASA when the classification is controversial.
317	*Rolls-Royce plc*	8.3	31	"Para 3 States: “The ability to verify and test on the physical device all the requirements in all the configurations is a prerequisite for the classification of an device as simple.” Why does this sentence differ from the definition of simple in DO-254? DO-254 allows “deterministic tests and analyses appropriate to the DAL” but the CM specifies “tests” only. Is the CM guidance deliberately different? If so can the CM make this clear to avoid the confusion, if not then this paragraph can be removed."				Accepted	Paragraph suppressed and section 1.4 is now referenced to avid confusion and to provide simple/complex definitions.
318	*Rolls-Royce plc*	8.3	31	Para 4 Asks for the assessment to be documented. Where? Is this a new lifecycle data item?				Accepted	Sentence suppressed as the topic is already covered above.
319	*Rolls-Royce plc*	8.4.2	32	"Title is Requirements Verification. Rolls-Royce are familiar with Requirements Validation but not with verifying the requirements. The first paragraph of this section discusses verification of the design description and of the implementation but not of the requirements. Please clarify the intent.				Accepted	Section title change to avoid confusion.
320	*Rolls-Royce plc*	8.4.2.1 a)	32	"This suggests that the implementation design (HDL or schematic) should be verified against the requirements. The method for doing this can be agreed and documented. Where should it be documented – is this another PHAC requirement?"				Partially accepted	Yes this activity is normally documented and is defined in ED-80/DO-254, the HVP may be used.
321	*Rolls-Royce plc*	8.4.2.1 b) & 8.4.2.2 e)	3234	This is a negative requirement which is impossible to achieve. The fact that something has “no effect” can only be verified by exhaustive testing which is not practical. EASA’s “requirements” should be verifiable.				Accepted	Sentence changed to avoid confusion.

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322	*Rolls-Royce plc*	8.4.2.1	33	How can coding standards ensure the device operates as expected? Coding standards are simply good practice and no guarantee of operation.				Accepted	Sentence suppressed to avoid confusion.
323	*Rolls-Royce plc*	8.4.2.1 f)	33	There appears to be a misplaced paragraph at the end of f) which starts "Design verification relies on …", does not appear to fit here.				Accepted	Sentence removed and placed in bullet k.
324	*Rolls-Royce plc*	8.4.2.2	34	a) this appears just to repeat DO-254 not add any guidance, what is it's intent?				Not accepted	Most items clarify ED-80/DO-254 (bullet a, b, e, f, g, h).
325	*Rolls-Royce plc*	8.4.2.2 a)		DO-254 actually recommends that for level A or B H/W one of a number of additional design assurance methods are used, these include architectural mitigation, product service experience, and advanced verification techniques (elemental analysis, safety specific analysis, and formal methods). Is it EASA's intent that the methods available should be restricted to elemental analysis only? If not this should be clarified.				Accepted	Bullet a suppressed.
326	*Rolls-Royce plc*	8.4.2.2 b)	34	This requirement is very subjective. One difficulty for example is agreeing the amount margin that is acceptable. In fact if margins are correctly handled during the design of the artefact then they will cover adequately the abnormal conditions and robustness testing beyond those margins is not necessary. It could be argued that testing a little bit beyond the requirements is the only way to verify that you have definitely met the requirement but that is not robustness that is a method for testing the existing requirement. So if we have designed the system robustly (i.e. managed the margins and boundaries correctly) then we do not need robustness testing, just testing to requirements. Testing to find missing requirements should not be advocated as good practice, it is in-efficient and continues indefinitely. Therefore the EASA guidance should request robustness analysis and appropriate derived requirements during the design phase, to create the philosophy of understanding and controlling margin and boundaries in design. This will achieve a better result than robustness testing.				Noted	EASA reminds that the following is written: "Where necessary and appropriate, additional verification activities, such as analysis and review, may have to be performed to address robustness aspects". It means that it is up to the applicant to assess the device and to find any areas where robustness has not been (or could not) introduced in the design and then to exercise accordingly robustness testing.
327	*Rolls-Royce plc*	8.4.2.2 c)	34	Verification at every level is usually a mixture of all the activities listed. Normally verification techniques are agreed only when requirements are developed and understood.				Noted	
328	*Rolls-Royce plc*	8.4.2.2 For levels A and B devices a)	34	Use of the terms "device level" and "hardware devices" is made without clarifying what these terms mean. It appears that this statement is asking for sub-device requirements (in order to verify the device sub-functions), ED-80 suggests that the requirements stop at the device level and sub-device is part of the detailed design activity which is not formally verified against requirements. Verification of the higher level requirements may need to be performed at these lower levels but verification must be against requirements and they generally stop at the device level. For example see the PLD and ASIC lifecycle mapping in HighRely's White Paper "DO-254 Overview & Process Flow" Updated by Vance Hilderman, 2009				Accepted	A note has been added in Section 8.1 to clarify.

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329	*Rolls-Royce plc*	8.4.2.2 For levels A and B devices b)	34	What type of analysis is being suggested here? How is the applicant (and then EASA) to judge when it is complete? Similarly, how do we judge the verification is sufficient? Where do EASA suggest this analysis is to be documented? Is this another lifecycle data deliverable?				Partially accepted	The intent of this bullet is to ensure that the implementation does show that implementation does not adversely affect the confidence got from the verification performed on requirement implementation. This analysis is like other analysis and should be stored.
330	*Rolls-Royce plc*	8.4.3	34	"First Paragraph (Bullet) Appears to say little other than follow DO-254 in which case it is not needed. Does "Traceability should be ensured at device level" mean that device level requirements need to trace to higher level requirements or be derived and validated AND device level requirements need to be traced to verification evidence?"				Accepted	Sub-section reworded to avoid confusion.
331	*Rolls-Royce plc*	8.4.3	34	3rd Bullet - Currently this "Note 6" is one of the major differences between DAL A&B and DAL C products. By removing this note EASA are eroding this differences between DALs and this reduces flexibility and increases cost. R-R would prefer this difference to remain.				Not accepted	It is the EASA understanding that traceability is needed for level C complex devices to ensure a correct behaviour.
332	*Rolls-Royce plc*	8.5		Last paragraph - It is unclear what this paragraph is saying. It seems to be saying that an ASIC or PLD can be simple and yet for it to also to be not feasible or impractical for a comprehensive set of test and analyses to be performed. Surely if the tests/analysis is impractical then the device is complex and not simple.				Partially accepted	EASA thinks that the device may be simple may cannot be verified following the criteria mentioned at the beginning of the section.
333	*Rolls-Royce plc*	9.2	38	"The introduction of 5 new classes of devices seems over complex. Especially when one considers that only three alternative methods are provided in the table in 9.3.11, 9.3.12 and 9.3.13. What is the point of defining 5 classes but only having 3 alternative actions? Surely all we need is Simple COTS, Complex COTS and Highly Complex COTS. Industry already understands the distinction between simple and complex and so only the distinction between complex and highly complex needs to be clarified.Taking this a little further there is not much difference between the activities required for highly complex devices (9.3.13) compared to those for complex devices (9.3.12) and so perhaps there is merit in considering how the CM could be written to reduce the classes further still, i.e. to complex COTS and Simple COTS only. Activities [5], [12] and [14] could be written to emphasise that more complex items will require more work for these activities (as already done in the last sentence of [5])."				Not accepted	EASA agrees that when looking on the tables (§9.3.12 an §9.3.13), the differences may be seen marginal. But behind the activities [5], [12] and [14] there is a substantive effort to be produced. Thus EASA proposes to maintain this classes of component in order to lighten the activities for the complex COTS.
334	*Rolls-Royce plc*	9.3.1 [1]		It should be acceptable to use ARP 4754A instead of ED-80 App B to justify the DAL assignment if lower than equipment DAL				Accepted	The sentence was changed to: The safety process may justify the lowering of the hardware DAL at board or at device level by using the appropriate standard (ED-79 and/or ED80 appendix B §2).
335	*Rolls-Royce plc*	9.2	38	The terminology used for the new classes does not match the terms uses in section 1.4 i.e. COTS components vs COTS IC				Accepted	Correction was performed.
336	*Rolls-Royce plc*	9.3	39	Last Paragraph states that a summary of the outcome of the activities should be included in the PHAC. However many of these activities will not be performed at the time of writing the PHAC as they are part of the design and V&V activities. Therefore this is not a reasonable request.				Accepted	The sentence was reworded like this: "A summary of the intended activities should be documented in the PHAC. A summary of the outcome of these activities should be documented in the HAS".

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337	*Rolls-Royce plc*	9.3.1	39	"The definition of Highly Complex is very ambiguous (and is reflected in the same text in section 1.4) For example the use of the term "More than one" and "several" implies that several means more than two, but how many more than two? 2nd bullet: What is a complex interface? And "exchange data" with what? 3rd Bullet what constitutes a bus being used in a "dynamic way"? These definitions need to be precise and easy to asses in order to avoid problems in the cert programme due to different interpretation of them. (Although Rolls-Royce would prefer them to be removed completely - see comment above on 9.2 page 38)"				Partially accepted	EASA uses "several" with the meaning "more than one". No change is proposed. Complex interface was replaced by complex peripheral. Definition of complex peripheral is included is COTS microcontroller definition. Exchange data: the sentence was reworded to explain that the controllers of the peripheral are exchanging data. It is not a bus which is used in a dynamic way, but several interconnected buses which exchanges data in a dynamic way. For example there is a matrix switch which contains multiple interconnected internal buses that can provide dynamically full bandwidth to multiple, simultaneous transmissions.
338	*Rolls-Royce plc*	9.3.2	39	This gives an "at least" list. What if these are not available? Does this mean that the IC can not be used? What if there are no errata sheets published?				Noted	If there are no errata sheet published then this should imply that there is no errata in the device. Of course this should be justified by the device manufacturer. If it is not possible, then such device cannot be used because confidence cannot be gained. This activity [2] asks to get information upon the usage of the device, its installation, its characteristics and its errata: no matter about the device manufacturer formalisation (4 dedicated documents or only one).
339	*Rolls-Royce plc*	9.3.3	40	[4] Is there any opportunity to use devices outside the manufacturers declared usage domain, e.g. up-screening or up-rating?				Noted	As far as the applicant has no detailed knowledge of the internal design of the component, the applicant is not able to confirm that the device can be used outside the manufacturer declared usage.
340	*Rolls-Royce plc*	9.3.3	40	"[5] Bullet 1 – What is this asking for over and above what has to be done for every component/design? Bullet 2 – Again it is unclear to Rolls-Royce what this section asks for that is not already covered elsewhere. The tests described will all be part of the standard verification tests against requirements; with the exception of "effectiveness of unused function deactivation" which Rolls-Royce considers is an un-testable requirement. Bullet 3 – Should this paragraph be split into two bullets or is the additional assessment only referring to the determinism? "				Noted	Bullet 1: The component (its characteristics and performances) should be chosen to be consistent with the device intended use and environment. Bullet 2: it is agreed that verification against requirements are already covered. But here the purpose is more to cover the usage domain of the components (used functions, unused functions, deactivation means and errata work-around). Bullet 3: These additional assessments are only referring to the determinism.
341	*Rolls-Royce plc*	9.3.4	41	[6] Is this intended to require the applicant to perform audits on all its IC suppliers to fully understand how they capture and maintain errata? The best we should hope for here is a minimum industrial quality standard (e.g. ISO 9000) from the supplier				Noted	The activity [6] does not ask to perform audits on all IC suppliers. Evidence on how the component manufacturer capture, maintain and publish the errata may be gained through manufacturer ISO9001 process (other means are also possible).
342	*Rolls-Royce plc*	9.3.7	42	[13] ISE Does the 2 years experience include development use or does it have to be in airborne service use by the applicant? Does the 2 years use have to be with the applicant or can it be from other users?				Noted	The 2 years of component usage should be demonstrated at the time of the certification. These 2 years are defined to enable a feed back (errata …).
343	*Rolls-Royce plc*	9.3.7	42	[13] ISE - Is it EASA's intention that in general no components will have sufficient ISE and will need to go through all the activities and this clause is only being added to allow existing designs with pedigree from other programmes run by the applicant to be used? Or do EASA expect that applicant will be able to gather the data required from other users of the devices?				Noted	EASA's first intention was to request 2 years of use in aeronautical domain only. After discussion with some applicant during dedicated projects, EASA agreed to extent the scope to other safety critical applications. Now EASA expects that applicant will be able to collect these data from other safety critical domains.

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344	*Rolls-Royce plc*	9.3.7	43	[13] Final Bullet - This excludes the use of new devices from airborne applications. The quickest way to get a new device in airborne applications would be to gather data from the other applications however the words "hours from the following application.				Noted	EASA does no agree. This bullet excludes the use of brand new devices in DAL A and B application only. Remember also that these 2 years should be justify at the time of the certification which should allow to work with these components before they reach sufficient maturity.
345	*Rolls-Royce plc*	9.3.7	43	[14] What happens if the applicant can not obtain the data requested by the bullets? Does that mean the device can not be used?				Noted	Maturity and stability of the component is essential to embed the COTS components in critical path. Evidences are also essential.
346	*Rolls-Royce plc*	9.3.8	43	[15] This appears to be saying that any design which relies on architectural mitigation to meet its safety requirements MUST use dissimilar designs for each channel. I do not think that this is the case today and if this is a new EASA requirement then there are major consequences to this for Applicants.				Not accepted	EASA would like to point out that architectural mitigation means are not restricted to dissimilarity. It is not the intent of EASA to go in that direction. For example, monitoring functions, when independent, may be considered as mitigation means.
347	*Rolls-Royce plc*	11.1 a.		Suggest removing the word "aircraft" from the second line unless EASA intend that this is not equally applicable to engine or propeller applications. There are other occurrences through the CM, suggest changing to "aircraft/engine/propeller" throughout.				Accepted	Comment applied in Section 11. To be extended to other sections.
348	*Rolls-Royce plc*	13	57-61	Although it is made clear that this section is only guidelines and things like the classification of OPRs is "one possible way" the chapter feels like it is being prescriptive and forcing a specific method. This is not in the spirit of DO-254 which says what needs to be considered and done but not how things are done. Again this is a major plus for DO-254 because it reduces the overhead of conformity. If EASA start to dictate the method then another layer of work will be introduced in order for applicant's processes to comply with these new C This will add cost but little value.				Not Accepted	Section 13.5 reflects the fact that the proposed categorization by EASA is one possible way therefore any applicant may propose something equivalent.
349	*Rolls-Royce plc*	13.5		Suggest adding an extra sentence to state that other classifications can be acceptable, if agreed with EASA. For example an applicant may wish to use the same method they use for software OPRs, which would also be agreed with EASA.				Not Accepted	EASA does not see the necessity to add a further sentence then the one in section 13.5: "*A logged OPR should be categorized according to the nature and effect of the OPR. One possible way to classify OPRs that is acceptable to EASA is as follows:*"
350	*Rolls-Royce plc*	13.6		Section refers to errors in the code - it's not necessarily 'in the code'				Not Accepted	EASA statement is not necessity only related to "*error in the code*" but as well to "*any associated methodological deviations*" see sentence below: However, to avoid confusion, the sentence in *13.6: "In the cases of Types 0, 1 or 2, this root cause analysis should lead to the identification of the corresponding error (e.g. in the VHDL code) and of any associated methodological deviations*."
351	*Rolls-Royce plc*	13.6 & 13.9.1 5) c)	59 61	These sections imply that all OPRs need to be closed at some point. Is this correct and how do EASA plan to track progress with the closure of these OPRs and over what time period?				Noted	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. Concerning the period and plan to track the progress of the closure of the OPRs, this will be dealt on a case-by-case basis depending on the project.
352	*MTU Aero Engine*	1.3	6	The following abbreviations are missing, but used in the document: TC, STC, DOA, QA, HLR, HCID, CRI, ETSOA	Add missing abbreviations in the list	Observation		Partially accepted	TC, STC, DOA and CRI abbreviation have been added. HLR, ETSOA and HCID abbreviations were removed in the text. The term Quality Assurance was removed in the text and replaced by Hardware Process Assurance.
353	*MTU Aero Engine*	1.3	6	MEU' is not used in the document	Delete 'MEU' from table or better extend section 6 with expectations on MEU.	Observation		Accepted	MEU was removed.

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354	*MTU Aero Engine*	4.3 b.	13	The first sentence is not understandable.	Rephrase the sentence to avoid misunderstanding.	Observation		Accepted	This sentence has been reworded in: "b. The applicant should perform an equivalent software hardware review process meeting that is fulfilling the same objectives as described in this section."
355	*MTU Aero Engine*	4.5.2	15	The second SOI should be called Hardware Design Review and not Development.	Change Development Review into Design Review.	Suggestion		Partially accepted	The wording "Development review" precisely intends to cover both the ED-80/DO-254 "requirements review" and "design review". This review is not meant to be limited to the sole "Design review" as described in ED-80/DO-254. Having said that, reading the section 4.5.2 again, EASA has noticed that some errors have been introduced that can explain your confusion. This has been corrected in the updated text.
356	*MTU Aero Engine*	4.5.2 (4)	16	What are implementation data in this case? In section 8.4.2. Implementation stands for post place & route and for the device itself. To establish traceability from detailed design data (VDHL) to implementation data (Download File) is simply impossible. No dedicated VHDL-Process (some lines of code) can be traced to a dedicated area in the download file.	Clarification needed to avoid misunderstanding during SOIs. Traceability can only be established to the download file itself. Further granularity is not possible.	Suggestion		Accepted	EASA has noticed that some errors have been introduced in this section 4.5.2 that can explain your confusion. This has been corrected in the updated text.
357	*MTU Aero Engine*	4.5.5	18	What is an audit and what is a review? Is it the same? The big four SOIs are explained as reviews in section 4. but in this table they are called Audit objective. In section 5.3.2. the term audit is used again.	Clarification needed, if review and audit is the same or if not a definition of audit should be given in section 4.2.	Observation		Accepted	"Audit" has been replaced by "review" consistently.
358	*MTU Aero Engine*	4.5.5	18	This section describes in detail the objectives, review items and entry criteria for each of the 4 suggested types of review. Applicant organisations will typically hold reviews internally as part of a DO-254 development process, which may differ in the timing, objectives, review number/types etc, but which are broadly similar to that described in the CM. Should the certification authority choose to exercise its' discretion to attend one or more reviews, would the certification authority consider attending applicant internal reviews; or is it expected that such reviews are 'certification specific' reviews and should be held separately?	Add note on this issue after the table to clarify if the mentioned reviews are set or if they can be done according the applicants reviews.	Observation		Partially accepted	In order to clarify the intent, the following wording has been introduced in 4.3.b:"The applicant should plan and perform his/her own hardware review process (independently from the EASA LOI defined in the Certification Memorandum section 5); this hardware 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 hardware process assurance (as described in ED-80/DO-254 section 8). Nevertheless the hardware process assurance team may be involved or take an active part to the establishment of the hardware review reports."
359	*MTU Aero Engine*	4.7 c. (2)	21	The phrase "progress against previous action devices or CRIs" is not understandable. Perhaps action devices mean action items?	Rephrase the sentence to avoid misunderstanding.	Observation		Accepted	Yes, "actions devices" should read "action items". This correction has been performed in the updated text.
360	*MTU Aero Engine*	4.7 d. (1)	21	The phrase "A list of the each life cycle data device reviewed to include:" is not understandable.	Rephrase the sentence to avoid misunderstanding.	Observation		Accepted	Indeed something went wring with this formulation. The text has been updated with the following wording: "(1) A list of each life cycle data item reviewed to include:"

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361	*MTU Aero Engine*	6	28	This section is correctly specified, but very brief. Neither DO-254, ARP4754 nor ARP4761 provide much guidance on the subject of hardware susceptibility to radiation. Since SEU phenomena have a quantifiable effect on safety, shouldn't more detailed guidance be provided or referred to? Both DO254 and this CM provide detailed guidance on component selection, use of fault tolerant architectures and other design techniques which militate against random faults and undetected design errors. Similar techniques have a significant effect on radiation susceptibility. This level of guidance detail is lacking for SEU phenomena. Section 6 currently does not appear to preclude the compilation of inadequate or poorly performed SEU analyses, since no minimum standards or detailed guidance is provided.	Consider providing more detailed guidance on this subject.	Suggestion		Not accepted	A list of potential errors appears in this Section. More detailed information is not needed.
362	*MTU Aero Engine*	7	29	The applicability of DO-254 for equipment and CBA level is described very vague and ambiguous. Is the DO-254 applicable or not? Is there is any modulation concerning DAL or other criteria, this should be clearly explained in a table for instance.	Clarification needed to avoid misunderstanding and never ending discussions during SOIs.	Suggestion		Accepted	The Section clearly identifies ED80/DO254 is to be used for LRU and CBA. The Section has been updated to better explain what need to be done.
363	*MTU Aero Engine*	8.4.1	31	Although titled 'Requirements Validation', the first part of this section discusses the 'capture' of derived requirements rather than dealing with the topic of 'validation'.	Rename the section or add a 'Requirements Capture' section.	Suggestion		Partially accepted	Section title has been changed.
364	*MTU Aero Engine*	8.4.1	31	This section recommends that derived requirements should be created by feeding back data and design decisions from conceptual and detailed design activities. However, it is not clear what level of design detail should be fed back. For example, should design data such as memory maps, register bit assignments, internal interfacing between sub functions, detailed state-machine implementation, use of device features such as PLLs, block RAM, global nets etc, be fed back? Is there a limit to what level of detail is appropriate? If there is, what criteria should be applied?	Additional guidance for derived requirements capture requested.	Suggestion		Partially accepted	EASA cannot detail how the detail design should be feeding back as derived requirements. This choice depends on the complexity and component.
365	*MTU Aero Engine*	8.4.2.2 a)	34	First paragraph: Elemental Analysis of DO-254 Appendix B is normally covered by code coverage generated during Simulation of the VHDL-Code.	Move the Elemental Analysis Term to section 8.4.2.1. g) and delete first paragraph of section 8.4.2.2. a)	Suggestion		Accepted	Bullet suppressed.
366	*MTU Aero Engine*	8.4.2.2 a)	34	Second paragraph: It is impossible to detect with Analysis of the implementation (post place & route netlist, bit download file, configured PLD) unverified hardware. In real-HW requirement-based testing can be performed with req. coverage as metric, but not structural coverage is possible to measure.	Clarification needed to avoid misunderstanding and never ending discussions during SOIs.	Suggestion		Accepted	Bullet suppressed.
367	*MTU Aero Engine*	8.4.5	35	Last bullet, last sentence: "This CM is written to aid…". What CM stands for? Cert. Memo? This would make no sense. Perhaps ist should be CI for Configuration Item.	As indicated in comment summary	Observation		Accepted	Sentence confusing and changed.

