Item #	Commenter	Page	~~Page &~~ Para #	Comment	Reason	Suggested Change	Comment Resolution
3	Krodel, James PW		General	It is interesting that the industry (I think) seems to be using 'FADEC' instead of 'EEC' yet this AC has 2 uses of FADEC and many, many uses of EEC.		Should you stick to one? Should you change EEC to FADEC?	Partially agree. FADEC is now only used in definitions and in other document titles. The use of FADEC limits the applicability of the text to Full Authority Digital Engine Control. EEC is a slightly more general term and fits with the rule intent.
8	Delamaide, Jean-Luc EASA		General	This AC should take care about the potential introduction of the ECS functions in a dedicated Integrated Modular Avionics (IMA) or the A/C IMA.	A proper integration of the ECS functions should be perform if an IMA is used and the RTCA DO-297 provides acceptable guidelines to ensure this integration.	EASA would like the FAA to add IMA considerations in this AC.	Agreed The implementation of a FADEC or ECS Functions in an IMA will need special consideration. This has been added to 16-1.b.(2).(a).
114	PW		<u>General</u>	Formatting of the document needs to be improved so that it is clear which paragraphs are sub paragraphs to other paragraph as this affects the interpretation of the requirements.	Formatting of the document needs to be improved so that it is clear which paragraphs are sub paragraphs to other paragraph as this affects the interpretation of the requirements.	As required. There does not appear to be an 11-2(b) though there is an 11-2 (a) & (c) – see page 42?	Agreed. Fixed section 11-2. The basic paragraph format is a set standard.

139	GE		General Comment	There are numerous references to engine installation or operating instructions. In many cases this information is already defined in a functional interface control document (FICD). This should be an acceptable alternative for many of the cases. Yet the only place FICD shows up is in chapter 16, in 16-2 c. (1).	This will reduce the burden for those engine manufacturers that adequately document this information in a FICD.	Acknowledge that a FICD may be a suitable location for much of the data identified for the engine installation or operating instructions.	Agreed. This has been added to Appendix 1.
74	Williams 01	i	Paragraph 2.b last sentence.	This sentence should be deleted. It implies that the FAA does not stand behind the guidance provided in the AC. We do recognize that if a novel design is proposed that the FAA will create issue papers and possibly special conditions to deal with those issues peculiar to that project. The equivocation that this statement represents will cause issues for FAA designees when trying to apply the guidance if non designees read this and think that the FAA is not on board with the means of compliance that the AC represents.			No change This text is simply intended to be clear that there could be circumstances where the guidance in the AC does not fully address the situation and that there may need to be supplemental compliance means applied.
140	GE	i.	(P-i) Applicability, 2.a.	Text states "…designated engineering type representatives…" Why is "type" used here?	Not consistent with DER title.	Delete type in sentence.	Agreed

39	Garmin	ii	Page ii, 3.b. (2)	AC20-136A has been updated to AC20-136B.	AC20-136B was published 9/7/2011.	All references to AC20-136A should be updated to AC20-136B. Alternatively, generic references could be made not only to this AC but other ACs.	Agreed
75	Williams 02	ii	paragraph 2.d	Delete. and renumber following sections as appropriate. This section is redundant as Paragraph 2.c. is not limited by engine design and the overall AC has been retitled eliminating the term Turbine from the title.			Agreed
76	Williams 03	ii	Paragraph 3.b	Add AC33.91-1 to the list of FAA ACs, Orders & Policy			Agreed
115	PW	ii.	Page ii, Section 3 (b)(6)	AC 33.2B Aircraft Engine Type Certification Handbook, June 30, 1993	Reference Format.	AC 33-2B Aircraft Engine Type Certification Handbook, June 30, 1993	Agreed