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368	*MTU Aero Engine*	9.3.7	42	This section discusses guidelines for 'In Service Experience'. Past experience has shown that obtaining the data specified from component vendors or manufacturers has been impossible due to commercial confidentiality. In practice, unless the component has been used in a previous product 'in-house', then it is difficult or impossible to get this data. This has been found true even for component manufacturers which have long provided complex devices into hi-rel markets such as space/aerospace/defence. This has also been found true for components which are anecdotally known in the industry to have been used for decades in multiple application areas - but specific provable data is simply not available (example: CAN controllers/transceivers). This approach is considered impractical in most cases currently. This approach could be more practical in future, but only if such data is more easily obtainable by system integrators and LRU providers.	Airframe manufacturers or certification authorities could facilitate the capture of ISE data for commonly used COTS components in future, providing this to system integrators or LRU providers. Commercial confidentiality considerations would need to be res	Observation		Noted	
369	*MTU Aero Engine*			===>>>Typos and style				Noted	
370	*MTU Aero Engine*	1.4	8	- First column, third row: Write microcontroller with "M". - Meaning for Integrated Circuit: Last paragraph, "highly complex, COTS should be written without the comma after complex.	As indicated in comment summary	Observation		Accepted	Corrections implemented as proposed.
371	*MTU Aero Engine*	4.2	12	The colon after Action and Recommendation should be removed.	As indicated in comment summary	Observation		Accepted	Agreed. The ":" have been removed consistently in the revised text.
372	*MTU Aero Engine*	General	General	In the CM for a list there is used a comma at a place it normally should not be used. Example in section 4.3 c. (1): "(i.e., planning, development, verification, or final certification)." The first and the last comma should not be used. Such a list with this structure ist used often in this CM.	As indicated in comment summary	Observation		Accepted	The text was corrected as proposed.
373	*MTU Aero Engine*	4.5.1 a. & 4.5.1 b.	14 15	The phrase written in bold should be also italic - see all other cases.	As indicated in comment summary	Observation		Accepted	EASA will attempt as far as practicable to harmonize the header formats.
374	*MTU Aero Engine*	4.5.3 (5)	17	Point "." is missing at the end of the sentence.	As indicated in comment summary	Observation		Accepted	The dot has been added accordingly.
375	*MTU Aero Engine*	4.5.5	18	- ""planning"" in Audit 1 should be written with ""P"" - For Audit 3 in Items to be reviewed: ""."" after standards for better readability needed, right parenthesis missing. - For Audit 4 in Items to be reviewed: Add points ""."" after each Item to separate them from each other for better readability. - Note (3) after the table: Write ""SEH"" instead of ""SHE"""	As indicated in comment summary	Observation		Accepted	Changes have been implemented accordingly in the updated text.
376	*MTU Aero Engine*	8.4.5	35	There should be no point "." at the end of the heading.	As indicated in comment summary	Observation		Accepted	Point suppressed.
377	*Latécoére*	All		Applicant role has to be clarified	Identify which type of applicant is relevant		x	Noted	Within this Certification Memorandum, EASA is reusing the definition of ED-80 / DO-254: Applicant - A person or organization seeking approval from the certification authority.
378	*Latécoére*	1.1	7	MEU not used in the rest of the document		x		Accepted	MEU definition was removed.
379	*Latécoére*	1.4	7	Definition of the different HW level has to be indicated and detailed	Define each level of HW element and detail the definition of each level	x		Not accepted	The comment is vague. If "level" means "Design Assurance Level" this is already defined in certification rules.
380	*Latécoére*	4.3 b.	13	Software review?		x		Accepted	The word "software" has been replaced by "hardware".

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381	*Latécoére*	4.5.2 a. (4)	16	What is the signification of hardware implementation	Clarify hardware implementation	x		Noted	Hardware implementation is defined in ED-80/DO-254. Having said that, EASA has noticed that some errors have been introduced in this section 4.5.2 that can explain your confusion. This has been corrected in the updated text.
382	*Latécoére*	7	29	What is expected at system level? What are the objectives for equipment, CBA?	Clarify the application of DO254 at system level and detail what is expected		x	Noted	Section has been changed to highlight that it is applicable to CBA and LRU are covered by ED79.
383	*Latécoére*	8.3	31	What do you expect regarding transition state?	Clarify what is expected for transition state	x		Noted	Here it is requested to provide the number of transition states.
384	*Latécoére*	8.4.1	31	The specification > what do you mean > high level requirement?	Clarify the sentence	x		Accepted	Sentence changed to avoid confusion.
385	*Latécoére*	8.4.2.1 c)	32	IP need a detailed definition	Clarify in detail IP according to DO254		x	Accepted	COTS IP Definition has been improved.
386	*Latécoére*	8.4.2.1 g)	33	Transition coverage need to be clarified	Clarify the sentence	x		Partially accepted	This an usual wording, it means that verification activities have exercised all transition of a state machine.
387	*Latécoére*	8.4.4	35	Same than comment #383			x	Not accepted	EASA does not understand the comment, comment 383 is related to transition state which is not introduced here.
388	*Latécoére*	9.3.2	40	Ambitious and in some cases not realistic	Has to be modified		x	Noted	The objective is to get the maximum information on the Components characteristics, usage or design.
389	*Latécoére*	9.3.4	41	Ambitious and in some cases not realistic	Has to be modified		x	Noted	The objective is to get confidence on the errata of the components.
390	*Latécoére*	9.3.5	41	Ambitious and in some cases not realistic	Has to be modified		x	Noted	The objective is to get confidence on the components' manufacturer configuration management processes.
391	*Latécoére*	13.8	60	Are system certification documents relevant for DO254 process?	Has to be modified		x TBC	Not Accepted	EASA is requesting for the OPR section 13.8 of this Certification Memorandum: "*The System Certification Summary or an equivalent certification document should describe*". EASA thinks there is a need to document critical OPRs in the Cert Summary and it is relevant to request that in this Certification Memorandum.
392	*Latécoére*	13.9	60	Are the system configuration plans applicable for DO254 process?	Has to be modified		x TBC	Not Accepted	EASA is requesting in section 13.9.1: "*In order to ensure that hardware problems are consistently reported and resolved, and that hardware development assurance is accomplished before certification, the applicant should discuss in their hardware Configuration Management Plan,* ***or other appropriate planning documents,*** *how they will oversee their supplier's and sub-tier supplier's hardware problem reporting process. The engineer responsible for certification should review the plans and verify that they address the following to their satisfaction*"EASA thinks there is a need to document critical OPRs in the Cert Summary and it is relevant to request that in this Certification Memorandum.
393	*Latécoére*	13.9	60	Something is confusing - HW level or system level?	Has to be modified		x	Not Accepted	EASA does not understand the confusion as this sub-section is talking about the oversight of hardware PRs which has been done under the applicant responsibility. The applicant will oversee their supplier's and sub-tier supplier's hardware problem reporting process. This starts at Hardware 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, it's supplier and sub-tier supplier.

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394	*Koch AvionicCert*	6		6. GUIDELINES FOR SINGLE EVENT UPSETS "The applicant should conduct a Component Single Event Upset safety analysis" What is Single Event Upset safety analysis? Is this part of the functional failure path analysis (FFPA) as defined in DO-254 or part of the Safety Assessment iaw CS25-1309 (AMC 25-1309)?"				Noted	This two-step approach analysis is asked to determine components sensibility to SEE and their safety impacts.
395	*Koch AvionicCert*	8.6.2		8.6.2. Tool Assessment and Qualification ""A claim for credit of relevant tool history, as discussed in ED-80/DO-254 Section 11.4.1 item 5, should be justified to the authority and documented in the appropriate certification plan or PHAC"". DO-254 defines: ""The history of the tool may be based on either an airborne or non airborne application, provided that data is available to substantiate the relevance and credibility of the tool's history"". Question: Does "relevant tool history" mean history data from non-airborne application similar as foreseen for Complex COTS (refer to Cert Memo Ch.9.3.7. In service experience) also?"				Partially accepted	This justification should be detailed in the PHAC and ED-80/DO-254 does not provide details about relevant history. Usually, relevant history is coming from equivalent use.
396	*Koch AvionicCert*	7		7. GUIDELINES FOR ELECTRONIC HARDWARE DEVELOPMENT ASSURANCE OF EQUIPMENT AND CIRCUIT BOARD ASSEMBLIES This chapter contains several simplifications. However almost all Equipment or Circuit Board contain a microcontroller and/or ASIC/PLD Hardware. a) Are different documents for the different application required? b) If not, how can they documents be combined (e.g. if using in-house industrial hardware development standards for boards mixed with Cert Memo requirements for COTS) c) For DAL D no standards at all have to be considered. Is this correct?"				Partially accepted	Section 7 has been improved to explain clearly what DAL levels are concerned.
397	*Koch AvionicCert*	8.1 & 8.2 & 8.5		8.1. PURPOSE For Level D components, the additional guidance of this Cert memo does not apply but the ED-80/DO254 processes are still applicable. 8.2. APPLICABILITY Defines: The considerations of this Certification Memorandum apply to the following types of digital de-vices that have assurance levels A, B, C. However: 8.5. SIMPLE ASICS/PLDS defines: For Level D, demonstrate the device satisfies the system or component level requirements specified for the device. There are some inconsistencies to DO-254 regarding DAL D which should be clarified.				Accepted	Sub-sections has been updated to avoid confusion and to get harmonised with the FAA AC20.152.
398	*Koch AvionicCert*	General		Classification of microcontroller A list of typical microcontroller including their classification (Simple COTS Microcontrollers, Complex COTS Microcontrollers and Highly Complex COTS Microcontrollers) used in commercial aircraft should be published by the authority.				Not accepted	EASA cannot publish this list as it will evolve regularly.

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399	*Koch AvionicCert*	9.3.7		9.3.7. In service experience The term ISE (In service experience) should be changed into Product Service History, due to this term is used in DO-178B, DO-254 , CAST and other documents.				Accepted	The text was improved as proposed.
400-1	*Koch AvionicCert*	9.3.7		9.3.7. In service experienceThe formulas are not realistic in several aspects:Example:– At least 2 years of use with { [number of hours of aircraft operation in flight or on ground + hours during board/LRU/system/aircraft ground or flight tests + hours within safety applications (Space, airborne military, nuclear, medical)] >105 AND [hours within following applications (railway, automotive, bank, computer, telecom…)] > 107 There are usually no trusted operating hours available, especially for military, automotive or bank applications.The proposed calculation (ISE Period) is unrealistic. (At least 2 years of use with…….)The typical design life cycle of microcontroller or other Complex COTS components are in the range of two until five years. That means now actual "state of the art" microcontroller can be used. Additionally after two years many of the components will not be longer available (obsolescence problems).				Noted	The idea is to use mature and stable components for critical application. These applications should not be influenced by trends.
400-2	*Koch AvionicCert*	9.3.7		Further there is a general contradiction in this formula: If a COTS Components requires at least two years ISE prior use in aircraft how can this be achieved for the first application? The meaning of the formula: "For DAL A and B COTS components, the minimum amount of usage is defined as follows:" is not clear, due to this is already contained within the first and second formula.				Noted	The two year of ISE is intended at the time of the certification not at the time of the application.
401	*Koch AvionicCert*	9.3.11 & 9.3.12 & 9.3.13		The activities defined in chapter 9.3.11, 9.3.12 and 9.3.13 establish several requirements related to the COTS component manufacturer. It is not clear how this requirements will or can be satisfied by the component manufacturer due to the small amount of components they can sell for customer of airborne products.				Noted	EASA agrees that it may be sometimes difficult to have access to some data requested. However these data are essential to have enough confidence on the COTS components.
402	*Koch AvionicCert*	General		A database of all microcontrollers used in Airbus and/or Boeing aircraft projects should be made available. This database could also be used for failure report handling.				Not accepted	EASA cannot publish details of the Airbus, Boeing and other projects.
403	*Koch AvionicCert*	General		"Microprocessor / Microcontroller A350 CRI F-08 define: Note: COTS Microprocessors are out of the scope of this IM. Assessment of the Microprocessors and CPU core part of the microcontrollers and CPU core part of the highly complex COTS micro-controllers design assurance will be based on their use as COTS and the hardware/software integration testing processes (application of ED12B/DO178B objectives) for selected tests performed with the integrated target computer environment."				Accepted	Text was changed in this Certification Memorandum.
404	*Koch AvionicCert*	General		Many parts of the introduction of 10. GUIDELINES FOR THE USAGE OF COMMERCIAL OFFTHE-SHELF GRAPHICAL PROCESSORS IN AIRBORNE DISPLAY APPLICATIONS are also applicable to section 9 COMMERCIAL OFF-THE-SHELF DIGITAL AIRBORNE ELECTRONIC HARDWARE and should therefore considered as a realistic situation for all Complex COTS components. For many of these issues there are still no affordable solutions.				Noted	

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405	*Koch AvionicCert*	General		Many equipment suppliers develop equipment to Boeing and/or Airbus. Due to the different requirements of AC20-152 in opposite to EASA Cert Memo different approaches are required. The AC20-152 requirements are less stringent than the EASA Cert Memo Requirements. This is not reasonable if considering that the B787 and A350 are similar aircraft but different requirements exist.				Noted	EASA and FAA are still in the process of harmonisation through CAST group. Moreover all aircraft manufacturers are equally treated once they apply for an EASA TC.
406	*Koch AvionicCert*	General		The Cert Memo is well structured. However there is no Graphical Overview. The attached overview shows the relationships and the structure. **If considered as helpful, the attached Power Point File can be used.**				Noted	
407	*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-80. This proposed certification memorandum, merging a collection of EASA CRI or FAA CAST papers, appears like a new version of ED-80 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.			Objection	Noted	
408	*SAFRAN*	General	All	Some parts of this CM is system and safety strongly oriented. In such a case, those aspects have to be considered at system/safety level (i.e out of the Electronic Hardware life cycle).			Objection	Noted	This Certification Memorandum has sometimes introduces topics related to system and safety processes due to their strong interaction with the HW data life cycle.
409	*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	Noted	It is up to the applicant to decide how demonstration will be provided.
410	*SAFRAN*	General	All	This CM should provide a clear distinction between clarification of DO-254 guidance material and additional requirement considered by EASA as additional acceptable means of compliance (i.e needing formal compliance substantiation).			Objection	Noted	It is really difficult or impossible to make this distinction, because clarification tends to raised new concerns.
411	*SAFRAN*	4.5 a. (2) & 4.5 a. (3)	14	"At least 75%" cannot be a fix and unique criteria: it should be defined jointly with EASA HW panel for 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 process assurance activity).
412	*SAFRAN*	4.5.3 b.	17	Tools qualification data can be incomplete for HW verification review	Add that tool qualification data can be incomplete for HW verification review		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 in 4.5.2.b and in 4.5.3.b.
413	*SAFRAN*	4.5.4	18	Tools qualification data should be referenced for the final certification review	Add tools qualification data for SOI4 review	Suggestion	Substantive	Accepted	Tool Qualification Data have been kept in the tables in 4.5.2.b and in 4.5.3.b, and a mention has been added in section 4.5.4.b: "Tool Qualification data (if applicable), including TAS if not provided at an earlier stage".

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414	*SAFRAN*	4.5.5	18	"At least 75%" cannot be a fixe and unique criteria: it should be defined jointly with EASA SW panel for each project, according to process maturity, project size and complexity, team skill level, incremental life cycle,...			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).
415	*SAFRAN*	5.3.3 c.	26	System Certification documents are out of the DO-254 scope			Objection	Noted	This sub-section does not discuss the scope of system documents but simply says that some system documents may be required by EASA panel 10 as they are relevant to the compliance determination of the AEH. For example, system level requirements are necessary during an SOI#2 to assess the consistency of hardware requirements with system requirements.
416	*SAFRAN*	7		As DO-254 DAL D is not quoted, is that means the § not applicable for this DAL?			Objection	Accepted	Section 7 has been improved to explain clearly what DAL levels are concerned.
417	*SAFRAN*	7		"This § is not sufficiently precise to be addressed by an applicant: - what means ""..unless, with the agreement of the responsible certification authority, an acceptable level of development assurance can be justified…"" or ""However, compliance with ED-80/DO-254 objectives can also be demonstrated by the applicant through the use of specific in-house industrial hardware development standards,..."" - the objectives to satisfy shall be clearly announced."			Objection	Accepted	The Section clearly has been improved and identifies ED80/DO254 is to be used for LRU and CBA. The Section has been updated to better explain what need to be done.
418	*SAFRAN*	7	29	The ED-80/DO-254 at equipment and board level is a new EASA requirement that should be formally introduced by EASA through AMC or equivalent ; in any cases, this paragraph is not sufficiently detailed to express the EASA expectations			Objection	Noted	EASA will consider our request to introduce ED-80/DO-254 in related AMC.
419	*SAFRAN*	8.3	31	Some criteria used for assessing a device complexity cannot be available at SOI stage: number of states, state machines...	Revise the complexity criteria for SOI1 perspective		Objection	Not accepted	It is essential to classify device at the beginning of the project to define the development and verification activities and it therefore be documented in the PHAC. Early communication is expected between applicant and EASA when the classification is controversial. PHAC may also be updated after SOI1.
420	*SAFRAN*	9		This § should be a reference to identify objectives/activities and applicability for the others § or future CRIs.		Suggestion		Noted	
421	*SAFRAN*	11.2.2	54	The §13.1.b is quoted but there is not §13.1.b in the document.		Observation		Accepted	Typo error. It should say 11.1.b.

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422	*SAFRAN*	13.5	58	"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 hardware 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 CEH? 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 §13.8."			Objection	Not Accepted	Usually, OPR can be classified in the scope of the HW activities, however depending on the product and constellation, 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 (section 13.6). The situation mentioned is taken into account, at a higher level, in section 13.6, otherwise this issue will be discussed between the Applicant and EASA on a case-by-case basis.
423	*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				Noted	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.
424	*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.				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 case by case which Certification Memorandum is applicable if any.
425	*Dassault Aviation*	General	-	The role of the applicant is ambiguous in many sections 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.c).	Replace applicant by equipment manufacturer where necessary.	X		Noted	The applicant definition is reused from ED-80 / DO-254: Applicant - A person or organization seeking approval from the certification authority. Moreover, this certification Memorandum cannot take into account the industrial organisation which is different from one project to another.
426	*Dassault Aviation*	General	-	Use the same wording as the SW Certif Memo 002 : - SOI#i review - Action item (instead Action device)	-	X		Accepted	This wording was improved.
427	*Dassault Aviation*	General	-	Numbering of the tables	-	X		Noted	

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428	*Dassault Aviation*	General	-	Use the same wording to identify the same thing. For example : - SW/CEH Panel, EASA SW/CEH experts, EASA software and CEH experts, EASA SW Panel, SW Panel, EASA System Panel, System Panel - Prime, Manufacturer, Supplier, developer	Define each involved person and relationship to each other	X		Accepted	The usage of these wording were re-worked.
429	*Dassault Aviation*	General	-	Sometimes DAL is used for Design Assurance Level, sometimes it is used for Development Assurance Level.	Define 2 acronyms or be consistant all along the document.	X		Noted	In this Certification Memorandum, the acronym "DAL" is used for Development Assurance Level (see §1,3).
430	*Dassault Aviation*	1.1	5	It should be clarified in the scope section if this is only AEH or AEH + system	-	X		Not accepted	EASA don't need to clarify: the scope of this Certification Memorandum is the use of electronic hardware in airborne systems.
431	*Dassault Aviation*	1.4	7	Add definitions for Validation and Verification in consistency with the SWCEH002 and DO	-	X		Partially accepted	To avoid confusion between the different validation and verification definitions among all standards, those definitions have been removed in the SW Certification Memorandum.
432	*Dassault Aviation*	1.4	7	The definition of a hardware/ hardware item / hardware component should be detailed.	Clarify what is considered as a HW item, and its scope.	X		Not accepted	The wording "hardware item" is not used.
433	*Dassault Aviation*	4.3 b.	13	Replace Software by Hardware in "… equivalent software review process meeting …"	Replace Software by Hardware in "… equivalent software review process meeting …"	X		Accepted	The word "software" has been replaced by "hardware".
434	*Dassault Aviation*	4.5 a. (2) & 4.5 a. (3)	14	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 process assurance activity).
435	*Dassault Aviation*	4.5	14	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 hardware reviews criteria well defined for iterative/ incremental hardware 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.
436	*Dassault Aviation*	4.5.1	14	Data Required for the Hardware Planning Review, suggestion to add "tool standards".	-	X		Partially accepted	EASA does not understand what "tool standards" are. Nevertheless "TQP" has been added to Data Required for the Hardware Planning Review in order to be consistent with the other Certification Memorandum.
437	*Dassault Aviation*	4.5.1 b.	15	Code standard should be added in the table (not consistent with table 4.5.5).	-	x		Partially accepted	Actually it is consistent as in the table under 4.5.5, the code standards appear in the development review and consistently in the section 4.5.2 (and not 4.5.1). Nevertheless, EASA agrees that it is better to ask for these HDL coding standards at the SOI#1 stage. Therefore "HDL code standards" has been introduced in 4.5.1 and consistently a change has been made to 4.5.5.
438	*Dassault Aviation*	4.5.2 b.	16	The HW items, defined in §8.4.5, are required in the bullet b). However, the Hardware Configuration Index (HCI) item is not required for an SOI2 and for the Hardware Life Cycle Environment Configuration Index (HECI), only the development environment should be required.	The following observation "See section 8.4.5 of this CM" related to the HCI should be removed from table. It should be clarified that the HECI is for the development environment.		x	Accepted	The reference to section 8.4.5 has been removed for the 'Hardware configuration management records'.For the HECI, the mention "development environment aspects" has been added.

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439	*Dassault Aviation*	4.5.2 b.	16	Qualification data for development tools to be added.	-		x	Accepted	Tool qualification data have been added.
440	*Dassault Aviation*	4.5.3 b.	17	Qualification data for verification tools to be added.	-		x	Not accepted	The table in section 4.5.3.b already contains a line "Hardware tool qualification data" which includes verification tools.
441	*Dassault Aviation*	4.5.3 b.	17	HCI are generally not issued for SOI3, in consequence 8.4.5 Objective can't be fulfilled. No formal HCI is issued for test baseline during development.	The following observation "See section 8.4.5 of this CM" related to the HCI should be removed from table.		x	Accepted	HCI has been removed.
442	*Dassault Aviation*	4.5.3 c.	17	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.
443	*Dassault Aviation*	4.5.5	18	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).
444	*Dassault Aviation*	4.5.5	18	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.
445	*Dassault Aviation*	4.5.5	19	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.
446	*Dassault Aviation*	4.5.5	19	In table, column "items to be reviewed" Move "Coverage of tests (integration / validation)" from audit 4 to audit 3.	-		x	Accepted	This text has been moved as suggested.
447	*Dassault Aviation*	4.5.5	19	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.
448	*Dassault Aviation*	4.5.5	19	In the note 3 : correct SHE by SEH		x		Accepted	"SHE" has been replaced with "SEH".
449	*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 corresponds better to current practices.
450	*Dassault Aviation*	5.2	22	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		Accepted	The complete section 5 has been reworked to introduce the notion of Panel 10.

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451	*Dassault Aviation*	4.3 b. & 5.3.3 a. & 5.3.3 b.	13 25 26	It should be clarified that the HW review Report is provided only 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 "Hardware Review Reports" and ""applicant Review Reports" by "hardware audit minutes"		x	Partially accepted	In order to clarify the intent, the following wording has been introduced in 4.3.b: "The applicant should plan and perform his/her own hardware review process (independently from the EASA LOI defined in the Certification Memorandum section 5); this hardware 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 hardware process assurance (as described in ED-80/DO-254 section 8). Nevertheless the hardware process assurance team may be involved or take an active part to the establishment of the hardware review reports."
452	*Dassault Aviation*	5.3.3 c.	26	Categories are not in line with the previous programs.	Replace cat 1 by cat 2, cat 2 by cat 1 and cat 3 by cat 0.		x	Noted	This is only an example. Each applicant can of course keep the own categorization.
453	*Dassault Aviation*	5.3.3 c.	26	System certification documents are not relevant for DO-254 process.			x	Noted	This sub-section does not discuss the scope of system documents but simply says that some system documents may be required by EASA panel 10 as they are relevant to the compliance determination of the AEH. For example, system level requirements are necessary during an SOI#2 to assess the consistency of hardware requirements with system requirements.
454	*Dassault Aviation*	5.3.3 c.	26	CID is not relevant for DO-254 process. It should be the HCI		x		Accepted	The text has been updated as suggested.
455	*Dassault Aviation*	6	28	It's impossible to analyze the effect of a SEU as, by definition, it may occur everywhere at any time. The only point that can be fully answered is the 3rd bullet. The only impacts that can be analyzed are at the pins of the AEH, or if memory is impacted. Furthermore this topic is still discussed in WG-63, S-18 meetings. Therefore, this section should be simply removed.	Delete section 6.		X	Not accepted	This section will be revised when ARP4761 A is issued.
456	*Dassault Aviation*	7	29	Previously developed HW may not have PHAC at the circuit or equipment level.			X	Noted	ED80/DO254 contains Section 11.1 on how to deal with Previously Developed Hardware.
457	*Dassault Aviation*	8.4.2.1 d)	32	Partitioning integrity is impossible to verify when partitioning mechanisms are embedded in the device itself (most of the recent processors are in this case).			X	Not accepted	Processors are out of scope of this section (see section 9).

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458	*Dassault Aviation*	8.4.2.2	34	For level A and B devices: "a) verification strategy for level A and B devices should be based on a hierarchical approach". This is not part of DO-254 guidance.	Remove this sentence.		X	Not accepted	The approach to capture, validate and verify the requirements in a top-down is developed in ED-80/DO-254.
459	*Dassault Aviation*	8.4.3	35	3rd bullet: not applicable PDH			X	Partially accepted	In case of PDH, it depends whether this was requested or not and modified or not in the frame of the new project.
460	*Dassault Aviation*	8.4.4	35	What is meant by intellectual property, it should be defined?	Define the "Intellectual Property"		X	Accepted	Definitions added in section 1.4.
461	*Dassault Aviation*	8.5	36	The definition of SEH is more restrictive than DO-254, which is at the pins of the component, and not internally. This new definition is only applicable to very small PAL component! It should be identical to what you define for DAL C.			X	Partially accepted	The first part of the section is to get harmonised with the FFA where the second part covers simple component which should be developed using section 7 guidance.
462	*Dassault Aviation*	9.3.2 [3]	40	It's totally unrealistic to ask for these type of data in the case of COTS. This design data subsection should be removed.	Remove sub-section		X	Not accepted	The objective is to get the maximum information on the Components characteristics, usage or design.
463	*Dassault Aviation*	9.3.4 [6]	41	2nd bullet: it's totally unrealistic to have this kind of request in the case of COTS. This bullet should be removed.	Remove 2nd bullet		X	Not accepted	The objective is to get confidence on the published errata of the components.
464	*Dassault Aviation*	9.3.5 [9]	41	2nd bullet: it's totally unrealistic to have this kind of request in the case of COTS. This bullet should be removed.	Remove 2nd bullet		X	Not accepted	The objective is to get confidence on the components' manufacturer change processes.
465	*Dassault Aviation*	9.3.5 [10]	41	This CIA and verification can be done only at the circuit level, as the implementation of the COTS is unknown.			X	Accepted	EASA intent is to have additional verification performed at Component/board level. EASA understand that that verification cannot be done at component design level.
466	*Dassault Aviation*	9.3.6 [11]	42	This is much deeper than what should be required at the circuit level in term of integration. This is much over the scope of our activities.			X	Noted	EASA does not agree with the comment. Validation of the components' requirements should be done to justify the choice of the component. Verification that component's requirements match with the environment (board, other components, software) should be done to demonstrate good integration.
467	*Dassault Aviation*	9.3.6 [12]	42	4th bullet is requested to ensure integration HW/SW is valid, but this is already done through HW/SW integration test.			X	Noted	This activity [12] is specific for the highly complex COTS devices. Configuration of these devices may be more complex to be only verified at board level. This bullet is there to get confidence on the device configuration.
468	*Dassault Aviation*	9.3.7 [12]	42	5th and last bullets: this should be amended, as this is not feasible in case of obsolescence. The design can't be totally reworked in this case. Furthermore, the request of 2 years of use is no more realistic as most of the components are now coming from other markets (automotive, railway…etc) with a very short life cycle.			X	Not accepted	The minimum of 2 years has been chosen as a balance between obsolescence and an essential level of maturity.
469	*Dassault Aviation*	9.3.7 [14]	43	Already discussed in 9.3.4. Furthermore last bullet should be removed.			X	Not accepted	Maturity and stability of the component is essential to embed the COTS components in critical path. Evidences are also essential.
470	*Dassault Aviation*	9.3.12	45	Table line #5: It should be required for sufficient ISE in the case of DAL A and B.		X		Not accepted	For complex COTS components level A and B with sufficient ISE, it is deemed sufficient to identify the usage domain and to compare it with limits/recommendations from the component manufacturer (activity [14]).
471	*Dassault Aviation*	10.1 g.	48	This should be removed. This comment does not bring anything as OpenGL library used by the graphical processor should be developed under DO-178B.			X	Not accepted	This is still an EASA concern which should be addressed by the applicant.

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472	*Dassault Aviation*	11.2.1	53	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 that the applicant is the equipment manufacturer.		X	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.
473	*Dassault Aviation*	11.2.2	54	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 DO254.		X		Partially Accepted	Starting by the second point, as mentioned in Section 11.1.a, EASA has considered that, due to the increase in the complexity of the industrial organisation employed in certification projects, it is necessary to clarify the ED80/DO254 intent. Nevertheless, concerning the document packaging, the certification Memorandum mentions that the requested information can also be included as part of any of the other planning documents. Concerning the first point, EASA concurs with the reviewer and it is necessary to avoid prescriptive information concerning the project organisation. EASA proposes the following alternative wording for the last part of the first paragraph: "The plan(s) should be reviewed by the applicant to ensure that the following areas are addressed"
474	*Dassault Aviation*	11.2.2	54	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	There is only one occurrence of this term in the document. EASA has preferred to introduce a different word ("main") in order to have a more clear understanding.
475	*Dassault Aviation*	11.2.2	54	The bullets 1-7 are already addressed within the existing PHAC and HW plans. Clarify the objectives of these new plans ?		X		Not Accepted	From EASA viewpoint, the information requested is additional with respect to the content of the PHAC and hardware plans as per ED80/DO254. As an example, for the problem reporting, the specific request is related to the presentation of how the sub-supplier's OPRs are managed by the main supplier. This information exceeds the scope of the sub-supplier PHAC and should be treated at upper level. Concerning the packaging, as mentioned in the introductory text of Section 1.2.2, the applicant can include the information in "the supplier management plan or other suitable planning documents". Then, information can be presented in the PHAC.
476	*Dassault Aviation*	13.7	59	Even if there is no impact on system, it has to be substantiated.		X		Noted	Yes, if there is no impact on the system, the HAS should include all OPRs. At system level, the description is different (see 13.8).
477	*Dassault Aviation*	13.2 1.	57	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-80/DO-254 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".
478	*Dassault Aviation*	13.8	60	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	Is DO254 meant here, instead of DO178B? EASA is requesting for the OPR section 13.8 of this Certification Memorandum: "*The System Certification Summary* ***or an equivalent certification document*** *should describe:*"

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479	*Dassault Aviation*	13.9	60	System Configuration plans are not applicable to DO-178B process.	To be removed.	X		Not Accepted	Is DO254 meant here, instead of DO178B?EASA is requesting in section 13.9.1: "*In order to ensure that hardware problems are consistently reported and resolved, and that hardware development assurance is accomplished before certification, the applicant should discuss in their hardware Configuration Management Plan,* ***or other appropriate planning documents,*** *how they will oversee their supplier's and sub-tier supplier's hardware problem reporting process. The engineer responsible for certification should review the plans and verify that they address the following to their satisfaction:*"
480	*Dassault Aviation*	13.9	60	At which level is dedicated this section? HW level or system level? What is the definition of Applicant in this section?	Scope to be clarified. "Applicant" to be replaced by "equipment manufacturer".		X	Partially Accepted	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". 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-80/DO-254 etc. However the "Applicant" is not always necessarily the "equipment manufacturer". Section 13.9 describes the "Oversight of Problem Reporting" including how the applicant will oversee their supplier's and sub-tier supplier's hardware problem reporting process it could be at HW Level as well at System Level, depending on the product as well as the constellation.
481	*Rockwell Collins, USA*	4.5 a. (2)	14	Does this mean that 75% of the total effort is completed? This may imply that no requirements have undergone formal verification. Or does it mean that 100% of 75% of the activities are complete? This would imply that 75% of the requirements have undergone formal verification. FAA guidelines define 50% completion for reviews.	Please define what is specifically meant by 75%. Note that the FAA guidelines define 50%.			Noted	It means 75% of 'formal' verification. As the concept of 'formal verification' is not defined in ED-12B/DO-178B, EASA does not consider necessary to add such a wording in this Certification Memorandum. What a certification authority expects to review is of course the final (formal) verification and at a mature stage.
482	*Rockwell Collins, USA*	4.5.3 b.	17	In the table, the DO-254 Section referenced for hardware verification procedures is different than what it was for the table in 4.5.2. Is this an error?	Please review content of table.			Accepted	The wording "hardware verification procedures" has been replaced by "hardware review and analysis procedures" in section 4.5.2.
483	*Rockwell Collins, USA*	7	29	This section implies that DO-254 should be applied at the equipment and circuit board assembly levels, but no specific guidance was provided.	Consider providing additional guidance.			Accepted	The Section clearly has been improved and identifies ED80/DO254 is to be used for LRU and CBA. The Section has been updated to better explain what need to be done.
484	*Rockwell Collins, USA*	8	30	This CM invokes DO-254 for DAL-D AEH; However, recent FAA issue papers have not.	Consider harmonizing.			Accepted	Sentence has been reworded to get harmonised with the FAA AC20.152.
485	*Rockwell Collins, USA*	8.3	31		Use the term "Design Assurance" rather than "Development Assurance", or provide definition/distinction/equivalence for "Development Assurance.			Not accepted	Section 1.3 defined what is Development Assurance Level and explains that it is called Design Assurance Level from a ED-80/DO-254 perspective. EASA would like in the future to standardize the DAL abbreviation by Development Assurance Level which represents more than Design Assurance Level.
486	*Rockwell Collins, USA*	8.3	31	The specific Simple/Complex classification criteria provided cannot be met until the design has been implemented. For example, the classification considers the number of flip-flops and the number of state transitions; these are not known until the AEH is designed.	Remove the last four bullets since these cannot be determined at the time that the classification must be performed.			Partially accepted	The bullet about the sequential cells has been removed but the other ones can be achieved, there are functional.
487	*Rockwell Collins, USA*	8.3	31		Clarify in this section the definition and scope of "device". Does this apply to Intellectual Property?			Partially accepted	The confusion has been removed by adding the note in section 8.1 it does not apply to COTS IP.

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488	*Rockwell Collins, USA*	8.3	31		Consider merging the content of sections 8.3 with 8.5.			Not accepted	EASA thinks it is better to keep separated Sections 8.3 and 8.5 to avoid confusion.
489	*Rockwell Collins, USA*	8.4.1	31	In the past, requirements validation would happen early in the design cycle and simulation was not an option. Why is it included here? It implies that validation can occur at any time.	Please elaborate on the DO-254 objective that is being further defined.			Partially accepted	EASA fully agrees with the comment and tries to clarify the ED80-DO-254 intent.
490	*Rockwell Collins, USA*	8.4.1	31	In the first sentence, what is meant by "specification"? Is the specification simply the requirement set or does it mean a categorization of a requirement type?	Change to read, The specification, including safety and derived requirements …" or provide a definition for specification as it is intended here.			Accepted	Sentence reworded to avoid confusion.
491	*Rockwell Collins, USA*	8.4.2	32	Is the definition of "Verification af the Implementation" implying post layout simulations or in-circuit tests? It appears to imply post layout simulations.	Clarify.			Accepted	Sub-section 8.4.2.2 has been updated to clarify.
492	*Rockwell Collins, USA*	8.4.2.1 b)	32	This section implies Robustness Testing which is good. However, here and in other sections of the CM robustness testing is mentioned or implied and there are no guidelines or limits set forth to attempt to define or bound robustness testing.	Provide guidelines for robustness testing.			Partially accepted	Robustness may be achieved by different means (robust requirements, robustness testing, analysis, etc.) and depends on the company strategy. EASA cannot define exhaustively this topic.
493	*Rockwell Collins, USA*	8.4.2.1 b)	32	Unused functions is not defined.	Clarify that 'unused functions' are functions that are unused in the physical implementation of the device, not in the HDL implementation. An unused function at the HDL level that is tied off will likely get optimized out during synthesis.			Partially accepted	A note has been added to refer to the ED-80/DO-254 section 3.3.1.2.3.
494	*Rockwell Collins, USA*	8.4.2.1 c)	32	This would be better placed in Section 8.4.4.	Consider relocating/merging text.			Not accepted	This section is talking about the integration of the COTS IP in an ASIC/FPGA.
495	*Rockwell Collins, USA*	8.4.2.1 f)	32 33	The phrase 'The need' beginning each of these bullet items is too loose a term.	This section should be rewritten to insist that the PHAC or developmental standard include these terms.			Accepted	The wording "the need" has been replaced by "guidelines" or "rules".
496	*Rockwell Collins, USA*	8.4.2.1 f)	3233	Synthesis checks were not called out. Additionally, style and naming rules should not be required as a means of compliance for safety objectives.	Consider these recommended edits.			Partially accepted	EASA fully agrees with the comment and add a bullet on synthesis check. About the style, EASA thinks it is up to the applicant to sort the rules as recommended, mandatory, etc in the coding standards.
497	*Rockwell Collins, USA*	8.4.2.1 f)	32 33	The examples provided with "exclude or limit the use of certain types of constructs" are not valid. Constructs would be limited based on whether they are synthesizable.	A rule simply stating that the only synthesizable constructs are to be used should be sufficient.			Partially accepted	EASA thinks it is up to the applicant to define all coding rules and in some case, there may be the need to exclude or avoid some constructs.
498	*Rockwell Collins, USA*	8.4.2.1 f)	32 33	The HDL standards should ensure a high probability of a valid, sound, deterministic design. There should be no constancy that this list is thorough.	Indicate that the listing provides an example.			Partially accepted	The sentence has been reworded to avoid confusion
499	*Rockwell Collins, USA*	8.4.2.1 g)	33	The use of a state machine would be considered design implementation, so the only way explicit coverage analysis of the state machine can be performed would be via robustness testing. Further, it is not clear what state machine transition coverage provides that is not provided by branch coverage.	Explain the need for state machine transition coverage.			Partially accepted	The comprehensive verification of a state machine may be done achieved by different ways to be determined by the applicant. If the transition coverage is met by the decision coverage (simple SM), it should be documented).
500	*Rockwell Collins, USA*	8.4.2.1 g)	33	The definition of decision coverage is lacking.	Define decision coverage and clarify whether this would imply branch or condition coverage.			Not accepted	The decision coverage is indicated into bracket in 8.4.2.1.g - For Level A: Decision coverage. (Every point of entry and exit in the HDL code has been invoked at least once and every decision in the HDL code has taken on all possible outcomes at least once.)
501	*Rockwell Collins, USA*	8.4.3.1 i)	33	This implies traceability between the code and the conceptual design.	Ensure this interpretation is correct; otherwise clarify.			Accepted	Sub-section reworded to avoid confusion.

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502	*Rockwell Collins, USA*	8.4.2.2 a)	34	The text implies elemental analysis at the gate level based on the previous definition of implementation as being the hardware. This is beyond the capabilities of any current tools. The only way to do this would be to link gates to the requirements, which is explicitly excluded from DO-254.	Reconsider the feasibility of this aspect of elemental analysis, providing clarification it the CM position is to be upheld.			Partially accepted	EASA agrees that elemental analysis is unfeasible to reach verification objectives. But it is not the intent of this section which just detailed the verification implementation performed on the device.
503	*Rockwell Collins, USA*	8.4.2.2 a)	34	The wording discussing sub-functions would imply writing requirements at the module level. Requirements are currently written at the device level. Testing at the sub-function level would appear to be function verification as opposed to requirements based verification.	Clarify the intent of sub-functional verification.			Not accepted	This section explains the need to verify the conceptual and design data (sub-functions) and to document it.
504	*Rockwell Collins, USA*	8.4.3	34 35	This is a change to DO-254. DO-254 only requires traceability from requirements to verification for DAL-C.	Provide rationale for this increased requirement.			Partially accepted	It is the EASA understanding that traceability is needed for level C complex devices to ensure a correct behaviour.
505	*Rockwell Collins, USA*	8.4.4	35	Robustness verification discussion is unclear.	Define "functional robustness verification". Also, clarify "Functional robustness verification at isolated IP level".			Accepted	Sub-section confusing and reworded.
506	*Rockwell Collins, USA*	8.4.4	35	IP is not clearly defined. Does it include building blocks from ASIC/PLD vendors such as FIFOs, Multipliers, Clock Conditioning Circuits, etc.? Does it include COTS IP? Or does it only pertain to custom IP developed in-house? Only the latter is likely to be developed to DO-254. Would guidance be different for the different IP types?	Define "IP". Also, state the type of IP to which this guidance applies.			Accepted	Definitions added in section 1.4.
507	*Rockwell Collins, USA*	8.4.4	35	Is this section implying that IP needs to be developed to DO-254? Or is it saying that it can be verified as a black box? What types of IP can be verified as a black box?	Please clarify.			Accepted	Sub-section confusing and reworded.
508	*Rockwell Collins, USA*	8.4.4	35	For vendor library functions, what are the criteria for defining requirements for the interface to that function?	Provide criteria.			Partially accepted	The interface should be defined by the user and verified accordingly.
509	*Rockwell Collins, USA*	8.5	36	For Level A and B "under all permutations of condition of the inputs" would not allow the exception of whether the combination is even possible.	Change text to read "… under all possible permutations …"			Accepted	Added possible.
510	*Rockwell Collins, USA*	8.5	36	It is not evident why "all possible states of any sequential state machine …" text was included in For Level C bullet.	Explain the basis for limiting to "sequential" state machines.			Accepted	Sequential suppressed.
511	*Rockwell Collins, USA*	8.5	36	The explanations under the various levels dictate demonstration "under all permutations", yet two bullets later it says "SEH may be tested at the equipment level to demonstrate the device performs as required." Is that in order to meet the "under all permutations" or as an alternative means to verifying "under all permutations".	Please clarify.			Accepted	Added "possible" before permutation.
512	*Rockwell Collins, France*	1.4	9	Simple Electronic hardware (SEH): "A hardware device is considered simple only if a comprehensive combination of deterministic tests and analyses appropriate to the Design Assurance Level can ensure correct functional performance under all foreseeable operating conditions with no anomalous behaviour." What does "appropriate to the Design Assurance Level" mean exactly? What does it imply?	Remove "appropriate to the Design Assurance Level".		objection	Not accepted	This definition was copied and pasted from ED-80 / DO254.

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513	*Rockwell Collins, France*	1.4	8	"Integrated Circuit last sentence: - remove "","" between ""highly complex"" and ""COTS"". - ""CEH,SEH"" are mentioned in the list, at the same ""level"" as ASICs, microcontrollers, etc., but they are not at the same ""level"" of definition, they are not specific types of components, CEH and SEH correspond to a different way of classifying hardware."	- 1st comment: Remove "," between "highly complex" and "COTS". - 2nd comment: Remove ", CEH, SEH".	suggestion		Partially accepted	The "," was removed. An Integrated circuit may be simple or complex: no change needed.
514	*Rockwell Collins, France*	1.4	7	an IP detailed definition would be useful	Add IP detailed definition	suggestion		Accepted	COTS IP definition has been added.
515	*Rockwell Collins, France*	2	10	A cross reference to FAA documents and CAST papers would be useful (see SW-CEH-02 section 2.1)	Add cross reference to FAA documents and CAST papers	suggestion		Accepted	Chapter 2.1 was added.
516	*Rockwell Collins, France*	3.2	11	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	Certification basis and associated interpretative material are defined at product level and ETSO should comply with them. Compliance to the Certification Memorandum may be indicated in the Declaration of Design and Performance of the ETSO. When the AC Cert basis is unchanged there is not need to comply with new Certification Memoranda.
517	*Rockwell Collins, France*	4.2	12	Why having removed the definition of word "Presentation" from EASA Certification Memo ref. MEMO-SWCEH-002?		observation		Noted	The reason for removing this definition is that no use is made of the term "presentation" in the rest of the document. Therefore no change to the existing text is considered necessary.
518	*Rockwell Collins, France*	4.5.2 a. (1)	15	"Conceptual hardware design data are documented, reviewed, and traceable to system requirements (if applicable to the SEH/CEH)." Why is it restricted to the SEH/CEH?		suggestion		Accepted	We agree that this non-applicability is misleading. The best solution is to remove this statement to avoid any confusion. This has been done in the updated text.
519	*Rockwell Collins, France*	4.5.2 a. (3)	16	Why mentioning "(if applicable)”? Precisions should be added.	Substantiate the cases where it is not applicable	observation		Accepted	We agree that this non-applicability is misleading. The best solution is to remove this statement to avoid any confusion. This has been done in the updated text.
520	*Rockwell Collins, France*	4.5.5	19	Note (3): Replace "SHE" by "SEH".		suggestion		Accepted	"SHE" has been replaced with "SEH".
521	*Rockwell Collins, France*	8.1	30	1st § : Why mentioning "FPGAs", as according to § 1.4, "PLD" include "FPGA" ?	Remove "and FPGAs".	suggestion		Accepted	FPGA removed.
522	*Rockwell Collins, France*	8.1	30	"For Level D components, the additional guidance of this Cert memo does not apply but the ED-80/DO254 processes are still applicable." There is a contradiction: if DO-254 applies to level D, the associated guidance should be applicable (it is only a mean to reach the concerned DO-254 objectives).			objection	Accepted	Section confusing and reworded.
523	*Rockwell Collins, France*	8.4.2	32	Title of this section is "Requirements Verification", whereas it deals with "Verification of the design description" (§ 8.4.2.1) and "Verification of the implementation" (§ 8.4.2.2).	Replace "Requirements Verification" by "Hardware Verification" or "Verification Process".	suggestion		Accepted	Title changed.
524	*Rockwell Collins, France*	8.4.2.1 f)	32 & 33	This CM states: "If a Hardware Description Language (HDL), as defined in ED-80/DO-254, is used, guidance for the use of this language should be defined" and "Conformance to those standards should be established." DO-254 does not require HW design standards for DAL C and D hardware. On the contrary, these CM statements apply to any DAL. So, this corresponds to supplementary requirements with regards to ED-80/DO-254, whereas this CM is only a guidance.			objection	Not accepted	Section 8 applies to complex ASIC/PLD level A, B and C and EASA thinks therefore it is necessary to ensure a correct HDL code for those levels when complex components are designed.