40	Garmin	iii	Page iii, 3.b.(9) and 3.b.(10)	References FAA Orders 8110.49 and 8110.105. FAA Orders are not methods of compliance for applicants to utilize but rather they are requirements for FAA personnel to follow when determining compliance to regulations. Applicants are legally obligated to comply with regulations and directives; policy can provide clarification of regulation and guidance can provide acceptable methods of compliance. Applicants are not obligated to follow Orders nor are FAA Orders written for applicants.	Referencing these orders may cause confusion in that applicants may feel that these orders are requirements for the applicant when they are not. FAA presentations at the 2011 SW/AEH Conference have acknowledged the confusion between ACs and Orders with respect to the applicant.	Remove references to Order 8110.49 and 8110.105 under 3.b and throughout this AC. If the references are retained, Order 8110.49 CHG 1 was published 9/28/2011, so the reference should be corrected.	Partially agree. The principle that the comment addresses is correct and thus we agree with that aspect of the comment. References are retained for completeness. Note added to clarify applicability.
141	GE	iii.	(P-iii) Related References, 3.b.(9)	Order 8110.49 dated June 2, 2003. Change 1 was issued 9/28/11	Change 1 issued, new date.	Update to show change 1, dated 9/28/11.	Agreed See item 40
6	Delamaide, Jean-Luc EASA	iv	Section 2.3.d.3	This AC 33.38 should reference the AC 20-174 "Development of Civil Aircraft and Systems", September 30, 2011	This AC recognizes the ARP-4754A as an acceptable method for establishing a development assurance process and it references 14CFR part 33 as potential candidates.	EASA would like the FAA to add this AC in the references.	Agreed

7	Delamaide, Jean-Luc EASA	iv	Section 2.3.d.3	This AC 33.38 should reference AC 20-170 "Integrated Modular Avionics Development, Verification, Integration and approval using RTAC DO-297 and Technical Standard Order-C.153	This AC sets forth an acceptable means of compliance for aircraft and engines that utilizes IMA systems	EASA would like the FAA to add this AC in the references.	Disagree Implementing a FADEC in an IMA will be treated as a special case as the implementation crosses between engine certification and aircraft certification.
200	Andy Ward	iv.	3	SAE International	Why no reference to ARP4754A/ED-79A and ARP4761 in the SAE section?		Agreed ARP 4754A reference added.
1	Krodel, James PW	v.	Pg v., Para 3f(4)	I believe the reference for RTCA & EUROCAE are outdated in the AC. Both of them have moved. And the website for EUROCAE was wrong	Incorrect addresses	(4) RTCA, Inc. 1150 18th St. NW, Suite 910, Washington, DC 20036 or EUROCAE, 102 rue Etienne Dolet, 92240, Malakoff, France. Also available online at www.rtca.org or www.eurocae.net	Agreed
77	Williams 04	v.	Paragraph 4 e.	Rename Analysis to Safety Analysis and move to the appropriate alphabetic location in the list. The definition and analyses are specific to the tasks of a safety analysis. In addition other analyses used in compliance are overlooked in this definition such as a similarity analysis or performance analysis.			Partially agree. The addition of this definition was based on an earlier comment and is mainly based on the definiton in AC33.75-1. Added other examples.
142	GE	v.	(P-v) Related References, 3.f.(4) and 3.f.(5)	Why are there addresses for two separate organizations in each of these two items of RTCA and SAE respectively?	Recommend that the EUROCAE address be made as a separate item. This would be easier to find.	Add new item (7) EUROCAE …Paris, France.	Agreed

143	GE	v.	(P-v) Definitions, 4.e.	Why is the definition of analysis related to 33.75? This is a generic activity that goes beyond 33.75.	Analysis covers a broad range of engineering activities, not just those for 33.75.	Delete … requirements of 33.75.	Partially agree. See item 77. This addresses the history of the addition of this definition and notes that other examples were added. Please note that it says "…of § 33.75 and other applicable requirements of the EECS"
2	Krodel, James PW	vi.	Pg vi., Para 4 o.	Your definition of ECS may be a wee bit misleading.	You have "*Engine Control System (ECS). Any system or device that controls, limits, or monitors engine operation.*" I think since we have PHM systems that '*monitors engine operation*' that I feel are not part of the ECS	"Engine Control System (ECS). Any system or device that controls, limits, or monitors active engine operation."	Agreed
78	Williams 05	vi.	Paragraph 4.l.	Delete Destructive Engine Explosion and replace with Non Containment of High Energy Debris. This more accurately defines the hazard to the aircraft from the engine failure and aligns with language used in 14CFR§33.75			Agreed