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525	*Rockwell Collins, France*	8.4.2.2 a)	34	"ED-80/DO-254 recommends for level A and B hardware that a complementary verification activity ("bottom up" approach) called "elemental analysis" and "analysis of the implementation" in this text should be performed."" This part a) should be moved in § ""For levels A and B devices"", and link should be done between it and the different items a) to d) of the 2nd part."	Move this part a) in § "For levels A and B devices", and make the link between it and the different items a) to d) of the 2nd part.	suggestion		Accepted	Sub-section removed.
526	*Rockwell Collins, France*	8.4.2.2 c)	34	"RTL" (Register Transfer Level or Register Transfer Language) should be defined in section 1.3.		suggestion		Partially accepted	EASA agrees a definition is useful but the definition has been added in the bracket.
527	*Rockwell Collins, France*	8.4.3	35	"Note 6 from ED-80/DO-254 table A-1 of Appendix A for DAL C stating that "Only the traceability data from the requirements to tests is needed" should be considered as not applicable. This means that for a DAL C device, traceability should be established between requirements, the detailed design, the implementation and the verification procedures and results."" This statement corresponds to a supplementary requirement with regard to ED-80/DO-254, whereas this CM is only guidance."		observation		Partially accepted	It is the EASA understanding that traceability is needed for level C complex devices to ensure a correct behaviour. ED80/DO254 and this Certification Memorandum are guidance only.
528	*Rockwell Collins, France*	8.4.6	35	"Netlist" is cited in the text, but it should be defined in § 1.4.		suggestion		Partially accepted	Netlist removed.
529	*Rockwell Collins, France*	8.5	36	* "The following guidelines apply to Simple Electronic Hardware (SEH) components according to their design assurance level (DAL): · The comprehensive combination of deterministic tests and analyses that: o For Levels A and B, demonstrate the expected operation under all permutations of conditions of the inputs of the individual logical components (gates or nodes) within the device." Formulation is not clear. * "For Level D, demonstrate the device satisfies the system or component level requirements specified for the device": What about board level?	* 1st comment: Remove "that" in 2nd sentence.	Observation		Accepted	Sentence changed to avoid confusion.
530	*Rockwell Collins, France*	8.5	36	"SEH may be tested at the equipment level to demonstrate the device performs as required. That is, testing of the card, module, or Line Replaceable Unit (LRU) in which the SEH is installed may be used to show that the SEH satisfies the device level requirements with the same test procedures used to verify correct operation of the card, module, or LRU. This approach should be documented in the system Certification Plan or in the Plan for Hardware Aspects of Certification."" This item should be gathered to 1st paragraph of section 8.5, as it covers similar verification topics."		suggestion		Accepted	Sentence removed to avoid confusion.
531	*Rockwell Collins, France*	8.5	36	Why having removed from EASA Certification memo ref. MEMO-SWCEH-002 the sub-section dealing with the minimum list of documents to be produced for SEH?		observation		Accepted	List of documentation reintroduced.
532	*Rockwell Collins, France*	9.1	38	"System-on-Chips" is mentioned in the text. This term should be defined in § 1.4.		suggestion		Accepted	The wording "System on Chip" was replaced by "highly complex COTS microcontroller".

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533	*Rockwell Collins, France*	9.2	38	"In ""Complex Commercial-Off-The-Shelf (COTS) components"" and ""Simple Commercial-Off-The-Shelf (COTS) components"", what does ""components"" mean? Does it include ASIC and PLD (it should, as COTS could be ASIC or PLD)? I guess it doesn't correspond to ""IC"", as ""IC"" includes COTS microcontrollers, and those COTS microcontrollers are listed in the following items."	Define in § 9.2 or in § 1.4 the terms "COTS component".	suggestion		Accepted	"Complex COTS components" was replaced by "Complex COTS ICs". "Simple COTS components" was replaced by "Simple COTS ICs".
534	*Rockwell Collins, France*	9.2	38	"COTS IP is outside the scope of this section (See section 8.4.4)." Section 8.4.4 doesn't address COTS IP topic, with the problematic of existence or non-existence of associated design data, etc.	Usage of COTS IP should be addressed explicitely in the CM.	suggestion		Accepted	Section 8.4.4 was improved to cover COTS IPs.
535	*Rockwell Collins, France*	9.3.1	39	"Its classification as simple and complex, which at least depends on: … the description of the functional blocks of the device with the types of interfaces and a description of the data processing performed": Most of the time, this data is not available.		observation		Noted	The objective is to identify the "complex" data processing.
536	*Rockwell Collins, France*	9.3.4 [6]	41	"That the rate of publication of new errata from the component manufacturer decreases as a function of time"": ""publication"" should be replaced by ""occurrence"". (Frequency of publication could decrease, but at the same time, frequency of occurrence of errata could increase.)"		suggestion		Accepted	Wording changed as proposed.
537	*Rockwell Collins, France*	9.3.7	43	For components allocated DAL C, it is mentioned "[Hours in flight + hours during board/…". I guess "Hours in flight" means "Hours in flight or on ground", as it is stated in the other paragraphs.	Replace "Hours in flight" by "Hours in flight or on ground"	suggestion		Accepted	Wording changed as proposed.
538	*Rockwell Collins, France*	9.3.8	43	Architectural mitigation examples would be useful or a reference to DO-254 section 3.1 could be done	Architectural design features, such as dissimilar implementation, redundancy, monitors, isolation, partitioning and command/authority limits, can be specifically employed to mitigate or contain the adverse effects of hardware design and implementation errors.	suggestion		Not accepted	EASA don't want to give examples which may be subject to misinterpretation. The means to fulfil this architectural mitigation objective should be discussed knowing the full environment of the COTS component. Of course, architectural mitigation proposed within ED-80/DO-254 appendix B §3.1 may be used.
539	*Rockwell Collins, France*	9.3.8	43	When architectural mitigation is used, it could be an alternative method replacing previously described activities [1] to [16]. Besides, section 10 related to COTS CGP only requires architectural mitigation to ensure COTS malfunction coverage, and doesn't require realization of activities [1] to [16] .		observation	substantive	Noted	It is EASA understanding that confidence given by an architectural mitigation at component level might not cover or alleviate completion of other items.
540	*Rockwell Collins, France*	9.3.11 & 9.3.12 & 9.3.13	44 to 46	What is presented in the 3 tables is that for DAL simple, complex or highly complex COTS, activity "Architectural mitigation" is applicable. Why couldn't we use this activity for DAL B, C or D COTS, when we have difficulties to cover some of the applicable activities ticked off in the tables?		observation		Noted	EASA cannot cover all combination of activities that can be or not performed and therefore this will be discussed on project by project cases. Also please note that the confidence given by an architectural mitigation at component level might not cover or alleviate completion of other items.
541	*Rockwell Collins, France*	11.1 b.	53	"Lack of proper validation and verification of life cycle data at the transition point has resulted in issues with regard to requirements, problem reporting, changes, etc.": "has resulted" is not appropriate.	Replace "has resulted" by "may result".	suggestion		Accepted	Change implemented as proposed.
542	*Rockwell Collins, France*	11.1 c.	53	"and mandatory corrections (airworthiness directives)": airworthiness directives rather address mandatory "evolutions".	Replace "corrections" by "evolutions".	suggestion		Partially Accepted	EASA proposes the addition of evolutions. EASA considers that the word correction should be kept because, in most of the cases, the airworthiness directive is targeted to correct a problem found in the aircraft/engine/propeller.
543	*Rockwell Collins, France*	11.2.2	54	Last §: The reference to § "13.1.b" is erroneous (dealing with transition between applicant's processes and suppliers' processes).	Replace "13.1.b" by "11.1.b"		Objection	Accepted	Typo error. It should say 11.1.b

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544	*Rockwell Collins, France*	12.2	56	"Where a change is made to AEH produced in accordance with the guidelines of EUROCAE ED-80/RTCA DO-254, the change should be classified as major if any of the following applies, and the failure effect is Catastrophic, Hazardous or Major"".- What is the ""failure effect"" related to ?- One of the criteria is that ""the failure effect is Catastrophic, Hazardous or Major"", whereas in part 1), only AEH equipment or CBA ""Level A or Level B"" is considered. There is here some inconsistency."		observation		Accepted	Wording was confusing and change.
545	*Rockwell Collins, France*	13.9.1 1)	60	"Re-verified (regression testing and analysis)": in term of re-verification following the correction of a problem, there are 2 steps: the problem correction testing, and the non-regression testing.	Replace "regression testing" by "problem correction testing, non-regression testing".	suggestion		Partially Accepted	Regression analysis is the generic term to refer to re-verification. EASA will amend section 13.9.1 1) as followed: 1) 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 analysis), closed, and controlled. The plans should consider all problems related to hardware, LRU, CBA, ASIC/PLD and COTS used in any systems and equipment installed on the aircraft.
546	*Rockwell Collins, France*	13.9.2 4)	61	"and other mandatory corrections or conditions": Why mentioning "mandatory corrections" ? Isn't it rather "mandatory evolutions"?	Replace "mandatory corrections" by "mandatory evolutions".	suggestion		Not Accepted	EASA see's no improvement of section 13.9.2 4) by Replacing "mandatory corrections" by "mandatory evolutions". Therefore no change of this section.
547	*Rockwell Collins, France*	General		The sections 1.4 and 9, which give definitions and which discuss about COTS, don't address ASIC and PLD. Yet, according to DO-254 definition (see Appendix C of DO-254), a COTS is a "Component, integrated circuit or subsystem developed by a supplier for multiple customers, whose design and configuration is controlled by the supplier's or an industry specification". So, a COTS could be an ASIC or a PLD. This should be precised in the Certification Memo.	ASIC and PLD should be explicitely addressed in Certification Memo in parts dealing with COTS.	Suggestion		Noted	Within the Certification Memorandum, ASIC and PLD are explicitly addressed within Section 8. In case the applicant has no access to the life cycle data of the ASIC/PLD to demonstrate compliance to ED-80 / DO-254, then the Section 9 could be used.
548	*Rockwell Collins, France*	General		Product in-service experience (ISE) is no more addressed in this Certification Memo, whereas, in the same time, a new section dealing with application of DO-254 to LRU and SRU level has been added. DO-254 doesn't present detailed criteria regarding product ISE as well.	A section should be added to address Product In-service experience, and a set of minimum quantitative acceptable criteria should be presented to be used for the constitution of the ISE dossier.	Suggestion	Substantive	Noted	Section 9.3.7 detailed some criteria to be taken into account when assessing the Product Service Experience of the COTS components.
549	*Thielert Aircraft Engines GmbH*	9.2	38	Microcontrollers are usually less complex than Microprocessors and have a lower potential to introduce errors. The test coverage by the manufacturer under different operating conditions is also higher compared to a microprocessor system with additional external TTL Logic, FLASH and RAM where only the microprocessor could be tested by the manufacturer.	Therefore it should be allowed to treat COTS microcontroller as microprocessors and certify them during the ED-12B/DO-178B process.		X	Not accepted	Beside the core processing part of the micro controllers there are peripherals which cannot be fully addressed be software activities. Thus they should be addressed by the activities listed in this §9.
550	*Thielert Aircraft Engines GmbH*	9.3.7	42-43	The data to establish sufficient ISE is very difficult if not practically impossible to get. The MPC555 for example is well known to be widely used in military, avionics and automotive applications. But I see no way to get data about the hours in service of this device.	Allow additional ways to qualify for sufficient ISE, e.g. time since product introduction, time since last product change for COTS that is known to be used in mass markets like automotive.		X	Noted	What is requested in this §9,3,7 is : "The total order of magnitude of the time for which the component has been used (i.e. the number of execution hours and usage duration in years).

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551	*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 airborne electronic hardware 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, instead, 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 intent is to publish new AMCs in the future. As written page 1: "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. "
552	*Avidyne Corporation*	All	All	DO-254/ED-80 provides the applicant with a concise set of compliance criteria by which a hardware product can be judged. We find it confounding that a "clarification" of DO-254/ED-80 can articulate so many concerns while providing so few actual compliance criteria. Moreover, while the criteria offered by DO-254/ED-80 are abstract, permitting the applicant freedom of choice in matters of form and format, in those cases where this CM actually provides criteria they are suffocating specific.To the extent that the CM is used to supply compliance requirements, the compliance items must be clearly identified and criteria myst be included. Merely identifying "concerns" without any indication as to what compliance items result from those concerns is unfair to applicants and guaranteed to be burdensome, time consuming and risky with no assurance of a successful outcome based on well-understood criteria.To the extent that the CM is used merely to provide information on topics of interest or concern, these informational passages must be clearly identified so that they do not inadvertently become compliance items through misunderstanding.	Clarify.	suggestion	objection	Noted	There are 2 reasons that lead EASA to issue this Certification Memorandum:- As it is written, ED-80 / DO-254 is not considered as precise enough and too much subject of misinterpretation,- Some concerns are not covered.

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553	*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	Noted	Certification basis and associated interpretative material are defined at product level and ETSO should comply with them. Discussions with manufacturers define case by case which Certification Memorandum is applicable if any.
554	*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 gap filler.	Add statement placing responsibility for determining whether applicant is in compliance with EASA	Suggestion	Objection	Noted	As far as possible, EASA intent is to raise only the issues which are not covered by the data provided by the applicant.
555	*Avidyne Corporation*			The CM makes not statement regarding harmonization with comparable FAA guidance. It should do so, even though it is clear that the majority of its compliance requirements are not harmonized. In particular, we find it peculiar that the CM makes no reference to FAA Order 8110.105 Change 1, which covers some of the same topics. Does EASA propose no credit for work done under the FAA's Order? 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.	Clarify.	suggestion	objection	Accepted	Chapter 2.1 was added.

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556	*Avidyne Corporation*	1.4	79	ASIC: Confusing and inexact definition. As written, does not exclude COTS. We believe the important distinctions from a process perspective are that ASICs are mask programmed (as opposed to field programmed) non-COTS integrated circuits. COTS IC: Confusing definition that conflicts with other terms used in the CM. For the definition of a COTS IC to make sense, it must be an IC (as defined in the CM) that is a commercial off-the-shelf component. The definition of COTS IC in the CM includes additional qualifiers such that some ICs that are COTS are not COTS ICs. COTS Graphical Processor: In the sense of Section 10, this definition is simplistic and focuses on the wrong attributes of the component. The intended application is not really a subject of concern. The subjects of concern are the architecture and life cycle of the component. The definition, to be usable in Section 10, should take these factors into account and disregard the intended application. COTS Microcontroller: The relevance of the last sentence (the parenthetical statement "See also definition of SEH below") is unclear. Highly Complex COTS Microcontroller: The meaning of "not strictly separated" in the first bullet point is unclear. The second and third bullet points are unclear. Microprocessor: This definition is unrealistically narrow and differs significantly from industry standard terminology. There are hardly any microprocessors available in today's markets that have none of the peripheral elements listed in the definition. Specifically, memory management units, watchdog timers, real time clocks and memory bus controllers are all nearly standard features of contemporary microprocessors and should be included in the definition.Simple Electronic Hardware: The purpose of the Comments is unclear. Are they meant to say that certain hardware devices may be considered simple even if the "deterministic tests and analyses" criterion is not met? Or are they intended to be criteria in addition to that? If the latter, we object: If a device meets the "deterministic tests and analyses" criterion, no other criteria are necessary.	Correct.	suggestion	objection	Partially accepted	The ASIC definition was improved to highlight that ASICs are mask programmable ICs as opposed to PLDs which are field-programmable.Within the definition of IC, it is clear in the last sentence that: "Digital and Hybrids ICs include ASIC, COTS ICs, highly complex, COTS Microcontroller, Microprocessor, COTS Microcontroller, COTS Graphical Processor, PLD, CEH, SEH. "EASA considers that definition within section 10 is consistent with definition in section 1.4The SEH definition is the definition of what is considered as simple component: EASA considers that it is clear enough."Not strictly separated": means that may have intercommunication between the Central Processing Units through a common bus. Microprocessor: any component which execute software and which does not fall into microprocessor definition is a microcontroller.SEH: Achievement of the criteria "deterministic test" can be demonstrated once the tests are finished. Before this step, applicant can just assume that the component is simple using the other criteria defined in this Certification Memorandum.
557	*Avidyne Corporation*	3.1	11	This section is confusing. It offers DO-254/ED-80 as an acceptable means of compliance but then suggests that additional guidance is required. Which is it?	Clarify	Suggestion	Objection	Noted	EASA considers that ED-80 / DO-254 alone is not sufficient. That's the reason why in the same sentence EASA recognise ED-80 / DO-254 as acceptable means of compliance why the use of EASA additional guidance.
558	*Avidyne Corporation*	3.2	11	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 or complement DO-254/ED-80 compliance. Once that compliance has been shown and a particular design assurance level (or levels) has been affirmed for an appliance, issues of DO-254/ED-80 compliance have been forever settled. 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-254/ED-80 compliance, even as extended by this CM, does not fall into those categories.	Revise statement of policy to eliminate TC/STC-time compliance activities for ETSOA appliances	Suggestion	Objection	Not accepted	EASA considers that the AEH technology evolve quickly. Guidance should evolve to follow these new technologies. It is wrong to say that ED-80 / DO-254 and this Certification Memorandum will remained forever.

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559	*Avidyne Corporation*	4	12-21	This section appears to have been based on FAA Order 8110.105 Chapter 2. Because EASA has made no reference to the FAA's Order, we have not reviewed this section for differences. We would recommend full harmonization with the Order.	Harmonize	Suggestion	Objection	Noted	The structure of the Certification Memorandum is not similar to the one of order 8110.105. Harmonisation is done under CAST meetings, and Certification Memorandum and orders may be updated according to the CAST discussions. The FAA order 8110.105 is recognized by EASA as acceptable guidance on a case by case basis for each project. Currently, no change to the existing text is considered necessary.
560	*Avidyne Corporation*	5	22-27	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-254/ED-80.	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)."
561	*Avidyne Corporation*	5	22-27	The section seems to take the view that the applicant is not the hardware developer and, perhaps, not even responsible for development of the system that contains the hardware. As a result, some of the information and processes assigned to the applicant are satisfied by ordinary information flow in a DO-254/ED-80-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. This consideration of the industrial organization and the relationship with suppliers does 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.
562	*Avidyne Corporation*	5.3.3 b. & c.	25-26	This section creates a new documentation item, Hardware Review Reports, not required by DO-254/ED-80. In addition, Item (c) requires their submittal in most projects.	Remove	Suggestion	Objection	Not accepted	In order to clarify the intent, the following wording has been introduced in 4.3.b: "The applicant should plan and perform his/her own hardware review process (independently from the EASA LOI defined in the Certification Memorandum section 5); this hardware 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 hardware process assurance (as described in ED-80/DO-254 section 8). Nevertheless the hardware process assurance team may be involved or take an active part to the establishment of the hardware review reports."

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563	*Avidyne Corporation*	6	28	This section contains no modulation by DAL. DO-254/ED-80 states in Section 2.3.4 that "As the severity of the system failure condition increases, the amount of hardware design assurance necessary to ensure that related failure conditions have been mitigated increases. […] For Level A or B functions implemented in hardware, the design assurance considerations should address potential anomalous behaviours and potential design errors of the hardware functions." In our view, SEU falls within the intent of "potential anomalous behaviours" in this passage. Accordingly, we suggest that SEU safety analysis be limited to Level A and B components only.	Modulate requirements by DAL	Suggestion	Objection	Not accepted	This section asks the applicant to perform an analysis in order to determine the safety impact of such effects. There is no need to link this analysis with the DAL of the component as the safety analysis will already take into account the criticality of component.
564	*Avidyne Corporation*	6	28	The section contains almost no guidance on depth or rigor of the analysis. Moreover, the section does not exclude COTS components, which will generally be impossible to analyze with any depth or rigor.	Clarify	Suggestion	Objection	Partially Accepted	COTS components as the rest of the hardware should be in the scope of this two-step approach analysis. Clarification has been added.
565	*Avidyne Corporation*	7	29	Full and immediate implementation of DO-254/ED-80 at the system level would, for many equipment manufacturers, represent a huge and expensive change in development methodology, especially in a very mature area of design practice. We are inclined to wonder whether there is conclusive evidence of design problems at the board and system level that would justify the effort and expense to both applicants and EASA (and, presumably, the FAA) and that can reasonably be expected to be corrected by full implementation of DO-254/ED-80. A phase-in strategy for new products might offer a path to full, system-level implementation. Implementation with regard to changes to existing products would be ruinous and unacceptable.	Adopt phase-in strategy for system level application of DO-254/ED-80	Suggestion	Objection	Noted	There is a need to deal with the inconsistency due to the lack of Development Assurance requested at system level (covers by ED79/ARP4754) and at item levels (SW cover by ED12B/DO178B and CEH/SEH cover by ED80/DO254). It is the EASA understanding that requirements at board level needs to be correct and complete and finally verified to ensure compliance with CS XX.1301 and 1309. The level of complexity for boards has increased tremendously during the last years and the Development Assurance is therefore necessary. That compliance to ED80/DO254 for boards is requested by some applicants to their suppliers for years.
566	*Avidyne Corporation*	7	29	The CM refers to DALs as determined under Table 2-1 of DO-254/ED-80. For small airplanes, EASA recognizes the guidance of FAA AC 23.1309-1D, which modulates DAL by airplane class. We would recommend that this be clarified.	Indicate recognition of FAA AC 23.1309-1D	Suggestion	Objection	Noted	The recognition of the FAA AC23.1309 is a more high level issue than this Certification Memorandum. It is usually done on case by case basis in a frame of an application.
567	*Avidyne Corporation*	7	29	The first sentence of the last paragraph in this section makes no sense. Paraphrasing, it says "You don't need to comply with DO-254/ED-80 as long as you comply with DO-254/ED-80." If the intent is to allow alternatives, this doesn't do it.	Correct	Suggestion	Objection	Accepted	The sentence was not clear and reworded
568	*Avidyne Corporation*	8	30-37	This section makes a number of references to Intellectual Property (IP). It appears that all of these are intended to apply only to COTS IP, not to the applicant's own intellectual property. We would recommend that all of these references be changed to COTS IP.	Correct	Suggestion	Objection	Accepted	Definition of IP has been changed, the title of the sub-section 8.4.4 and the content of sub-section 8.4.4.
569	*Avidyne Corporation*	8.1	30	The CM refers to DALs as determined under Table 2-1 of DO-254/ED-80. For small airplanes, EASA recognizes the guidance of FAA AC 23.1309-1D, which modulates DAL by airplane class. We would recommend that this be clarified.	Indicate recognition of FAA AC 23.1309-1D	Suggestion	Objection	Noted	The recognition of the FAA AC23.1309 is a more high level issue than this Certification Memorandum. It is usually done on case by case basis in a frame of an application.
570	*Avidyne Corporation*	8.1	30	We do not understand the meaning of the Note. In particular, the word "requested" seems out of place. We would recommend that the note be changed to read "… provided that compliance with ED-80/DO-254 Development Assurance objectives is shown as part of ETSOA."	Correct	Suggestion	Objection	Partially accepted	The note was confusing and has been reworded.