144	GE	vi.	(P-vi) Definitions, 4.v.	Definition of fault or failure is not consistent with that of DO-178B and DO-254.	A consistent definition for fault and failure is important to understanding.	Utilize definitions of fault and failure from DO-178B and then adapt to include hardware.	Partially agree. The definitions of Failure and Fault have been modified to be compatable with those in SAE ARP4754A, Guidelines for Development of Civil Aircraft and Systems, December 21, 2010. This SAE document is the foundation for safety analyses and is the more general system document it is appropriate to guide this topic. These are similar to the DO documents.
201	Andy Ward	vi.	v.	Fault (or) failure	In the ARP 4754A & 4761 we established separate definitions for fault and for failure: Fault: “A manifestation of an error in an item or system that may lead to a failure”. Failure: “An occurrence which affects the operation of a component, part or element such that it can no longer function as intended, (this includes both loss of function and malfunction). Note: errors may cause Failures, but are not considered to be Failures. (AMC 25.1309)"		See item 144

26	Turbomeca	vii	§ Definitions z. Local Events. Page vii :	In " *Failures of aircraft systems and components, other than the EEC system, that may affect the installed environment of the EEC*", shall we understand "*environment of the EEC system*"? Could you please clarify (as EEC is not defined) ?			Agreed. Minor changes made. EEC is referenced in the definition of FADEC.
68	Cessna 1	vii	Definitions	None	Minor Thrust Loss (MTL): An ECS failure event resulting in the ability to attain less than 97%, but more than 90% of rated thrust.	Cessna suggests that Minor Power Loss is defined, but Minor Thrust Loss is not. 3% value chosen for threshold of minor thrust loss based on guidance in chapter 4-2e for HIRF events. New definition is related to proposed words added in comment #29 (editor note: This last sentence is directly from Cessna and it is not clear what comment 29 is.)	Disagree. There is a difference between Turbines and recips in the area of loss of function. A minor thrust loss is one that is less than 3%. Between 3% and 10% is not classified as a minor thrust loss. Thrust loss up to 10% is not called an LOTC event.
69	Cessna 2	vii	Affected Section: Definitions	cc. Minor Power Loss (MPL). An EEC failure event resulting in the ability to attain less than 95%, but still greater than 85%, of rated power	cc. Minor Power Loss (MPL). An EEC ECS failure event resulting in the ability to attain less than 95%, but still greater than 85%, of rated power	Cessna feels that the current wording limits failures to those of the EEC itself, and should be changed to ECS to clarify failure of any component in the control system, which also makes it consistent with the definitions for LOPC and LOTC.	Agreed. Changed to ECS as this covers all cases.

79	Williams 06	vii	Paragraphs 4. .z, 4. aa, and 4. bb.	The definitions for Loss of Power Control (LOPC), Loss of Thrust Control (LOTC) and Minor Power Loss (MPL) are inconsistent. Suggested changes to the definition of LOPC is "A reciprocating engine ECS..." Suggested change to the definition of Loss of Thrust Control is "A tubine engine ECS..." and Suggested change to the definition of Minor Power Loss (MPL) is "A reciprocating engine EEC..."			Agreed.
116	PW	vii.	Page vii, Section 4, definition cc	Should "EEC" be changed to "ECS" in the following definition – "Minor Power Loss (MPL). An EEC failure event …"	Assumed intent.	As suggested.	Agreed. See item 69
145	GE	vii.	(P-vii) Definitions, 4.cc.	"EEC" should be changed to "EECS"	EEC limits the failure mode to the electronic control and not the control system	Change EEC to ECS	Agreed
146	GE	vii.	(P-vii) Definitions, 4.ff.	Programmable Logic Devices (PLD) title is in French. There are other sections in the document that are also in French, e.g. ch 12, 15, appendix 2 titles.	This entire document should be in English.	Change language to English in this text section.	No change. The document is written and published in English. I do not understand how areas of your copy was not in English.