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571	*Avidyne Corporation*	8.2	30	This section states that "The Development Assurance of COTS Graphical Processors (CGPs) is outside the scope of this Section…" It appears to us that *all* COTS devices are outside the scope of this Section. This statement should be corrected.	Correct	Suggestion	Objection	Not accepted	EASA thinks it is beneficial to indicate that GCP and COTS are not in the scope of section 8.
572	*Avidyne Corporation*	8.3	31	After presenting a list of characteristics to be considered, this section states "As a result of the assessment of the criteria here above, the ability to verify by test on the physical device all the requirements in all configurations is a prerequisite for the classification of an device as simple." This is a different, and narrower, criterion from that presented in the definitions of Section 1.4. Inasmuch as the definition in Section 1.4 is consistent with that of the FAA, we recommend its use rather than the definition in this section.	Adopt Section 1.4 definition of SEH	Suggestion	Objection	Accepted	The section refers now to section 1.4.
573	*Avidyne Corporation*	8.3	31	Inasmuch as the purpose of the assessment is to substantiate that a component is simple, we would request that the assessment requirement (which represents a substantial amount of effort) be waived if the applicant elects to treat a component as complex.	Waive assessment requirement for complex components	Suggestion	Objection	Partially accepted	In the case an applicant would like to develop a component as complex without doing the assessment, it is implicit that this section would not apply. However, EASA cannot write this kind of statement.
574	*Avidyne Corporation*	8.4.2.1	32-33	As a compliance requirement, we view item (f) as excessively detailed and prescriptive. While weagree that the listed items are generally good practice, we do not agree that all representappropriate minimum compliance requirements or appropriate to every situation. In particular:· Comment, style, naming, file structure and file organization rules tend to be arbitrary and trivialand contribute little or nothing to code quality.· Traceability information may not be required if supplied by means other than inclusion in thesource files.· Standards related to testability are unnecessary, as it will be evident whether test objectivesare met or not.· "Lessons learned" may not be best addressed by their inclusion in code standards.	Remove	Suggestion	Objection	Partially accepted	EASA fully agrees that some rules are not mandatory but improved the maintainability of the HDL code for example. Also, EASA thinks it is up to the applicant to define all coding rules and to mention when they are mandatory or recommended.
575	*Avidyne Corporation*	8.4.2.2	34	As written, item (b) seems to indicate that all robustness considerations must be tested and that analysis may be required in addition to this testing. This would not seem to make sense – if all robustness considerations are tested, analysis would be redundant in every case. We suspect that the passage was intended to mean that testing be performed wherever practical, supplemented by analysis as necessary to cover those considerations that remain. We would recommend that it would be simpler and sufficient to change the first sentence to read "… requirements-based testing should be defined, supplemented by analysis as necessary …" and that the second sentence be removed.	Clarify.	Suggestion	Objection	Not accepted	EASA thinks that it is better to keep both sentences to make it clearer.
576	*Avidyne Corporation*	8.4.2.2	34	Depending on the applicant's chosen documentation approach, the description of planned verification activities requested in item (c) may be more appropriate for inclusion in the Hardware Verification Plan. We would recommend that the item be changed to "The PHAC (or, at the applicant's discretion, the Hardware Verification Plan) should…" to accommodate this choice.	Correct.	Suggestion	Objection	Accepted	HVP plan has been added.
577	*Avidyne Corporation*	8.4.4	35	This section's scope should be limited to COTS IP, not the applicant's own IP.	Correct	Suggestion	Objection	Partially accepted	In case it an IP applicant, it should be classified as Previously Developed Hardware (PDH)

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578	*Avidyne Corporation*	8.4.4	35	The first bullet point states that "the used functions of the [COTS] IP should be defined as derived requirements…" The used functions of the COTS IP are, in fact, likely to be the subject of developed, not derived, requirements. These developed requirements form the interface to the COTS IP and the basis for its selection. We would recommend deletion of the word "derived" from this sentence, allowing the requirements of the COTS IP to be treated like any other requirements in the project.	Correct	Suggestion	Objection	Accepted	"Derived" removed
579	*Avidyne Corporation*	9.2	38	No justification is presented for the compliance requirements presented in this section. We do not see any reason why a simple COTS microcontroller should not be treated as a COTS microprocessor, which would be qualified by software verification under DO-178B/ED-12B, plus one or more simple COTS components, which would be qualified under the guidelines of this section. We do not see any reason why a complex COTS microcontroller should not be treated as a COTS microprocessor plus one or more complex COTS components. In both cases, the functionality and interfaces between the microprocessor element and the peripheral elements are comparable to those that would be found in a discrete design. Integration adds no issues of any consequence – in fact, through reduction of package count; it probably yields a more reliable design. And the microprocessor elements used in common microcontrollers tend to be much simpler than "ordinary" microprocessors in today's market.	Treat simple and complex COTS microcontrollers as COTS microprocessors plus additional simple or complex COTS functions	Suggestion	Objection	Accepted	In fact EASA treats already the core part of the COTS microcontrollers as the COTS microprocessors and the peripheral part of the COTS microcontrollers as simple or complex COTS components (see §9,11 § §9,12).
580	*Avidyne Corporation*	9.3	39	The last sentence of this section states that "A summary of the outcome of these activities [specified in the remaining subsections] should be documented in the PHAC." It is unreasonable to expect that all of these activities will have been concluded at the time the PHAC is written and submitted. We would recommend that the sentence be changed to "An acknowledgement of the applicability of these activities should be included in the PHAC and a summary of the outcome should be documented in the HAS."	Correct	Suggestion	Objection	Accepted	The sentence was replaced by: A summary of the intended activities should be documented in the PHAC. A summary of the outcome of these activities should be documented in the HAS.
581	*Avidyne Corporation*	9.3.1	39	In those cases where data reflecting detailed design characteristics of COTS devices and/or detailed information on manufacturers' processes are required, we are sceptical that these will generally be made available. As an alternative, a process reliant on infrequent, high volume component purchases with strict configuration control (by part number, revision level, mask level, etc.) and re-qualification as necessary should be expressly permitted.	Permit alternative to indicated approach	Suggestion	Objection	Accepted	§9.3.10 already introduces the possibility of alternatives methods. No change of the text.
582	*Avidyne Corporation*	9.3.1	39	The first bullet point indicates that each COTS device should be characterized by "Its development assurance level." Since COTS devices are not, in general, developed following a DO-254/ED-80-compliant process, they do not normally have design assurance levels. We believe the intended meaning of the item is "Its assigned development assurance level".	Correct	Suggestion	Objection	Accepted	The wording was updated by: "the allocated development assurance level".

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583	*Avidyne Corporation*	9.3.1	39	The third bullet point (classification of a device as simple or complex) is inappropriately organized in that the criteria for separating simple/complex/highly complex microcontrollers are entirely different from the criteria for separating ICs. We would recommend separation of these two major categories for clarity.	Clarify	Suggestion	Objection	Accepted	The chapter was reworked taking into account the comment.
584	*Avidyne Corporation*	9.3.1	39	The criteria for separating simple vs. complex microcontrollers presented in the third bullet point do not appear to match the criteria presented in the definitions of Section 1.4. They should be coordinated.	Coordinate defintions throughout document	Suggestion	Objection	Accepted	The link with the definition for simple vs complex COTS has been added.
585	*Avidyne Corporation*	9.3.1	39	The criteria for determining that a microcontroller is highly complex presented in the third bullet point are unclear.	Clarify	Suggestion	Objection	Partially Accepted	The definition of highly complex COTS was improved.
586	*Avidyne Corporation*	9.3.1	39	We do not understand the last data requirement under Item [2] ("the activation/deactivation of COTS functions") in the context of this item. Please clarify.	Clarify	Suggestion	Objection	Accepted	The sentence was updated: (including the hardware/software interface and the explanation of activation/deactivation of COTS functions).
587	*Avidyne Corporation*	9.3.4	41	The second bullet point requires an analysis of the component manufacturer's published errata to show a declining rate of error discovery. We are skeptical that statistically significant data can be gathered in this way. We recommend that this requirement be removed.	Remove	Suggestion	Objection	Not accepted	The objective is to get the maximum information to have confidence in the component and in the list of errata published.
588	*Avidyne Corporation*	9.3.5	41	We are sceptical that any meaningful information about management of component life cycle data (in the DO-254/ED-80 sense) will be made available by manufacturers, as required by the first bullet point of Item [9] and, if it is, that it will have any real value in assessing the integrity of the component.	Remove	Suggestion	Objection	Partially accepted	The wording " device life cycle data" was replaced by "device data (ref §9.3.2)".
589	*Avidyne Corporation*	9.3.5	41	The second bullet point of Item [9] is vague. If the intent of the item is that the applicant must be aware of, and assess the adequacy of, the means by which component configuration (e.g., part number, revision level, mask level, grade, etc., as applicable) is made known at the point of purchase, we are supportive. We are sceptical that any meaningful information of a more detailed nature will be made available by manufacturers.	Clarify	Suggestion	Objection	Noted	The applicant must be aware of how the component manufacturers make visible the changes which are performed and how he will be able to take them into account.
590	*Avidyne Corporation*	9.3.6	42	We object to the inclusion of the second bullet point. We do not understand how an architectural analysis would, in the general case, contribute meaningfully to an understanding of failure modes for the classes of devices under consideration. Moreover, the item discusses "associated failure rates" when it is uniformly agreed that failure rates of complex digital systems cannot be estimated. (This, of course, is why we rely on design assurance and prohibit intermixing of design assurance levels and failure probabilities in system safety assessment.)	Remove	Suggestion	Objection	Not accepted	Depending of the architecture and of the independence of blocks/pin-outs, the failure modes of the device is affected.
591	*Avidyne Corporation*	9.3.7	42 43	We are highly sceptical that an applicant will be able to get reliable usage information by environment and criticality as required by this section. Commercial component manufacturers are more likely to insist that their components not be used in safety-related applications than to give any information they must have. Component manufacturers are extremely unlikely to know in what functional paths their components have been used and are unlikely to be able to make any assessment as to criticality or provide the information necessary for the applicant to make that assessment.	Remove	Suggestion	Objection	Not accepted	The objective of this section 9 is clearly to gather all the available device data in order to substantiate the adequacy of its design regarding its intended usage. This includes data from the device manufacturer (errata, installation guide...), from the other users (ISE), and from the applicant (verification activities).

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592	*Avidyne Corporation*	9.3.7	42 43	We view the "minimum of two years of use" requirement as impractical, especially in light of the need for consistency of component configuration. Commercial product lifetime plus avionics design cycles, when combined with this two year requirement, would often leave no time for commercialization of the resulting system. We recommend that this requirement be removed.	Remove	Suggestion	Objection	Not accepted	The minimum of 2 years has been chosen as a balance between obsolescence and an essential level of maturity. The 2 years of component usage should be demonstrated at the time of the certification which should allow working with these components before they reach sufficient maturity.
593	*Avidyne Corporation*	9.3.7	4243	The second bullet point makes no sense as written. If it is taken as a given that all components have errata, it must be assumed that all parts have problems. How, then, is it possible to determine how many operating hours have been recorded "without any problems"? If errata have been discovered as a result of user experience, how can those hours be identified and excluded? The primary goal of the service experience criterion is not to prove the component to be free of problems, it's to establish an acceptable level of confidence that all problems are known and documented. Thus, problem-free use might actually be regarded as a negative criterion. We recommend that the phrase be deleted.	Remove	Suggestion	Objection	Accepted	The sentence was updated and "without any problems" removed.
594	*Avidyne Corporation*	9.3.7	42 43	As written, the criteria for "sufficient ISE" vs "low ISE" are unclear and confusing. Specifically, a. Where multiple criteria for a single category are presented, there is no conjunction linking them. From context, we take it to be "or". It should be explicit. b. The criteria would be less cumbersome if you established some definitions first. We would recommend defining "aircraft applications" as including "civil aircraft operation in flight or on ground plus hours accumulated in board/LRU/system/aircraft ground or flight tests"; "safety related applications" as including "space, airborne military, nuclear and medical"; and "non-safety applications" as "all applications other than aircraft applications and safety-related applications". These terms could then be used without elaboration in the criteria. c. We believe that Item [14] cannot be satisfied without objective criteria and that no such criteria can be defined that would be applicable to the general case.	Clarify. Remove Item [14].	Suggestion	Objection	Partially accepted	a) When multiple criteria for a single category are presented, a OR can be use to link them. It is already explained at white bullet level: "if one of the following criteria is met…". No change was performed. b) The criteria were simplified as proposed. c) The evidence of the stability, maturity of the component cannot be standardised on a general case, because it depends on the component complexity. No change was performed.
595	*Avidyne Corporation*	10	47-52	We believe that many of the statements in this section used to characterize COTS graphical processors are inaccurate and deliberately inflammatory. CGPs are ubiquitous in computing today and are used in essentially the same quantities as general purpose microprocessors. While the majority of these applications are not safety-related (as is the case for general purpose microprocessors), the applications are nevertheless mission critical (including complex rendering, research in molecular modelling, quantum chemistry, nuclear physics and other). Those tasks rely on the accuracy and reliability of GPUs to produce good, valid, and accurate data repeatedly. While not safety-of-life, these applications pour massive amounts of data through their GPUs (often arrayed in hundreds or thousands of parallel processors) for hours/weeks/months of continuous run time in order to produce the required complex simulation data.	Treat CGPs as COTS microprocessors	Suggestion	Objection	Not accepted	Section 10 has been harmonised with others Certification authorities (CAST paper 29) and therefore EASA would prefer to dedicate this Section 10 only to CGP. EASA will consider merging of Section 9 and 10 in the future. Basically, ED-80 / DO-254 consider COTS components as DAL E components and provide specific COTS considerations. This Certification Memorandum provides considerations to allow wide usage of COTS components. Please note that, in Section 1.4, COTS microcontrollers and COTS Graphical Processors definitions introduce a level of complexity that precludes those components from being viewed as microprocessors. Finally, the CGP FAA IP / EASA CRI have existed for 10 years and were accepted and applied by the airborne displays hardware industry.

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596	*Avidyne Corporation*	12	56	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 has been modified accordingly.
597	*Avidyne Corporation*	13.5	58-59	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-254/ED-80 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 13.5 reflects the fact that the proposed categorization by EASA is one possible way to classify OPRs that is acceptable. Section 13.6 reflects as well the fact that an an equivalent typology to the one defined is also acceptable for EASA.
598	*Avidyne Corporation*	13.6	59	The costly and intrusive requirement that a root cause be determined for every problem has no basis in DO-254/ED-80. 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 hardware (whether under test or, if applicable, in the field).	Remove	Suggestion	Objection	Not Accepted	In section 13.6 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." 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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599	*Avidyne Corporation*	13.6	59	The CM states: In order to avoid decreasing the assurance of the quality of the airborne hardware 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 system (the only meaningful measure of its "quality"). The safety of the system can only be determined by considering the specific characteristics of the problems, singly and in combination, and applying judgment to those characteristics.	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 Memorandum 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.
600	*Avidyne Corporation*	13.7	59-60	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 hardware assurance" is, without consideration of the specific characteristics of the individual OPRs, without foundation in regulations, guidance or DO-254/ED-80. 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."*

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601	*Avidyne Corporation*	13.8	60	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 HAS must, for its own purposes, include consideration of the system-level and aircraft-level issues associated with each OPR. The HAS is a required submittal; any EASA engineer who needs access to the list of open OPRs can simply be given access to the HAS. Duplicating the list leads to the possibility of error and the necessity of duplicate document modifications.	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 13.6). A Certification Summary or Equivalent Document at system level is already requested; therefore it is not an additional request at the HW Level. Furthermore, the HAS is actually a HW 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.
602	*Avidyne Corporation*	13.9.1	60-61	The requirement that EASA's classification system be used is overly prescriptive and not based in DO-254/ED-80. It should be removed.	Remove	Suggestion	Objection	Not Accepted	Section 13.5 reflects the fact that the proposed categorization by EASA is one possible way to classify OPRs that is acceptable. Section 13.6 reflects as well the fact that an an equivalent typology to the one defined is also acceptable for EASA.
603	*Avidyne Corporation*	13.9.1	60-61	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-254/ED-80. These requirements should be removed.	Remove	Suggestion	Objection	Not Accepted	As previously stated, 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."*
604	*Avidyne Corporation*	13.9.2	61	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 remove	Remove	Suggestion	Objection	Partially Accepted	Text Proposal GNG: This section is dedicated to the Applicant's Certification Responsible. However, EASA agrees that this section is not clear, therefore it will be amended. -> In this section change the word "Applicant" modifies the sense of it to address it to the applicant.

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605	*Honeywell*	1.2	5	The document references the older ARP4754 and DO160E, (and of course no mention of the imminent DO178 release), DO160F is in common usage now, and the new ARP4754 has been released. This Cert Memo would therefore not be applicable any new projects. Why ballot the document like this?.	Update references, and perhaps hold until the DO178 updates occur?.	suggestion	substantive	Accepted	The table was updated.
606	*Honeywell*	1.2	5	Even though it is referenced, there appears to be no discussion of DO160 anywhere within the body of the document; it should be clear where DO160 fits within the context of this Certification Memo.	Remove DO 160 reference of place text in body to describe where relevant.	suggestion	substantive	Accepted	Reference to ED-14E / DO-160E was removed.
607	*Honeywell*	1.4	09-Jul	AEH should be defined. All of the types of components in the 9.2 applicability section should be defined in the 1.4 definitions section; only “Highly Complex COTs microcontroller” is presently defined. Is Anomalous Behaviour to be defined per DO254?. Perhaps add this too?	**Add definitions suggested left.**	suggestion	substantive	Partially accepted	AEH definition from ED-80 / DO-254 has been reused in §1,1. Complex COTS IC, Simple COTS IC, Complex COTS microcontroller, Simple COTS Microcontroller definitions are not needed as §9.2 and §9.3.1 have been reworded. COTS IP has been defined. Anomalous behaviour: this term was used in this Certification Memorandum with the same meaning as in ED-80 / DO-254.
608	*Honeywell*	4	12	Are the guidelines in this section to be applied to all hardware or just the “custom micro-coded” devices? The 4.3 scope section should be clear on this. It is assumed it applies to section 8.0 devices?	Clarify scope section 4.3.	suggestion	substantive	Not accepted	EASA believes that there is no ambiguity on the scope of section 4 as section 4.3.a indicates that it clarifies the application of ED-80/DO-254. Therefore this section applies basically to all hardware that is falling under the applicability of ED-80/DO-254.
609	*Honeywell*	5.3.3 c.	26	The table is a very reduced subset of DO254 table A-1, and section 7.0 then “clarifies that a PHAC is not requested?. The certification memorandum should be very clear on what is required for life cycle data for Complex or Simple hardware at the DALs of A, B, C and D especially since section 7.0 indicates all hardware at the equipment level should be considered in a DO254 context?. It should be clarified how it is proposed that DO254 table A-1 requirements should be met for the hardware described in sections 7.0 and 8.0.	Please clarify.	suggestion	substantive	Partially accepted	ED-80/DO-254 explains which documents are to be issued. This section 5 in the Certification Memorandum explains which documents of those defined in ED-80/DO-254 are requested to be delivered. To avoid misunderstanding, the wording "Documents to be provided" has been replaced by "Documents to be delivered".
610	*Honeywell*	6	28	There appears to be no possibility to allow some SEU upsets to be uncovered as long as any uncovered upset rates are analytically demonstrated to be acceptable as part of the SSA process.	Allow the possibility by adding a new bullet.	observation	substantive	Accepted	Link with the safety analysis at equipment / system / aircraft level (separate Particular Risk Analysis) has been added.
611	*Honeywell*	8.4.6	35	This section makes reference to the DO178B Software Conformity Review section 8.3, and not all of this will be applicable to the Hardware Conformity assessment. The requirements for Hardware Conformity Reviews should be more explicit especially since this is beyond the DO254 scope.	**Expand on this per the comment.**	observation	substantive	Accepted	Sub-section reworded to avoid confusion.
612	*Honeywell*	9	38	It was odd that this section did not see the need to mandate an effective parts management process like IEC/TS 62239 which would address at least some of the [1] to [16] issue areas.	**Add text as suggested left, perhaps in section 9.1.**	observation	substantive	Noted	EASA agrees that IEC TS62239 ECMP may be an acceptable means of compliance for some of the 16 activities. Section 9.1 was improved: "ED-80/DO-254 Section 11.2 states that “the use of an Electronic Component Management Process (ECMP), in conjunction with the design process, provides the basis for COTS component usage”. The following sections of this Certification Memorandum provide some guidance for an ECMP. Some other guidance exists (e.g. IEC TS62239) which cover part of the activities described below."

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613	*Honeywell*	9.3.7	42	(11) Section 9.3.7: Regarding the phrase "related numbers of operating hours without any problems" it is the case that probably all COTs devices will have errata, hence what is the relevance of "without any problems". Should this be removed?. If not please clarify what is meant.	Delete of clarify as indicated in the comment.	observation	substantive	Accepted	"Without any problems" was removed.
614	*Honeywell*	9.3.7	42	For ISE, is not the most important aspect that the device operations have been demonstrated (and experience gained) in any volume application to the extent that a reputable supplier will demonstrate an established FITs rate, and have a comprehensive understanding from a large user base of errata findings. Railway and automotive applications have safety requirements to meet, and device suppliers to the high volume automotive markets would not be commercially viable with unreliable hardware. For these various reasons it is suggested that automotive and railway hours be given an equal footing with the other safety fields mentioned and hours used for ISE credit accordingly.	Amend as per the comment.	observation	substantive	Accepted	Railway and automotive were added in the list of safety applications.
615	*Honeywell*	9.3.8	43	This section appears to be attempting to dissuade the use of identical COTs parts within redundant systems. The use of identical COTs (and many other identical types of parts) within redundant systems has been demonstrated to be effective provided common mode influences have been effectively considered and effective mitigations provided. Any anomalous behaviour should be understood through errata and/or comprehensive V& V activities, i.e. there should not be any unknown anomalous behaviour because of these reasons. Suggest that the following phrase (or something like it) be appended to the end of the 3 rd sentence, "It is not intended that the use of identical devices within redundant systems be prohibited, but rather that such usage be supported by effective Common Mode analyses, effective mitigation of potential exposure to anomalous behaviours by selection of parts with sufficient ISE, and effective management of known errata and potential device faults by the system architecture."	Amend as per the comment.	suggestion	objection	Not accepted	As COTS devices may have very high complexity and very short design cycles, there is an increased possibility that they may contain design errors which could result in a reduction of the availability of the systems in which they are embedded and in the loss of multiple, redundant systems. EASA would like to point out that architectural mitigation means, which are requested in this Section 9.3.8, are not restricted to dissimilarity. It is not the intent of EASA to go in that direction. For example, monitoring functions, when independent, may be considered as mitigation means. The Common Mode Analysis should also be used to confirm that the approved design contains the design requirements and the production processes to mitigate common cause faults. This Common Mode Analysis should refer to faults that would be initiated by the device, that have an effect on the device itself and on the aspects of the design that support the device. It is assumed that the system level Common Mode Analysis has already been accomplished.
616	*Honeywell*	12.2 1)	56	Please indicate where a "qualification dossier" is defined, or elaborate on what is meant.	Per comment left.	suggestion	substantive	Accepted	Wording was confusing and change.
617	*Thales Avionics S.A.*	General	General	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	

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618	*Thales Avionics S.A.*	General	General	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	EASA considers this Certification Memorandum as acceptable practices to address airborne electronic hardware. This Certification Memorandum will be subject to project by project adaptation as it will be called up by projects CRI.
619	*Thales Avionics S.A.*	General	General	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]				Noted	EASA agrees to say that some subjects like suppliers oversight are not limited to hardware or software. However they are process related, this is the reason why EASA addresses them in these Certification Memorandum.
620	*Thales Avionics S.A.*	General	General	- 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]				Accepted	Harmonization with FAA and other Certification authorities is still on going.
621	*Thales Avionics S.A.*	General	General	- 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]				Noted	
622	*Thales Avionics S.A.*	General	General	- 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]				Noted	This Certification Memorandum will be discussed project by projects.
623	*Thales Avionics S.A.*	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.			Noted	This Certification Memorandum will not alleviate discussions in the scope of Certification Project, but rather provides unique EASA position related to airborne electronic hardware.
624	*Thales Avionics S.A.*	General	All	This newly released EASA MEMO provides both improvement and clarification versus the previously known EASA guidelines, but also retain few unsolved issues that required difficult clarifications during past and current certification programs.				Noted	EASA will be pleased to discuss further improvement on this Certification Memorandum.

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625	*Thales Avionics S.A.*	General	All	Unsolved issues that required difficult clarifications during past and current certification programs: => EASA should publish an AMC to clearly mandate/recommend - including the related limitations/restrictions - the applicability of ED-80/DO-254 to Electronic Hardware"	EASA should publish an AMC to clearly mandate/recommend - including the related limitations/restrictions - the applicability of ED-80/DO-254 to Electronic Hardware"	Suggestion	Substantive	Accepted	EASA intent is to publish an AMC in the future.
626	*Thales Avionics S.A.*	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, 11 mainly related with part 21 regulation and addressing Certification Team organisation and processes, for Hardware items, supplier oversight 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	Accepted	EASA intent is to publish an equivalent "System Certification Memorandum".
627	*Thales Avionics S.A.*	General	All	Regarding the content of the CM, we identify several categories of information that could be usefully split in dedicated CM or documents: - Chapter 6 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 easily eligible for EASA CRIs & FAA IPs	Suggestion	Substantive	Accepted	Harmonisation with other Certification authorities is still on going.
628	*Thales Avionics S.A.*	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, 10 could be subjected to FAQ papers when related to best practices, or when too close to industrial practices	To elaborate a clarification document as per DO248 B for software topics.	Suggestion	Substantive	Noted	EASA does not intent to publish FAQs. Moreover, Section 10 of this Certification Memorandum is still a CAST Paper.
629	*Thales Avionics S.A.*	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 7, 8, 9, 12, 13 require further discussions				Noted	This Certification Memorandum will be discussed project by projects.
630	*Thales Avionics S.A.*	General	All	Unsolved issues that required difficult clarifications during past and current certification programs: => A Main Objection remains also on the guidelines provided for SEH in section 8.5, which proved inapplicable in recent certification programmes and that are reinstated as is.	To review guidelines provided for SEH in section 8.5	Suggestion	Objection	Accepted	Section 8.5 has been improved and answers to your comment.
631	*Thales Avionics S.A.*	General	All	Unsolved issues that required difficult clarifications during past and current certification programs: => Section 9 on COTS-AEH is viewed as too complicated to be practically applied, and could possibly preclude the use of new technology, which is a main obstacle to industry.	To review Section 9 on COTS-AEH	Suggestion	Objection	Noted	EASA intent is not to limit the usage of COTS component. Section 9 intent is to clarify §11.2 and §11.3 of ED-80/ DO-254.
632	*Thales Avionics S.A.*	Title	1	Despite the caveat provided in front page boxes, experience has shown that such Certification Memoranda become applicable certification requirements when used in certification programs via CRIs or Interpretative Material (IM)	If not already incorporated within the EASA Certification Memorandum Procedural Guidelines, establish the rules and limitations allowing those CM to become CRIs or IMs	Suggestion	Objection	Noted	SW and HW Certification Memoranda will be introduced in product cert basis inside CRIs, the way of working does not change. However, with published Certification Memoranda, suppliers like Thales are now aware of the guidelines in advance. Also, they are going to be applied consistently worldwide and therefore provide equity between manufacturer and supplier.

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633	*Thales Avionics S.A.*	1.2	5	ED-79/ARP-4754 should not be used as part of this Memo. In addition the latest issue of ED-79A/ARP-4754A is not currently endorsed by EASA	Remove this reference to ED-79/ARP-4754	Suggestion	Objection	Accepted	The table was updated.
634	*Thales Avionics S.A.*	1.2	5	ED-14/DO-160 is not referred to within the Memo. Or: SWCEH-001-01 should be referring to latest issues F or G	Remove this reference to ED-14E/DO-160E, or new release to be in conjunction with DO160G	Suggestion	Substantive	Accepted	Reference to ED-14E / DO-160E was removed.
635	*Thales Avionics S.A.*	1.3	6	TC, STC, DOA not defined in §1.3 ABBREVIATIONS	Please add to the list of Abbreviations	Suggestion	Substantive	Accepted	These abbreviations were added.
636	*Thales Avionics S.A.*	1.4	8	Understood that the definition of "Highly Complex COTS Microcontroller" is actually limited to "Microcontrollers"	None	Observation	Substantive	Noted	The category "Highly Complex COTS Microcontroller" is limited to the components having the same definition as the one provided.
637	*Thales Avionics S.A.*	1.4	9	Included in the definition of SEH are two comments (1 & 2), which seems not correlate clearly to each other	Distinguish between the definition of a SEH (same as ED-80/DO-254) and the way the SEH is assessed for simplicity	Suggestion	Objection	Not accepted	The ED80/DO254 definition is impracticable in real design and those definitions exist for 10 years and shown the adequacy.
638	*Thales Avionics S.A.*	1.4	9	This portion of the sentence in Comment 1 of the SEH Definition: "and hysteresis characteristics" should be removed or replaced as it seems not relevant	Suppress sentence element: "and hysteresis characteristics"	Suggestion	Substantive	Not accepted	EASA proposes to keep this term" hysteresis characteristic" as it has been used on past projects by some suppliers to demonstrate the simplicity of some components.
639	*Thales Avionics S.A.*	2	10	It should not be the aim of this CM to define applicability of ED-80/DO-254, in particular for LRUs & CBAs	EASA to publish an AMC to clearly mandate/recommend - including the related limitations/restrictions - the applicability of ED-80/DO-254 to Electronic Hardware	Suggestion	Objection	Noted	It is EASA intention to publish an AMC.
640	*Thales Avionics S.A.*	2	10	SEU is addressed under a full chapter in § 6.	In the list of items covered by this Memorandum add "guidelines for Single Event Upsets"	Suggestion	substantive	Accepted	The text was updated to introduce the Single Event Effects.
641	*Thales Avionics S.A.*	3	11	The use of terms such as: "EASA Requirements", EASA Policy", "acceptable means of compliance" (lower case) seems to contradict CM Page 1 where "Requirement", "AMC", and "GM" are explicitly excluded.	In the absence of EASA AMC on the applicability of ED-80/DO-254, the "Elect-to-Comply with this CM" approach should be offered only.	Suggestion	Objection	Noted	As written page 1: "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. "
642	*Thales Avionics S.A.*	4.3 b.	13	"[…] equivalent software review process […]"	Replace "software" by "hardware"	Suggestion	Substantive	Accepted	The word "software" has been replaced by "hardware".
643	*Thales Avionics S.A.*	4.5.2	16	With respect to the text in table: "HDL or hardware design schematics: n/a". This kind of data can be expected, for instance to argue about unused function inequity.	This line shouldn't be typed "N/A", but included in "hardware design data" (at least for Audit SOI#3 review).	Suggestion	Substantive	Accepted	"n/a" has been removed and the reference to section "10.3.2" of ED-80/DO-254.
644	*Thales Avionics S.A.*	4.5.3	17	Same as above	Same as above	Suggestion	Substantive	Accepted	"n/a" has been removed and the reference to section "10.3.2" of ED-80/DO-254.
645	*Thales Avionics S.A.*	4.5	19	HDL code vs standard should be reviewed during Audit N° SOI#2 (one line above), as the HDL is a result of the design activity, and is available for review withiin the scope of SOI#2. Finding on that subject during SOI#3 is too late in the process.	Move the text: "HDL code vs standards" one line above (i.e. as part of Audit Objective N°2). Note that: - This text was actually existing within Audit N°2 in the previous known version of this MEMO. - Audit N°3 is more dedicated to adddres a verification of the design versus requirements, - "HDL code vs standards" is addressing a verification of a "detailed design" (i.e. HDL coding) vs standards.	Suggestion	Objection	Accepted	The text has been moved as suggested.
646	*Thales Avionics S.A.*	4.3 b.	13	"[…] equivalent software review process […]"	Replace "software" by "hardware"	Suggestion	Substantive	Accepted	The word "software" has been replaced by "hardware".
647	*Thales Avionics S.A.*	4.5.5	19	Typo in Item (3)	Replace SHE by SEH	Suggestion	Substantive	Accepted	"SHE" has been replaced with "SEH".

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648	*Thales Avionics S.A.*	4.5.5	18 & 19	"[…] 75% of the design life-cycle data […] "[…] 75% of the verification data […] It is not clear if this 75% criteria applies as a global data assessment or applies to each and every portion of the data (HLR, LLR, Reviews, HLT, LLT, Coverage, etc.	These 75% criteria should be further detailed with respect to ED-80/DO-254 activities, or suppressed.	Suggestion	Objection	Noted	The 75% maturity criterion applies to the development data (respectively verification data) listed in the tables in section 4.5.2.b (respectively 4.5.3.b). No change to this section is considered necessary.
649	*Thales Avionics S.A.*	6	28	As no standard SEU model, methods or guidance is referred to, it is difficult to perform such analysis	Please trace this guideline at least to ED-80/DO-254. E.g. §2.3.3 (Qualitative assessment of hardware design errors and upset	Suggestion	Substantive	Noted	It has been added that a Single Event Effect (SEE) is a basic hardware issue.
650	*Thales Avionics S.A.*	7	29	With respect to the sentence "[…] CBA level, unless, […] an acceptable level of development assurance can be justified from the validation at the system or equipment level (e.g. by compliance with ED79/ARP-4754 objectives)."It is unclear how the ED-79/ARP-4754, which is System-oriented, can justify Hardware-Oriented Level of Development Assurance.	Please clarify for example, how a System or Equipment level V & V can be used. For example, use of ED-79/ARP-4754 should be limited to Validation and Verification activities	Suggestion	Substantive	Accepted	The Section clearly has been improved and identifies ED80/DO254 is to be used for LRU and CBA. The Section has been updated to better explain what need to be done.
651	*Thales Avionics S.A.*	7	29	The ED-80/DO-254 is not currently mandated formally by EASA via an AMC or equivalent, particularly for LRUs & CBAs In-House Processes does not bring anything	EASA to publish an AMC to clearly mandate/recommend the applicability of ED-80/DO-254 to Electronic Hardware Or rely upon an "Elect-to-Comply" approach to be clearly expressed via an AMC	Suggestion	Objection	Noted	EASA recommends the use of ED80/DO254 as Guidance Material by CRI project by project basis. EASA will consider in the future to publish an AMC accordingly.
652	*Thales Avionics S.A.*	7	29	The last paragraph seems to contradict itself as the "[…] use of specific in-house industrial hardware development standards, provided it is demonstrated that the ED-80/DO-254 objectives are covered […]"	Please allow the use of specific in-house standards via reference to ED-80/DO-254 § 1.7 Alternative Methods or Processes. In particular do not require "demonstration that" but "equivalent level"	Suggestion	Objection	Accepted	The Section clearly has been improved and identifies ED80/DO254 is to be used for LRU and CBA. The Section has been updated to better explain what need to be done.
653	*Thales Avionics S.A.*	8.3	31	It is not explicit for what purpose those "characteristics" should be justified	Please clarify that the purpose is to provide visibility on those characteristics of the hardware device.	Observation	Substantive	Partially accepted	EASA believes that Thales understood that complex devices follow section 8.4 whereas simple device follows section 8.5. It is therefore essential to consider the device complexity.
654	*Thales Avionics S.A.*	8.3	31	State transitions are not known at the PHAC editing stage, hence may not be relevant information for simplicity assessment, as far as the number of states is provided Number and type of functioning mode do not appear to be a relevant information for simplicity assessment Moreover this information, most of the time, is not available at the PHAC stage, or may be understood in different ways.	Remove state transitions Remove or clarify number and type of functionning modes. Provide a definition of "Functionning modes"	Observation	Objection	Not accepted	It is essential to classify device at the beginning of the project to define the development and verification activities and it therefore be documented in the PHAC. Early communication is expected between applicant and EASA when the classification is controversial. PHAC may also be updated after SOI1. This classification was used during the last 5 years without complaint from the manufacturer.
655	*Thales Avionics S.A.*	8.3	31	The sentence: "The ability to verify by test on the physical device all the requirements in all configurations" brings confusion as both terms "ability to verify by test" and "all configuration" may be understood in multiple different ways (all input configuration, all functioning modes, normal/abnormal cases, et.) and does not provide more information/clarification than the wording of the simple definition of DO254 §1.6..	Replace "in all configurations" by "under all foreseeable operating conditions", to match the ED-80/DO-254 definition and remove any ambiguity. In addition clarify "ability to verify by test on the physical device", and allow analyses (i.e. simulation testing) in accordance with ED-80/DO-254 definition. Place also the "prerequisite" well ahead in this section	Observation	Objection	Accepted	Sentence removed.
656	*Thales Avionics S.A.*	8.4.1 bullet 1	31	With respect to the sentence: "Derived requirements should be created from the design data […]. ED-80/DO-254 § 10.3.2.1 & 10.3.2.2 do not require to raise derived requirements from the detailed design.	Delete the bullet or replace "should be" by "may be", and make reference to ED-80/DO-254 § 5.2.1 & 5.3.1 items 3 stating that "requirements omissions or errors are provided to the appropriate procees for resolution."	Suggestion	Objection	Partially accepted	EASA agrees that derived requirements should be considered carefully. According to that, conceptual design and detailed design should create derived requirements. Sentence changed to avid confusion that derived requirements are created only for conceptual and detailed data.
657	*Thales Avionics S.A.*	8.4.2.1 b)	32	Clarify what are "[…] specific constraints to control unused functions." Unused may be understood in various ways: Unused I/O ports or interfaces, unused internal functions or resources, unexpected states (sometimes called "unused states")	An unused function is an block destined to perform a function, that is not available (inhibited), un-configured logic elements or not connected pins on a device.	Suggestion	Substantive	Accepted	Bullet improved to avoid confusion.

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658	*Thales Avionics S.A.*	8.4.2.1 f)	32	"HDL guidance" as described looks like coding standard, which is destined to enhance the quality and maintainability of the code but cannot "ensure that the device operates as expected". This latest expectation must be met by other formal verification means such as simulation analysis or physical verification.	Reword as following: "If a Hardware Description Language (HDL), as defined in ED-80/DO-254, is used, guidance for the use of this language should be defined to contribute to reduce errors introduced during the HDL capture and to enhance the quality and maintainability of HDL code."	Suggestion	Objection	Partially accepted	Bullet text has been improved to avoid confusion.
659	*Thales Avionics S.A.*	8.4.2.1 g)	33	It is unclear what is Decision Coverage and particularly what a point of entry and exit is. Indeed in HDL there are concurrent rolling processes, including Boolean equations used for conditions in IF-like statements or for pure logic descriptions. Decision as written in this MEMO is a software concept that is not directly applicable to H/W previous HDL concurrent processes.	Use Statement, Branch & Condition, which are the most commonly used terms for code coverage measurement in the development of PLD/ASICs.	Suggestion	Objection	Partially accepted	As this coverage is performed at HDL level, decisions are identifiable and it is not a SW concept. EASA recognises that in some case decision coverage is like branch coverage and a note has been added to allow it.
660	*Thales Avionics S.A.*	8.4.2.1 i)	33	It is unclear what is meant by "HDL code review (detailed design review) against conceptual design should be conducted." As so worded it seems that it is already covered by 8.4.2.1 a). What is expected more from such a review? What are the expected criteria?	Delete this sentence. Note that the HDL code review should be better performed with criteria regarding design standards, or regarding HDL coding standard (see above).	Observation	Objection	Partially accepted	Bullet a and bullet i have been changed to avoid confusion.
661	*Thales Avionics S.A.*	8.4.2.2 e)	34	This expectation is already mentioned in 8.4.2.1 b) It looks like it is redundant.	Delete this 8.4.2.2 e) section.	Observation	Objection	Accepted	Sub-section deleted.
662	*Thales Avionics S.A.*	8.4.2.2 For levels A and B devices b)	34	With respect to the sentence: "An analysis of the internal implementation of the device […]". The implementation is a binary-like description that cannot be analysed by a human being. So this expectation is ambiguous or impossible to perform.	Remove this section 8.4.2.2 second (b)	Suggestion	Substantive	Partially accepted	Sub-section changed to avoid confusion.
663	*Thales Avionics S.A.*	8.4.3	34	This chapter deals with complex PLD or ASICs. So "high level architecture" belongs to conceptual design, and "detailed functional description" belongs to detailed design and not to "(conceptual design)".	Clarify the use of terms "conceptual design" and "detail design" as described in §5.2 and §5.3 of the DO254.	Observation	Substantive	Partially accepted	EASA thinks that those 2 items are enough described in ED80/DO254 section 5.2 ad 5.3.
664	*Thales Avionics S.A.*	8.4.4 bullet 1	35	With respect to the sentence: "The requirements of the used functions […] verified as part of the overall verification activities." It is unclear if "overall" stands for the IP scope or the PLD/ASIC scope.	Add "IP" or "PLD/ASIC" after "overall" and clarify the IP definition: (for example in §1.4) In-House or COTS?	Suggestion	Substantive	Accepted	COTS IP definitions are provided in section 1.4 and the word overall has been suppressed.
665	*Thales Avionics S.A.*	8.5	36	For DAL A & B the requested activity regarding "[...] all permutation of conditions of the inputs of the individual logical components (gates and nodes) within the device" is conflicting with the wording of §8.3 that says "the ability to verify by test on the physical device". Indeed all the gates and nodes are not reachable in the physical device. So this may be done mainly through analysis means (mainly simulation with code coverage). For DAL C the sentence "all permutations of conditions at the pins of the device" is ambiguous. This is conflicting with DO254 which requires "under all foreseeable operating conditions". Moreover this is often not possible to do on the physical device, as cases are not "operational" and are not relevant. If we consider the example of an independent clock generator with one clock entry, then the 2 permutations of the input clock are not sufficient to prove that the clock generator is properly working. Moreover there is no reason to link this clock input to the other inputs for checking this independent clock generator.	The guidelines would rather follow with the intent of ED-80/DO-254 expectations for simple devices that requires the verification and configuration management process, with simplified documentation. More room should be offered to use CEH-like verification means such as simulation of RTL, with Code coverage and post layout simulations. The methodology and expected results agreed with EASA as part of other programs should be used to replace this section for SEH.	Suggestion	Objection	Accepted	Sub-section has significantly change and should answer to your comment.

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666	*Thales Avionics S.A.*	8.5	36	Last paragraph seems already be covered by the third bullet allowing SEH may be tested at the equipment level […]"	If other means may be accepted, please write it as such. Please also clarify if one or more, or all of the above bullets are to be considered to encompass the guideline.	Suggestion	Substantive	accepted	Paragraph removed.
667	*Thales Avionics S.A.*	8.6.1	36	The first sentence seems contradictory in itself: "[…] can be changed […] without modification […]"	Reword te sentence	Suggestion	Substantive	Accepted	Sentence changed to avoid confusion.
668	*Thales Avionics S.A.*	8.6.2	37	Second sentence in the third bullet is not understood and seems to introduce additional requirement for such tools: "[…] Any other particular usage …. On a case-by-case basis […]"	Clarify or Reword the sentence.	Suggestion	Objection	Accepted	Sentences reworded to avoid confusion.
669	*Thales Avionics S.A.*	9.2	38	It should be indicated also that for the (highly) complex COTS, the CPU core part is out of the scope as it is covered by ED-12B/DO178B activity (as for "COTS microprocessors")	Add "and CPU core part of complex COTS" in the sentence "The development assurance of microprocessors will be based […]"	Observation	Objection	Accepted	The sentence was modified as followed: "Software and COTS microprocessors are out of scope of this Section. The development assurance of microprocessors and of the core processing part of the microcontrollers and of the highly complex COTS micro controllers (Core Processing Unit) will be based on the application of ED-12B/DO-178B to the software they host, including testing of the software on the target microprocessor/microcontroller /highly complex COTS microcontroller ."
670	*Thales Avionics S.A.*	9.2	38	The word "component" is used here, while the word "IC" is used in the next section (9.3)	Align wording among both sections.	Suggestion	Substantive	Accepted	"Complex COTS components" was replaced by "Complex COTS ICs". "Simple COTS components" was replaced by "Simple COTS ICs".
671	*Thales Avionics S.A.*	9.3.1	39	If the device is a COTS no DAL can be defined for it	Modify into "DAL of the design in which the COTS device is involved in "	Suggestion	Substantive	Accepted	The wording was updated by: "the allocated development assurance level.
672	*Thales Avionics S.A.*	9.3.1	39	The simplicity criteria for a COTS cannot clearly fit the ED-80/DO-254 definition	Refer to the definition of SEH, may be Comment 1 and/or Comment 2 could be used	Suggestion	Substantive	Accepted	This sentence was added to recall the definition: "As a result of the assessment of the criteria here above, the ability to verify by test on the physical device all the requirements in all configurations is a prerequisite for the classification of an device as simple."
673	*Thales Avionics S.A.*	9.3.1	39	Some examples of Simple COTS should be provided such as: UART, A/D converters, D/A converters, PWM	Please be consistent with the definition of simple peripheral (in § 1.4 COTS Microcontroller), which includes some examples	Suggestion	Substantive	Accepted	This sentence was added into §1.4 for Simple COTS definition: "Some examples of Simple COTS could be: UART, A/D converters, D/A converters, PWM "
674	*Thales Avionics S.A.*	9.3.2 [2]	40	Sentence within brackets is not clear and there is no clear definition of an "installation manual". In addition the "hardware/software interface" document mentioned is usually a document from the applicant, not from the COTS manufacturer	Clarify the last part of the sentence while distinguishing what is data from COTS versus data generated as part of the use of the COTS within a design	Suggestion	Substantive	Noted	All of these data are intended to come from the component manufacturer. The component manufacturer should describe (if needed) the hardware/software interface: how the SW should configure the hardware, how the software can get information (and which information) from the hardware…
675	*Thales Avionics S.A.*	9.3.2 [3]	40	With respect to the two last white bullets: "The applicant should verify […] deterministic and repeatable manufacturing process". And "The applicant should verify [..] test procedures with detailed acceptance criteria)" COTS manufacturing and acceptance processes would be generally assessed as part of their quality management system through compliance to international quality standard as suggested in the first white bullet.	Remove the two last white bullets as the first white bullet is also covering both and more.	Observation	Objection	Noted	EASA agrees that the first bullet is more general and normally covers to 2 last bullets. Nevertheless, EASA deemed essential to add these detailed information.
676	*Thales Avionics S.A.*	9.3.2 [3]	40	With respect to the last paragraph: "Manufacturers private data"	This should be requested only for highly complex COTS with Low SE	Suggestion	Objection	Accepted	The sentence was reworded: "In case of a highly complex COTS microcontroller, if the component manufacturer's public data and training support are not sufficient to address the aspects above, then access to the component manufacturer's private data should be requested and established."