147	GE	vii.	(P-vii) Definitions	There is no definition included for “Self-Contained Electrical Power Systems.”	Several comments are submitted to Chapter 11 (below), regarding the vagueness and inconsistency shown in the guidance for the definition of Self-Contained Electrical Power Systems. A clear and concise definition, appearing in this section of the AC, is needed to address this issue.	Provide a clear and concise definition of “Self-Contained Electrical Power Systems” in the Definitions section of the AC.	Agreed Clarification has been added to Chapter 11 rather than via definitions
148	GE	vii.	(P-vii) Definitions, 4.ii.	Time-Limited Operation is defined. The FAA policy is for time-limited dispatch.	Widely recognized term is TLD, not TLO.	Replace TLO with TLD.	Disagree. While TLD is used for Turbine engines, the term TLO is used for Recips
80	Williams 07	viii.	Paragraph 4.ii:	All the guidance associated with the definition of Time Limited Operations are restricted to Reciprocating Engines. Consequently this definition should be updated to "The duration of reciprocating engine flight operation ..."			Agreed.

81	Williams 08	viii.	Paragraph 4. kk:	The definition of Unsafe Condition provided has clearly been written with respect to reciprocating engines only. Furthermore this definition is reiterated in Appendix A which is devoted to reciprocating engines. Consequently the definition should be deleted as it does not address turbine engines or change the title to Unsafe Reciprocating Engine Condition.			Agreed Definition changed. It is limited to recips only as written.
4	Krodel, James PW	1	Pg 1, Para 1-2	Sect 1-2 you say "*The engine manufacturer must, of course, note any*"	I think you should use a stronger word than 'note'	How about "The engine manufacturer must, of course, detail any"	Agreed.
70	Cessna 3	2	Affected Section: 1-7	We also recommend that the following limitation be included in any reciprocating engine TCDS or STC for any reciprocating engine with an approved EEC system: "Installation of this engine is not approved for airplanes certificated under part 23 commuter or part 25 transport categories."		Cessna suggests deletion as it is unaware of regulation that restricts the installation of an electronic engine control system on a reciprocating engine on a Part 23 commuter or Part 25 airplane. This line as written seems to be regulatory, not advisory and therefore should be deleted.	Agreed. This has been deleted.
149	GE	3	(P-3) 2-1.b.	Replace, "Even low cycle fatigue"…with, "For example low cycle fatigue…"	Improve readability	Replace "Even" with "For Example."	Agreed.

71	Cessna 4	4	Affected Section: 3-2c	When evaluating adequate sensitivity in compliance with § 33.28(b)(1)(iii), the applicant should consider two additional aspects of power or thrust modulation. First, the power or thrust setting regions should be void of any inversions. Second, flats, or "no response" regions, in the power or thrust setting implementation, other than at the ends of range, are undesirable, except for positions that represent fixed power settings like maximum climb or cruise power. You should also show that a continuous positive relationship exists between increasing the power lever setting in the cockpit and the resultant engine thrust or power output, unless the applicant shows that in special applications safety is enhanced by deviating from this relationship.	When evaluating adequate sensitivity in compliance with § 33.28(b)(1)(iii), the applicant should consider two additional aspects of power or thrust modulation. First, the power or thrust setting regions should be void of any inversions. Second, flats, or "no response" regions, in the power or thrust setting implementation, other than at the ends of range, are undesirable, except for positions that represent fixed power settings like maximum climb or cruise power. You should also show that a continuous positive relationship exists between increasing the power lever setting in the cockpit and the resultant engine thrust or power output, ~~unless the applicant shows that in special applications safety is enhanced by deviating from this relationship.~~	The deleted text is counter to the requirements of 23/25.779, 1143(c) which require a continuous positive relationship between throttle movement and thrust as installed. Allowing for a deviation under Part 33 certification would also require a similar deviation be granted at the airframe level. If the text is not deleted, then Cessna suggests additional text should be added noting that any deviation approved under Part 33 will also have to be approved at the aircraft installation (Part 23/25) level and therefore close coordination with the engine installer will be required to ensure the acceptability of any deviation granted.	Agreed. Text added.