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677	*Thales Avionics S.A.*	9.3.3 [5]	40	The suggested guidance " Test for verification of support for fault tolerance effectiveness of unused functions deactivation[…]" is not always possible (e.g. full ECC test for internal RAM).	Allow a combination of Testing and Analysis as test is not always possible.	Suggestion	Objection	Accepted	The following sentence has been added: "As test is not always possible, a combination of testing and analysis may be performed. "
678	*Thales Avionics S.A.*	9.3.3 [5]	40	Test of "[…] effectiveness of unused function deactivation […]" is practically impossible to achieve. If a function is not used on a system, there will be no external access on the board to exercise this function.	Replace "test" by "test or analysis" for the effectiveness of unused function deactivation	Suggestion	Objection	Accepted	The following sentence has been added: "As test is not always possible, a combination of testing and analysis may be performed. "
679	*Thales Avionics S.A.*	9.3.3 [5]	41	In the sentence "The determinism of a device should be ensured for any usage domain", the word "any" needs to be clarified. There is only one usage domain defined for the COTS for a given program/system. Test & analysis should be performed in front of the usage domain defined, not of "any" usage domain.	Replace "any" by "the"	Observation	Objection	Accepted	The wording was modified as proposed.
680	*Thales Avionics S.A.*	9.3.6 [11]	42	Reference to ED-79/ARP-4754 is surprising, together with the term "Hardware/Software requirements" . These guidelines goes well beyond Development Assurance for AEH	Delete reference to ED-79/ARP-4754 and "Interface"	Suggestion	Objection	Not accepted	EASA does not agree with the comment. Validation of the components' requirements should be done to justify the choice of the component. Verification that component's requirements match with the environment (board, other components, software) should be done to demonstrate good integration.
681	*Thales Avionics S.A.*	9.3.6 [12]	42	Definition of "used configurations" is not clear: Are boot sequence of Microcontroller or firmware loading of FPGA considered as "used configurations" ?	Precise what is a "used configuration" or add "when the device can be configured via hardware or software pin-programming, ensure that …"	Suggestion	Substantive	Accepted	The sentence was updated as proposed.
682	*Thales Avionics S.A.*	9.3.7	42	The definitions of "Sufficient" "Insufficient" becomes way too much complex	Please simplify	Suggestion	Objection	Accepted	The presentation of the criteria was simplified.
683	*Thales Avionics S.A.*	9.3.7 [13]	43	Conclusion is unclear "DAL A and B COTS components with less usage than this minimum amount should not be used" as this seems to totally exclude or strongly restrict the use of new Complex COTS for DAL A & B design	"..Should not claim service experience" instead. An alternative way for Complex COTS IC in DAL A & B without ISE should be offered& B. and §9.3.10 is not helpful in term of alternative methods	Suggestion	Objection	Not accepted	EASA considers that if a complex COTS IC or a highly complex COTS microcontroller is not mature enough, then it should not be used in critical application DAL A and DALB).
684	*Thales Avionics S.A.*	9.3.7 [13]	43	It is unclear how the determination of ISE in §9.3.7 relate to the tables in §9.3.12 & § 9.3.13 1- Tables entries are done via 2 types of ISE with 2 associated sets of activities among Items [1] to [16] 2- The only one criterion: "DAL A & DAL B components with less usage than minimum amount should not be used"	Clarify minimum of usage and ISE applicability criteria together with the "how-to-use" for tables in § 9.3.12 & 9.3.13	Suggestion	Objection	Not accepted	Once the COTS component is define as simple, complex or highly complex (Activity [1]), once there is a DAL allocated to this component (Activity [1]), then the tables 9.3.11, 9.3.12, 9.3.13 can be used to identify if the activity [13] is requested (case of Complex COTS ICs, Complex COTS microcontrollers, highly complex COTS microcontrollers) and thus identify the Service Experience of the component.
685	*Thales Avionics S.A.*	9.3.8 [15]	43	It seems that there is no difference with the fail-safe - No Single failure with CAT effects- criteria requirement of AMC 25.1309	Clarify the need for this item.	Suggestion	Substantive	Not accepted	This item has no link with AMC 25.1309 and the fail-safe concept. The intent here is to avoid a complex COTS design or highly complex COTS design to cause a Catastrophic effect.

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686	*Thales Avionics S.A.*	9.3.8 [15]	43	With respect to the last paragraph: "Also the Common Cause Analysis performed at Aircraft level may reveal some Hazardous engine/propeller Failure Conditions that lead to a Catastrophic Aircraft Failure Condition. In such a case, this topic [15] should be addressed." sentence is unclear and seems way beyond the purpose of this MEMO. - According to ED-79/ARP-4754 a CCA includes CMA, PRA & ZSA. hence it is unclear if PRA an ZSA against the objective of this memo that should only address H/W development error. - There is mix of usage of the terms between "Catastrophic" and "Hazardous" designations within the same sentence. - What is the benefit of this sentence compared to the previous one saying "Architectural mitigation should be implemented in any case in which one or more instances of the COTS component could cause a Catastrophic failure effect without any other contributing faults occurring."	It should not be the purpose of this MEMO to adress engine/propeller FCs. However: - Replace "Common Cause Analysis" by "Common Mode Analysis" and clarify the sentence - Highlight more in detail the benefit of this sentence versus the sentence saying "Architectural mitigation [..] faults occurring."	Suggestion	Objection	Partially accepted	a) EASA introduces engine/propeller FC due to the fact that the FC classified HAZ at engine/propeller level may have Catastrophic impact at aircraft level - no change b) Common Cause Analysis was replaced by Common Mode Analysis c) Both sentences have the same meaning viewed is different ways. - no change.
687	*Thales Avionics S.A.*	9.3.9 [16]	44	There is no clear criteria to define when a "COTS component can provide robust partitioning". When robust partionning is implemented, it is assessed as part of the system design, including other H/W & S/W items.	Clarify the need for this item.	Suggestion	Substantive	Noted	EASA considers that it is not possible to define generic criteria: it depends on the partitioning which is needed and on the COTS component itself. Thus EASA proposes a case by case analysis.
688	*Thales Avionics S.A.*	9.3.11	44	Item [2] should be reserved for Complex COTS. In particular "Errata sheets", "user manual errata sheet", "installation manual" may not be pertinent or available for Simple COTS	Remove item [2] in the table	Suggestion	Objection	Not accepted	There is a need to identify the device data and to take them into account even for Simple COTS.
689	*Thales Avionics S.A.*	10.3 Item d.	52	With respect to the sentence:[…] any production/manufacturing errors […] will be detectable…" This implies test of unexpected configurations, or is analysis sufficient versus testing?	Please detail the mean of compliances (testing and/or analysis) acceptable to meet this guideline	Observation	Substantive	Not accepted	It is written that: The applicant should demonstrate that these errors will be detectable by the proposed system operation and monitoring, end device acceptance test, or other applicable check.
690	*Thales Avionics S.A.*	10.3 Item h.	52	With respect to the sentence: "The applicant should work with EASA to determine an acceptable method […]. Does EASA have data (service experience, good examples, etc.) to share to improve the way of calculating the failure rates ? What are the criteria for an "acceptable method" ?	Please elaborate	Observation	Substantive	Not accepted	EASA proposes to discuss the acceptable method on a case by case basis.
691	*Thales Avionics S.A.*	11.1 a.	53	The text: "[…] lack of expertise could result in incomplete or deficient certification activities.[…] is making a very strong and negative assumption.	Remove the last part of this sentence	Suggestion	Objection	Partially Accepted	EASA concurs partially with the comment. Current text may be understood that inappropriate subcontractor selection process is available on applicant side. Nevertheless, EASA still considers that this is an existing risk supported by the experience got in different certification projects. Then, it is proposed to introduce the word "potential" in the text.
692	*Thales Avionics S.A.*	11.2.1 (7)	53	What is designated as the "System Supplier" versus "Applicant"	Clarify and adapt the text to the purpose of this SWCEH MEMO that is limited to Airborne Electronic Hardware.	Suggestion	Substantive	Partially Accepted	Based on the raised comment, EASA has introduced some changes in the Certification Memorandum Text intended to emphasize the need of coordination between the supplier and applicant's processes, procedures and standards. This coordination may include the use of the applicant documentation by the supplier as well as the review and agreement of the supplier documentation by the applicant.

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693	*Thales Avionics S.A.*	11.2.2	54	This section seems written to apply to a "System-level" Supplier, while this SWCEH MEMO is addressing AEH, hence Suppliers of AEH	Simplify the content of this section	Suggestion	Substantive	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. The applicant should be the main target for this Certification Memorandum as far as it is the responsible entity for showing compliance in the certification projects (either ETSO or TC). Then, it is up to the applicant to make these guidelines applicable to the different suppliers and sub-tier suppliers (where appropriate or applicable) but the compliance demonstration responsibility remains at applicant level.
694	*Thales Avionics S.A.*	12.1	56	This section makes reference to "Subpart D of Part 21". This seems way beyond the purpose of this MEMO to provide interpretative material for Part 21	Could you add the extract and complete reference of this document. In general all referenced documents should be identified in §1.2 (or in a new §)	Suggestion	Substantive	Partially accepted	EASA would like to keep the Part21 background section which is here to introduce only the subject.
695	*Thales Avionics S.A.*	12.2 1) b.	56	What kind of limitation is envisioned? Non conformity to requirements, to certification basis, etc.	Modify in "introduce a design limitation or deviation to the certification basis"	Suggestion	Substantive	Partially accepted	Wording was confusing and change.
696	*Thales Avionics S.A.*	12.2 1)	56	Items (c) (d) & (e) cannot be sufficient in themselves to classify a change as Major as they can be impacted without any effect on when Form, Fit and Function.	Remove those items from the list	Suggestion	Objection	Not accepted	Those criteria are useful to classify the HW changes.
697	*Thales Avionics S.A.*	12.2	56	Understood that the frequent common case of change such as a COTS IC silicon technology shrink (without functional modification).	Clarify as a an example that such a COTS IC shrink can, according to the guidelines, be considered as "minor change"	Suggestion	Substantive	Not accepted	It is the EASA understanding that when the complex device is changed (e.g. obsolescence) from one technology to another one, it should be classified as major. For example, timing requirements can be slightly modified due to technology change.
698	*Thales Avionics S.A.*	13.6 Para 5 - 3rd bullet	59	Not all (any) OPR are candidate for rectification. It is the purpose of this SWCEH MEMO to allow OPR to be left open	Modify into "Any type 0 OPR should be rectified […]	Suggestion	Objection	Not Accepted	Not only "type 0 OPR" are mention here to be rectified, other types could be as well.
699	*Thales Avionics S.A.*	13.6 Para 8 - 1st bullet	59	With respect to the text: "Type 0: such OPRs should be rectified before certification […]".	Replace by : ""Type 0: such OPRs should be rectified before Entry into service […]"	Suggestion	Objection	Not Accepted	EASA considers that "before certification" is the appropriate milestone for Type 0 OPRs.
700	*Thales Avionics S.A.*	13.6 Para 8 - 4th bullet	59	With respect to the text: "[…] additional validation and/or verification activities need to be performed." It is unclear what activities and in which cases.	Remove this last part of the sentence	Suggestion	Objection	Not Accepted	The additional validation and/or verification activities to be performed vary on a case-by-case basis.
701	*Thales Avionics S.A.*	13.9.1 1)	60	Does "[…] all problems related to hardware [..] include environmental qualification related OPR list?	ED-80/D0-254 does not cover environmental qualification	Observation	Substantive	Accepted	Environmental qualification is covered by ED-14/DO-160 and the reference in Section 1.2 has been removed.
702	*Thales Avionics S.A.*	13.9.1 5) b)	61	Quantitative objectives cannot be established as this is the OPR actual content that is relevant, not the number	This item in the section should be removed.	Suggestion	Objection	Not Accepted	EASA has not established any quantitative objectives on the OPRs in this Certification Memorandum, This will be determine case-by-case and project-by-project basis in accordance with the applicant.
703	*Thales Avionics S.A.*	13.9.1 5) c)	61	This item suggested that all OPRs should be closed some time, which is not the case for all Type 3, 2 or even 1	This item in the section should be removed.	Suggestion	Objection	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 13.5).
704	*Pratt & Whitney*	7	29	Formal compliance to ED-80/DO-254 at the CBA or LRU level is not practical as this document was primarily focused at the device level. It is not clear when an acceptable level of development assurance would not be justified from the validation at the system or equipment level ... which has been the foundation of FADEC System certification since the beginning.	Clarify what ED-80/DO-254 objectives need to be addressed at the CBA or LRU level and when validation at the system or equipment level would not be adequate.		Objection	Accepted	The Section clearly has been improved and identifies ED80/DO254 is to be used for LRU and CBA. The Section has been updated to better explain what need to be done.

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705	*Pratt & Whitney*	9.3.8	43	It is not clear in this section in what way the architectural mitigation is being proposed. If the intent is aimed at advocating dissimilar hardware/software in a redundant FADEC channel it is in direct conflict with almost all legacy FADEC designs which have billions of hours in virtually flawless service. The perceived benefit to dissimilarity has been debated for years with no clear acceptance that a benefit is obtained in the end. What is the safety basis for requiring such a quantum change in FADEC design?	Revise the words to clarify that the intent is not to force dissimilar hardware in redundant FADEC architecture but to assure that common mode analysis issues are adequately addressed in the design.		Objection	Noted	EASA would like to point out that architectural mitigation means, which are requested in this Section 9.3.8, are not restricted to dissimilarity. It is not the intent of EASA to go in that direction. For example, monitoring functions, when independent, may be considered as mitigation means. The Common Mode Analysis should also be used to confirm that the approved design contains the design requirements and the production processes to mitigate common cause faults. This Common Mode Analysis should refer to faults that would be initiated by the device, that have an effect on the device itself and on the aspects of the design that support the device. It is assumed that the system level Common Mode Analysis has already been accomplished.
706	*Pratt & Whitney*	12	56	The concern here is relative to the application of this section to a parts obsolescence issue where an equivalent part is substituted without any additional functions, limitations, etc. If testing in conjunction with simulation, analysis, etc. is done to ensure equivalency; this should not result in the change being classified as "Major".	Clarify what is meant by item c) "requires an update of the qualification dossier" such that substitution of an equivalent part for obsolescence does not trigger a "Major" classification in such instances.		Objection	Not accepted	EASA thinks that if the certification process (and not dossier) has changed, it means that the change is major.
707	*Boeing Commercial Airplanes*	Multiple occurrences throughout the document		The proposed Certification Memorandum (CM) has not been harmonized with FAA Notice 8110.105. Suggest harmonizing to Change 1 of FAA Order 8110.105.	We suggest aligning the proposed CM to Change 1 of FAA Order 8110.105, to ensure harmonization of requirements.		x	Noted	The Common Mode Analysis should also be used to confirm that the approved design contains the design requirements and the production processes to mitigate common cause faults. This Common Mode Analysis should refer to faults that would be initiated by the device, that have an effect on the device itself and on the aspects of the design that support the device. It is assumed that the system level Common Mode Analysis has already been accomplished.
708	*Boeing Commercial Airplanes*	Multiple occurrences throughout the document		It would be helpful if discussions reference specific objectives in ED-80/DO-254 where possible. It also would be helpful if the guidance of the Certification Memorandum specifically identified where its guidance differs from that in ED-80/RTCA DO-254.	Clarification of the intent of the guidance is needed.	x		Noted	EASA considers that this Certification Memorandum already references ED-80/DO-254 where possible.EASA considers that this Certification Memorandum does not contradict ED-80/DO-254; however it clarifies it and adds more precise objectives which are still in the spirit of ED-80/DO-254.
709	*Boeing Commercial Airplanes*	Multiple occurrences throughout the document		This hardware CM contains multiple system activities. These system activities are good activities to be done by an applicant, but are inappropriate in a hardware-specific memorandum.	We suggest that EASA create a "systems" CM and move these system activities to the new certification memorandum. This would also support usage of ED-79A/ARP4754A by applicants.		x	Accepted	EASA intent is to publish a "System certification Memorandum".

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710	*Boeing Commercial Airplanes*	Multiple occurrences throughout the document		Within this proposed CM, the terms "quality assurance" and "process assurance" appear to be used interchangeably, although there is a very definite distinction. The "quality assurance" function is within the domain of manufacturing engineering, and is responsible for ensuring that each item produced to a set of drawings is a correct and accurate implementation of the design specified in those drawings. There are plans, procedures, processes, and standards that are unique to the manufacturing domain. There are configuration management tools, processes and procedures unique to the manufacturing domain for maintaining the correct configuration of all associated drawings, datasets, tools, and work instructions. The "process assurance" function is within the domain of development engineering, and is responsible for ensuring that the resulting set of design data that defines the product to be produced is a correct and accurate implementation of the design specified in its requirements.			x	Accepted	Improvement was performed in the text as proposed.
711	*Boeing Commercial Airplanes*	Multiple occurrences throughout the document		There are inconsistent acronyms used for the Hardware Configuration Index.	Suggest changing from *"CID"* and *"HCID"* to ***"HCI."*** [CID = configuration index document, HCI = hardware configuration index]. (NOTE: ***HCI*** is used in the document already and is the acronym used in parallel FAA Order 8110.105.)	x		Accepted	Improvement was performed in the text as proposed.
712	*Boeing Commercial Airplanes*	1.2	5	Table data row 4. The proposed CM uses ED-79/ARP4754 as a reference. We request changing these references to ***ED-79A/ARP4754A***.	Update reference to the current version. Also, ensure that all discussions are consistent with new guidance or information in ED-79A/ARP4754A.	x		Accepted	Table was updated.
713	*Boeing Commercial Airplanes*	1.4	8	Table of definitions: The distinction between *"COTS Microcontroller"* and *"Highly Complex COTS Microcontroller"* seems unnecessary.	All COTS microcontrollers are treated the same during the hardware development life-cycle. We suggest combining the descriptions.	x		Not accepted	This Certification memorandum makes a distinction between "complex Microcontroller" and "Highly Complex Microcontroller" in order to lighten the activities for the "complex Microcontrollers".
714	*Boeing Commercial Airplanes*	1.4	8	Table of definitions: The definition used for a *"microprocessor"* rules out most of the devices in production today. Even the devices of the 1990's were starting to embed MMUs onto the same silicon.	Consider modifying the definition of microprocessor to be a component of a microcontroller.	x		Not accepted	Any COTS component which executes software and does not fall into the microprocessor definition should be considered a Microcontroller.
715	*Boeing Commercial Airplanes*	2 bulleted items, last item	10	This section indicates that this proposed CM specifically excludes Analog ICs. Section 8 specifically applies to Digital ICs. Hybrid ICs are discussed only in the definitions of Section 1.4. It is also noted that if ED-80/DO-254 is extended to high level assemblies, as discussed in Section 7, then the items in this bullet are not excluded.	Clarification needed. We suggest adding Hybrid ICs to the last bulleted item in Section 2. Alternatively, delete the last bullet from Section 2, and add a specific exclusion for Analog and Hybrid ICs in the later sections.		x	Accepted	Hybrid ICs were excluded from Section 2 last bullet.
716	*Boeing Commercial Airplanes*	4.2	12	Definitions The definition of "finding" includes a non-compliance with this proposed DM.	This should be deleted from the definition. To be consistent with FAA Order 8110.105 and the FAA Job Aid for conducting hardware reviews, this definition should only include non-compliances with ED-80/DO-254.		x	Accepted	The definition of findings has been updated to remove "Certification Memorandum" and add "applicable Certification Review Items (CRIs)" instead.
717	*Boeing Commercial Airplanes*	4.5.2 b. Table data rows 4 and 5	16	Hardware Development Review The proposed CM includes "Hardware verification procedures" and "Hardware verification results" as part of the Hardware Development Review.	We suggest postponing this material until the Verification Review. This change would harmonize with FAA Order 8110.105.	x		Accepted	"Hardware verification results" has been replaced by "Review and analysis results". Consistently, the same change has been performed for the procedures.

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718	*Boeing Commercial Airplanes*	4.5.5 Table data row 2	18	SummaryThere is a reference to AEH HLR in this section. "HLR" is not listed on the acronym list and the term is not used elsewhere in the document. Further, hardware requirements do not generally make distinctions between "high level requirements" and "low level requirements," and all requirements must be traced.	We suggest changing "AEH HLR" to "AEH requirements".	x		Accepted	The wording HLR is erroneous and has been removed.
719	*Boeing Commercial Airplanes*	4.5.5 Table data row 2	18	Summary The proposed CM states that the hardware development review should be conducted when at least 75% of the hardware development data is done and reviewed.	Although the FAA Order 8110.105 does not specify a completion goal for the review, the Job Aid encourages review sufficiently early in the process to allow the applicant to make process updates before significant rework might be required. Suggest changing 75% to 50%.	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).
720	*Boeing Commercial Airplanes*	4.5.5 Table data row 2	18	Summary The proposed CM states that the hardware verification review should be conducted when at least 75% of the hardware verification data is done and reviewed.	Although FAA Order 8110.105 does not specify a completion goal for the review, the associated FAA Job Aid encourages review sufficiently early in the process to allow the applicant to make process updates before significant rework might be required. We suggest changing 75% to 50% in this table.	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).
721	*Boeing Commercial Airplanes*	4.5.5 Table data all rows	18	Summary There should be associated with each of the reviews. (Note that row 4 currently calls out Quality Assurance records instead of Process Assurance records and the associated footnote contains a typographical error.)	We suggest adding Process Assurance records and Hardware Configuration records reviews to the Documentation column. This will make the summary consistent with table data in Sections 4.5.1 through 4.5.4.		x	Accepted	"Quality assurance" wording has been changed to "process assurance". Other slight modifications have been performed in order to make the table in 4.5.5 fully consistent with the other tables.
722	*Boeing Commercial Airplanes*	5.1	22	Purpose In the third paragraph, there are two references to "embedded hardware." This is not standard terminology, especially when applied to LRUs and circuit boards. Other uses of "embedded" in the document occur in reference to logic within devices.	We suggest deleting the term "embedded" in this section.	x		Accepted	The text has been updated as suggested.
723	*Boeing Commercial Airplanes*	5.1	22	Purpose 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 PHAC or a Hardware 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.
724	*Boeing Commercial Airplanes*	5.3.2	24, 25	Determination of EASA AEH level of involvement There is not enough information here for applicants to put together a presentation that justifies their proposed level of involvement.	Suggest adding specific guidance for the applicant as to how this determination is made.		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).

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725	*Boeing Commercial Airplanes*	5.3.3 c.	26	Table of documents This table in the CM requests that data in addition to that specified in DO-254, Appendix A, Table A-1, be submitted for information. A summary of Hardware Review Reports is included as part of the HAS. Are complete reports also required?	Please clarify which other plans and reports are being requested.		x	Noted	We confirm that complete reports are requested to be delivered for information. As the HAS is delivered at the end of a project, it cannot match with the need to get reports at SOI1, 2 and 3 stages. In order to better reflect this aspect, the section 5.3.3b has been reworded in the updated version of the Certification Memorandum.
726	*Boeing Commercial Airplanes*	6	28	Guidelines for Single Event Upsets The guidance in the CM simply states that the analysis should be done. [Also, note that the listed acronym MEU is not used within the document.]	We suggest removing this section. Equipment safety analysis is a separate activity outside the scope of this guidance, since it is a system-level activity.		x	Partially accepted	Hardware safety analysis is addressed by §2.3 of ED80/DO254. In this Section the link to Equipment/System/aircraft safety analysis (Separate Particular Risk Analysis) is added.
727	*Boeing Commercial Airplanes*	7	29	Guidelines for Electronic Hardware Development Assurance of Equipment and Circuit Board Assemblies The third paragraph of this discussion appears to be requesting something similar to all the life-cycle data that would be listed in a HAS for LRUs although a PHAC is not required. Is this the case? Is there an expectation that such documents would be submitted?	Clarification is needed to specify exactly what is requested.		x	Accepted	The Section clearly has been improved and identifies ED80/DO254 is to be used for LRU and CBA. The Section has been updated to better explain what need to be done.
728	*Boeing Commercial Airplanes*	8.3 & 8.5	31	Classification and Determination of Device Characteristics; and Simple ASICs/PLDs It is not clear whether a distinction is to be drawn between functional complexity and physical complexity for classification purposes. It is possible to have a very functionally simple design that cannot be exhaustively testable, like a RAM. Alternatively, a simple logic construction that is repeated many times over can create a very complex device, like a FIFO. Consider a random number generator composed of a few latches, with feedback. Such a device is complex because the number of possible outputs grows as a strong power function of the number of register length and the number of clock cycles which have elapsed. However, each part of the generator is simple (1 latch and 1 wire) and can be exhaustively tested if such testability and observability is provided.	We suggest revising the paragraphs to:1. distinguish between criteria for functional complexity versus physical complexity; and 2. to provide guidance for determining the classification of a device when the assessments for functional and physical complexity differ.		x	Partially accepted	EASA fully agrees that complexity definition is really difficult and differences may appear between functional and physical criteria. It is the reason why it is expected that the applicant provide the information in the PHAC as to be seen and agreed early by Certification Authority.
729	*Boeing Commercial Airplanes*	8.4.2.1 g) & h)	33	Verification of the design description The criteria listed in sub-paragraph (g) are very software-centric and the code coverage results specified may be misleading. An example of where a code coverage result may be misleading is in assessing an If. Then statement pair versus a if … then… else statement set. A if … then statement pair implies a latch, but an If… then… else statement may simply imply combinatorial logic and be incorrect if a latch is actually needed. When code coverage tools are used, the results (gaps in coverage) should be assessed by examining the RTL level synthesis: - to determine what the tool actually generated and that it matches the design intent; and - to show the rationale as to why the "missing" code coverage is acceptable.	We suggest revising the guidance to recommend for Level A and B an analysis of coverage tool results to ensure that the tool assessed the design correctly and that there is a justification for the areas not assessed by the tool.		x	Partially accepted	A note has been added to cover the coverage done at the RTL.

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730	*Boeing Commercial Airplanes*	8.4.2.2 a)	34	Verification of the implementation The description of verification appears to be in an incorrect place in the document. Coverage analysis of tests run on an implementation usually needs to be assessed against a representation of the design (such as in Section 8.4.2.1 step g/h). If it is kept here in Section 8.4.2.2 in some form, it is unique to Level A and B; therefore, it should be moved to the second group of lettered items unique to Level A and B.	Correct the description of verification activity and place it in appropriate section.		x	Partially accepted	Sub-section removed.
731	*Boeing Commercial Airplanes*	8.4.2.2 a)	34 and Multiple places throughout document	Verification of the implementation There is inconsistency in the use of the term "contribute" when defining failure conditions. For example: • Section 10.3., Item a, uses "contribute" in a marginal way; • Section 10.3., Item c, uses "contribute to" in a way that should simply be changed to "cause" or "lead to" for clarity (and to avoid what it means to "contribute" here).	The text should be changed to show that hardware failure or anomalous behaviour causes a hazard. Remove the term *"contribute to"* in order to be consistent with the definitions in ED-80/DO-254.			Partially accepted	In CS25, the current definition of Failure Condition is "A condition having an effect on the aeroplane and/or its occupants, either direct or consequential, which is caused or contributed to by one or more failures or errors, considering flight phase and relevant adverse operational or environmental conditions, or external events." However, in section the word "cause" has been added
732	*Boeing Commercial Airplanes*	8.4.5	35	Configuration Management The second bullet requests that an HCI be submitted if the Top Level Drawing does not contain sufficient configuration information to completely identify the configuration of the hardware and the embedded logic.	Since the HCI is typically considered the Top Level Drawing for a device, we suggest that this bullet be restructured to specify the information needed in an HCI.	x		Not accepted	EASA thinks this section is enough detailed to explain that a TLD, HCI and/or should provide the necessary information to reproduce the HW.
733	*Boeing Commercial Airplanes*	8.4.5	35	Configuration Management The third bullet requests that a dedicated Hardware Lifecycle Environment Configuration Index (HECI), document be submitted.	Specifying a dedicated document is counter to the guidance of ED-80/DO-254, which deliberately does not specify how documentation is to be packaged. Suppliers frequently document design environment data separately from verification environment data, and simulation environment data separately from environment data from testing on the target hardware. We suggest requiring instead the listed HECI data.		x	Partially accepted	EASA agrees and request the HECI only if the information in not in the TLD or HCI. This section aim to explain that a TLD, HCI and/or should provide the necessary information to reproduce the HW.
734	*Boeing Commercial Airplanes*	8.4.5 & 8.4.6	35	Configuration Management and Process AssuranceThese two sections are included in the Configuration Memorandum section dedicated to ASIC/PLD Electronic Hardware. Should these discussions be in separate sections with broader scope? The scope of the discussion needs to apply to all hardware discussions.	We suggest placing these discussions in separate sections with broader scope.	x		Not accepted	Those 2 sections provide clarification on how complex devices should be manages into configuration and follow a strong process assurance. For simple device, CBA and COTS, the ED80-DO254 guidelines have to follow without the clarifications of those sections.
735	*Boeing Commercial Airplanes*	9.2	38	Applicability If this approach is limited to only microprocessors, then how to assure the Complex CPUs embedded in the microcontrollers must be addressed.	We recommend allowing DO-178B activities to provide assurance for components of the microcontroller exercised by these activities.		x	Accepted	The sentence was modified as followed: "Software and COTS microprocessors are out of scope of this Section. The development assurance of microprocessors and of the core processing part of the microcontrollers and of the highly complex COTS microcontrollers (Core Processing Unit) will be based on the application of ED-12B/DO-178B to the software they host, including testing of the software on the target microprocessor/microcontroller /highly complex COTS microcontroller ."

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736	*Boeing Commercial Airplanes*	9.3 & elsewhere throughout the document	39	Activities for Commercial Off-The-Shelf Components (COTS); The proposed text states: *"A summary of the outcome of these activities should be documented in the PHAC."* The phrase *"the PHAC"* implies a specific expectation from the applicant.	We suggest using the phrase *"**a** PHAC"* to help harmonize with the statements made in Section 7, page 29. This will clarify the expectation for the information to be provided in a plan without implying there is a specific scope of that plan.	x		Accepted	This wording was replaced as proposed within §8.3 and §9.3.
737	*Boeing Commercial Airplanes*	9.3.2 [3]	40	Life cycle data - design data Experience has shown that COTS component suppliers are unwilling to share their processes or data with low volume customers (the entire aerospace industry is a low volume customer for most COTS components). We can and will ask for information, but cannot guarantee that we will be able to get it.	We suggest replacing the second bullet with the following: "When design data is not available, the applicant should provide justification for use of the components from those suppliers that consider that supplier's ability to control quality and provide timely notification of manufacturing changes."	x		Not accepted	The idea is to get relevant information from the component manufacturer and particularly to know if he uses a documented quality management process.
738	*Boeing Commercial Airplanes*	9.3.3 [5] last bullet & 9.3.6 [12] first bullet	41 and 42	Usage Domain aspects & HW/HW and HW/SW integration Define what is meant by the *"determinism of a device."*	Clarification is needed.	x		Accepted	The determinism of a device was explained: "e.g. bus throughput, data latency, WCET, stack activity must be guaranteed no matter the device solicitation ".
739	*Boeing Commercial Airplanes*	9.3.2 [3] & 9.3.5 [9]	41	COTS lifecycle data; and Configuration Management An Electronic Components Management Plan (ECMP) is an integral part of production configuration management. ED-80/DO-254 states: "The use of an electronic component management process, in conjunction with the design process, provides the basis for COTS component usage." The part management per the ECMP must manage the part's usage in all products, independent of the design assurance level of the product. The component manufacturer's errata are frequently tied to a configuration by mask set or date code. The supplier must implement parts control at a level commensurate to the component manufacturer's configuration control. This must be documented in the part specification per the process in the ECMP. For example, if a label is used to mark a programmed part, the label should repeat date code or mask set information if the label would obscure the markings on the un-programmed part.	We suggest this section be restructured to provide guidance for an ECMP.		x	Partially accepted	Section 9.1 was improved: "ED-80/DO-254 Section 11.2 states that "the use of an Electronic Component Management Process (ECMP), in conjunction with the design process, provides the basis for COTS component usage". The following sections of this Certification Memorandum provide some guidance for an ECMP. Some other guidance exists (e.g. IEC TS62239) which cover part of the activities described below."
740	*Boeing Commercial Airplanes*	9.3.6 [12] second bullet	42	HW/HW and HW/SW Integration The recommendation here assumes that there is some independence of blocks/pin-outs and that the applicant will be able to substantiate this independence. However, the applicant is unlikely to be able to obtain such substantiation.	The safety analysis should treat the device as having no independence between functional blocks without substantiating data justifying the claim. Functional independence does not necessarily translate to physical independence. We suggest this section be revised accordingly.		x	Not accepted	There is no assumption about the independence of blocks/pin-outs. but depending of the result of the analysis (based on the identification of the architecture and an assessment of the independence of blocks/pin-outs) the failure modes and associated failure rates of the device should be refined. If substantiation cannot be provided then safety analysis should treat the device as having no independence.

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741	*Boeing Commercial Airplanes*	9.3.7	42	In service experience The guidance in this section is a quantification of the qualitative assessment recommended in ED-80/DO-254 in sections S11.2 and 11.3. The quantitative assessment relies on information not readily available, especially if service history outside the applicant's immediate product line is being claimed. The guidance of ED-80/DO-254 was intended to encourage the use of components with wide usage in other applications. This guidance in the proposed CM appears to discourage the use of components from other applications.	We suggest revising this section by reverting back to a qualitative assessment, with perhaps more detailed expectations than those given in ED-80/DO-254.		x	Not accepted	EASA intent is not to limit the usage of COTS component widely used, but Service Experience gained in critical application is more appreciate then from non critical applications. Thus EASA deemed important to make a difference. Many applicants ask us to detail the acceptable criteria for Sufficient Service Experience. Thus EASA defines some quantitative criteria (order of magnitude) which can be measured and are unambiguous. These criteria help also to have an equal treatment between all applicants.
742	*Boeing Commercial Airplanes*	9.3.7	42	In-service experience should consider that specific part numbers are often produced for less than 2 years, but that the functional blocks within the parts are used for longer periods. Rather than quantifying what constitutes sufficient or low in service experience, we suggest that the applicant justify the use of ISE towards the completeness of the errata to their intended use of the device. Also, rather than ruling out the use of a device with low ISE, we recommend that the applicant show how they intend to demonstrate the acceptability of the part for their intended use. Such plans should consider (1) the amount of use that will be seen during development prior to certification, (2) test programs designed to robustly exercise the device over the envelope of use, and (3) any additional data that can be wheedled from the vendor to substantiate the adequacy of the design, etc.	We suggest this section be revised as we have discussed.		x	Not accepted	Credit cannot be taken from ISE for functional blocks which were used from previous components, because a COTS component should be assessed as a whole.The objective of this section 9 is clearly to gather all the available device data in order to substantiate the adequacy of its design regarding its intended usage. This includes data from the device manufacturer (errata, installation guide...), from the other users (ISE), and from the applicant (verification activities).
743	*Boeing Commercial Airplanes*	9.3.10 & 9.3.11	44	Alternative methods; and Activities for Simple COTS ICs and Simple COTS Microcontrollers The distinction between simple and complex microcontrollers seems unnecessary.	(See our Comment #7.) We suggest removing the distinction between simple microcontrollers and complex microcontrollers. They are all complex.	x		Not accepted	EASA prefers to keep a distinction between simple and complex microcontrollers to be able to alleviate the activities for simple microcontrollers.
744	*Boeing Commercial Airplanes*	9.3.12 & 9.3.13	45 and 46	Activities for Complex COTS ICs and Complex COTS Microcontrollers; and Activities for Highly Complex COTS Microcontrollers Given the low service life of these parts and difficulty in obtaining design and process data from the suppliers of complex and highly complex microcontrollers, these tables effectively disallow their use for other than level D applications.	Please resolve.	x		Noted	Experience has shown that data may be gathered.
745	*Boeing Commercial Airplanes*	10	47	Guidelines for the usage of Commercial Off-The-Shelf Graphical Processors in Airborne Display Applications. The guidance provided for CGP will apply to much of the complex and highly complex microcontrollers in use.	We request that Section 10 be modified to include material discussed in Section 9, and then Section 9 removed.	x		Not accepted	Section 10 addresses specific concerns related to the use of CGP in display systems such as hazardously misleading information, display system availability, etc. Section 10 has been harmonised with others Certification authorities (CAST paper 29) and therefore EASA would prefer to dedicate this Section 10 only to CGP. EASA will consider merging of Section 9 and 10 in the future.
746	*Boeing Commercial Airplanes*	10	47	Guidelines for the usage of Commercial Off-The-Shelf Graphical Processors in Airborne Display Applications Does the guidance only apply to the use of a CGP when it is used for display drivers? They could be used for more general purpose processing.	Clarification is needed.	x		Noted	As written in Section 10.1, Section 10 applies when CGPs are used in airborne Display systems and this section provides considerations linked to display system functions, data and architectures.

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747	*Boeing Commercial Airplanes*	11.2.2	54	Supplier Oversight: Reviewing the Applicant's Plans Item 3 (Tasks and responsibilities) and Item 5 (Integration verification activity) are too vague. Responsibilities for what? "Responsible person" for what?	Clarification of the scope of this item is needed. As proposed, the scope appears too broad.		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.
748	*Boeing Commercial Airplanes*	12.2 1)	56	Procedures A change that impacts the SSA should be also considered major. Reallocation of functions to different functional elements, for example, typically will impact the failure modes of the equipment enough so that the failure analysis, including fault tree and FMEA analysis, will need to be revisited.	We suggest that this section be revised to clarify this issue.	x		Partially accepted	EASA fully agrees that in case the SSA has changed the classification is major. However, it is already considered in bullet c - c) requires an update of the certification process.
749	*Boeing Commercial Airplanes*	13.5	58	Typology of Open Problem ReportsDepartures from plans and standards are part of process evolution and, if agreed upon, can take effect prior to formal revision of the plan or standard. "Significant" departures should be corrected and the certification authorities should be notified.	We suggest replacing Type 3 with problems in the development data, as well as departures from plans and standards. Consider the following revised text:• Type 3: Any problem which is not of type 0, 1 or 2, but which is a problem with the development data (i.e. the requirements, design, test procedures, or test results) or a departure from plans and standards . If agreed between the aircraft/engine manufacturer and the equipment/hardware supplier, this type should be divided into three sub-types: o Type 3A: a "significant" problem with the data or departure from plans and standards, whose effects could be to lower the assurance that the airborne software behaves as intended and has no unintended behaviour. Type 3B: a "non-significant" problem with the data that does not affect the assurance obtained. o Type 3C: an approved departure from plans and standards that does not affect the assurance obtained. These departures should be discussed in the HAS.		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. HAS 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.
750	*Boeing Commercial Airplanes*	13.7	60	Contents of Hardware Accomplishment Summary (HAS) 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.	We suggest two revisions to this section: 1. Remove *"scheduled closure data for the OPR"* from the information to provide in HAS. 2. Add a comment that significant Type 2A OPRs should provide a date for fielding a fix for the OPR.		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 13.5).
751	*Boeing Commercial Airplanes*	13.8	60	Content of System Certification Summary or equivalent document Concern: System activities in a hardware CM. (See our Comment #705.)	(See our Comment #705.) Move this section to a "systems" CM. Keep system and hardware activities in their respective certification memorandums.		x	Not Accepted	EASA thinks that guidance specific to a given issue/concern/problem should be defined in this section.
752	*General Aviation Manufacturers Association*	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.
753	*General Aviation Manufacturers Association*	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	

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754	*General Aviation Manufacturers Association*	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	EASA intent is to publish new AMC in the future. EASA wants to highlight that all the subjects addressed within this Certification Memorandum are already addressed within ED-80 / DO-254.
755	*General Aviation Manufacturers Association*	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.
756	*General Aviation Manufacturers Association*	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	EASA intent is to call-up this Certification Memorandum through project related CRIs.
757	*General Aviation Manufacturers Association*	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-80/DO-254, 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-80/DO254 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-80/DO-254 standard again in light of the existance 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 a case by case which Certification Memorandum is applicable if any.
758	*General Aviation Manufacturers Association*	1.4	7	The current definition of COTS Microprocessors is not reflective of any existing definition. GAMA believes it would not be advantageous to create a new definition.	One resolution is to use the same definitions as FAA Order 8110.105 for custom micro-coded components, COTS devices, and COTS Intellectual Property. Having consistency with that FAA Order would reduce confusion and inconsistency. In Order 8110.105, ED-80/DO-254 aspects are targeted towards custom micro-coded components and COTS IP; those devices can be adequately addressed within a design assurance process.	Suggestion	Objection	Partially accepted	COTS IP has been defined. "Custom micro-coded components" and COTS IPs are addressed in the Section 8 of this Certification Memorandum. The FAA order 8110.105 excludes discussion of the others COTS components like Microprocessors and Microcontrollers. There is today no possibility to harmonise.
759	*General Aviation Manufacturers Association*	4.5 a. (2) & (3)	14	GAMA believes traditional compliance and verification has permitted hardware development review once 50% of hardware verification has been completed.	EASA should change this section to state that hardware development and verification reviews may begin once 50% of hardware verification is completed.	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 process assurance activity).
760	*General Aviation Manufacturers Association*	4.5.5	18-19	Section 4.5.5 provides a list of documents "to be submitted to the authorities at least 10 working days before the audit", this list contains additional documents for submittal compared to that in ED-80/DO-254. For example, ED-80/DO-254 does not require HDP, HVaP, HCMP and HPAP to be submitted (but to be available)	We recommend that we continue to work with local cert authorities and agree on the list of documentation to be submitted based on novelty of the program. This agreement will be captured in program specific PHAC.	Suggestion	Objection	Not accepted	The plans and standards documents are necessary to perform the Hardware 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. Note: data typically available on-site are more requirements, design and test data for example, for obvious proprietary considerations. However, EASA does not consider that plans and standards are falling under proprietary data.

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761	*General Aviation Manufacturers Association*	4.5.5	18-19	This section states: "Once all activities are finished and at least 1 month prior to final system/equipment certification." GAMA believes this is a new requirement not supported by the current regulatory structure of EASA.	GAMA recommends the EASA remove this new requirement from the CM and consider promulgation in CS or AMC if it is necessary	Suggestion	Objection	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 AEH is ready for formal certification approval." in the updated text.
762	*General Aviation Manufacturers Association*	5.3.3 a. & b.	25-26	The Applicant Hardware Review Reports required as part of the hardware audits applicable to each LOI seem to be an additional item and not clear in terms of content.	GAMA believes that the historical ED-80/DO-254 compliance process and regular IPT meetings with Suppliers are sufficient to cover all hardware processes and that additional reporting is not necessary. Further such a requirement expansion is not supported by the CM process and therefore it should be removed.	Suggestion	Objection	Partially accepted	As part of his design assurance system, an applicant should perform certain reviews to assess the compliance to ED-80/DO-254. The reports generated during such reviews are the one in question here. The status report that is mentioned in the first paragraph of section 5.3.3.b is not meant to be an additional report, but may be simply some slides in the entry briefing presentation. This section has been reworded to better reflect this guideline.
763	*General Aviation Manufacturers Association*	6	28	The guidelines for Single Event Upset analysis should be based on failure mode or DAL (similar to Appendix B of ED-80/DO-254).	EASA should follow the material in Appendix B of ED-80/DO-254.	Suggestion	Objection	Not accepted	This section asks the applicant to perform an analysis in order to determine the safety impact of such effects. There is no need to link this analysis with the DAL of the component as the safety analysis will already take into account the criticality of component.
764	*General Aviation Manufacturers Association*	7	29	This section does seem to extend ED-80/DO-254 beyond discrete CEH as it has been applied historically. Applying ED-80/DO-254 to circuit boards, a host of devices attached to a particular circuit, etc. goes beyond historical demonstrations of compliance to XX.1301/9.	GAMA recommends the EASA revise this section to limit application of ED-80/DO-254 to programmable logic devices.	Suggestion	Objection	Partially accepted	There is a need to deal with the inconsistency due to the lack of Development Assurance requested at system level (covers by ED79/ARP4754) and at item levels (SW cover by ED12B/DO178B and CEH/SEH cover by ED80/DO254). It is the EASA understanding that requirements at board level needs to be correct and complete and finally verified to ensure compliance with CS XX.1301 and 1309. The level of complexity for boards has increased tremendously during the last years and the Development Assurance is therefore necessary. That compliance to ED80/DO254 for boards is requested by some applicants to their suppliers for years.
765	*General Aviation Manufacturers Association*	8.4.1	31-31	Requirements Validation, states "Requirements validation could be satisfied either by review, analysis or simulation, or a combination of these methods." and does not explicitly reference "test" as a method as does ED-80/DO-254 section 6.1.2.	GAMA requests that EASA clarify this area.	Suggestion	Substantive	Accepted	Sentence suppressed as it is already covered in ED-80/DO-254.
766	*General Aviation Manufacturers Association*	9	38-46	This section addresses guidelines for COTS-AEH and it differs greatly from material recently published by the FAA (February 2011).	GAMA requests that the EASA and FAA coordinate on COTS-AEH guidance.	Suggestion	Objection	Noted	EASA and FAA are still in the process of harmonisation through CAST group.
767	*General Aviation Manufacturers Association*	9.2	38	GAMA believes Complex Microcontrollers and Complex Microprocessors have not historically been treated differently and therefore it is inappropriate to make such a change in the CM.	Both microcontrollers and microprocessors should be out of scope for this CM.	Suggestion	Objection	Not accepted	Peripheral of microcontrollers are getting more and more complex. Internal architecture of microcontrollers are also getting more and more complex. EASA is addressing those components for 5 years. Thus EASA deemed essential to address those components also in this Certification Memorandum.