117	PW	4	Page 4, Chapter 3, section 33.28(b)(1) Validation, Paragraph 3-2 a.	In some cases throughout the document, references to "the applicant" have been replaced by "you". An example is "You should perform this testing ..".	Traditional wording.	It may be better to say "The applicant should perform this testing …" or even "Testing should be performed …." Similar comment for other cases where the word "you" appears.	No change. The use of the familiar "you" is preferred by the FAA. However, for the purpose of clarity the specific reference to "applicant" has been used throughout this AC. The use of you assumes that all readers of the document are specifically the engine certification applicant. This on a valid assumption.
13	Martin, Billy SAE AE-2 Lightning Committee	6	Paragraph 5.1	See SAE proposal for providing default test levels	Provides for the use of generic data as a method of similarity for applicants to meet the HIRF/IEL requirements for a FADEC engine without the benefit of a full aircraft test. There are restrictions applied to the usage of the data.		Agreed, but the wording has been cross-checked against FAA technical advisors recommended wording..

38	Lycoming	6	Paragragh 4-2, d	Our concerns are with some of the pass/fail criteria listed in the section. The draft AC defines a requirement for no adverse effects and provides some examples of such adverse effects. Lycoming has concerns with two of these as listed below: (b) For reciprocating engines: a change greater than 10% of most sensitive operating point or 3% of take-off power and/or thrust, whichever is greater, for a period of more than 2 econds. (c) Transfers to alternate channels, back-up systems, or alternate modes.	The Lycoming Test Plan for DO-160F Section 15-23 & 25 (document 95A100015) revision B as approved by the FAA indicates that we may have a disruption including an undefined loss of power as long as the system regained full operational function and associated power levels following the removal of the perturbation. Earlier drafts with comments indicated that for a GA aircraft the engine briefly going quite after a lightning strike was acceptable if full recovery following the event was demonstrated.	We request a revision to the AC to allow engine power disruptions during the lightning perturbation if a full recovery is made within 3 seconds of the removal of the perturbation. Additionally, we feel a channel swap which does not cause a change or disruption in engine power should be considered an acceptable outcome of the test, not an adverse effect.	Disagree. Part 1: We have reviewed and consulted with numerous test experts in this field and reached agreement on the 2 sec time limit. Use of a 3 second criteria might be acceptable on a case-by-case basis. Part 2: We cannot allow a channel transfer. The transfer occurs when the "channel in control" believes it has failed. A HIRF/lightning event is not allowed to cause this type of event. If the channel in control believes it has failed – during such an event – there is no reason to believe the alternate channel will not be affected. - Critical systems are not allowed to be affected by these external events.
41	Garmin	6	Page 6, 4-2.d.	Update lightning regulations	New lightning regulations have been published for Parts 23, 27, and 29.	Add §§ 23.1306, 27.1316, and 29.1316 where lightning regulations are listed.	Agreed

72	Cessna 5	6	Affected Section: 4-2(b)	"Environmental Test Procedures and Test Limits. AC 21-16F and SAE ARP5757 provide further guidance on showing compliance with §§ 33.53, 33.91, and 33.28. This AC recommends SAE ARP5757 in combination with RTCA/DO-160F for testing, but MIL-STD- 810 may be used when the tests are equal to or more rigorous than those defined in RTCA/DO-160F. Unlike RTCA/DO-160F, however,…"	"Environmental Test Procedures and Test Limits. AC 21-16F and SAE ARP5757 provide further guidance on showing compliance with §§ 33.53, 33.91, and 33.28. This AC recommends SAE ARP5757 in combination with RTCA/DO-160 (Revision F or later FAA accepted revision) for testing, but MIL-STD- 810 may be used when the tests are equal to or more rigorous than those defined in RTCA/DO-160F. Unlike RTCA/DO-160F, however,…"	RTCA/DO-160 is a living document and is revised on a somewhat regular basis. To avoid updating the AC every time DO-160 is revised, Cessna suggests the specific call out to DO160F should be changed to a more generic reference. This change should be incorporated wherever DO-160 is referenced in the AC.	Disagree. We are unable to reference a document with an open ended revision status. We will include a statement that will open the door to the possible use of future revisions.

73	Cessna 6	6	Affected Section: 4-2(b)	Unlike RTCA/DO-160F, however, we recommend that a minimum of 10 temperature cycles be performed for temperature variation tests. We also recommend that installers use AC 20-136A and AC20-158 to show lightning and HIRF compliance, respectively, for the engine installation in the aircraft.	Unlike RTCA/DO-160F, however, we recommend that a minimum of 10 temperature cycles be performed for temperature variation tests. We also recommend that installers use AC 20-136A and AC20-158 to show lightning and HIRF compliance, respectively, for the engine installation in the aircraft.	Cessna feels that the recommendation to use AC20-136A and 20-158 is probably acceptable, but guidance for installers should not be included in a Part 33 AC.	Agree This has been reworded to clarify that the engine applicant should expect that the installer will likely use the reference AC's..
150	GE	6	4-2.b.	AC references DO-160F & ARP 5757 (which references DO-160E). DO-160G also exists.	Confusing as to which of the various revs of DO-160 would be acceptable to the FAA.	Delete all revisions letters.	Agreed. See item 72 We will add a reference to AC21-16 latest revision to aid in closing this gap. We also added recommendation to coordinate with FAA if DO-160 is revised beyond G.
151	GE	6	4-2 d.(1)	States "…and test results included…" should read "tested limits" not "test results."	Limits that are established based on tests are the concern.	Use tested limits.	Agreed.

14	Librantz, Helio SAE AE-2 Lightning Committee	7	Paragraph 4-2 d.(1)(c)	Add the following to the Table in this paragraph Add to column 1 :Rear fuselage jet engines (Note 2) Add to column 2: Cat Y (300mA) Add to column 3: Cat G (100 MHz - 400 MHz up to 100 v/m) Cat F (400 MHz - 18 GHz up to 150 v/m) Add to column 4: Cat F (up 1500v/m)			Agreed
15	Librantz, Helio SAE AE-2 Lightning Committee	7	Paragraph 4-2 d.(1)(c)	Add Note 2 following note 1 as follows: Note 2: Using these HIRF test levels and the design requirements in paragraph (7) below, fuselage mounted jet engines with EECSs intended for use on Part 23 small airplanes should be acceptable without further HIRF testing.			Agreed
16	Librantz, Helio SAE AE-2 Lightning Committee	7	Modify the last line of Paragraph 4-2 d.(1)(e)	… meet the requirements listed in the following items (1) to (6):			Disagree. There are not 6 items. Sentence reads correctly as writen without specifing the number of items.

33	Thielert	7	4-2 d. (1) (c), page 7	The minimum HIRF levels for reciprocating engines seem to be based on catastrophic levels	On airplanes using reciprocating engines, criticality of engine failure may be less than catastrophic.	For reciprocating engines use a HIRF level based on criticality of engine failure. To harmonize with 23.1308 and EASA rules, use the levels defined in 23.1308	Disagree. Section 4-2d.(1)(a) states "If the HIRF and lightning test levels for the engine installation on a particular aircraft are not known at engine certification, the engine applicant may use the test levels in paragraphs below." The test levels in the table are conservative values, based on EECS that perform functions that could have catastrophic failures. The values were selected to minimize the need for additional airplane lightning tests for the engine installation certification. These test values are consistent with 23.1308.
42	Garmin	7	Page 7, 4-2.d.(1)(c)	RTCA/DO-160F Table	The term "Fixed Wing Aircraft" also applies to aircraft with reciprocating engines like a Cessna 182 that is being differentiated from this term in the 3rd row labeled "Reciprocating Engine Intended for use with Propellers"	Replace Fixed Wing Aircraft" with "Fixed Wing Aircraft with Turbofan Engines"	Agreed.

43	Garmin	7	Page 7, 4-2.d.(1)(c)	RTCA/DO-160F Table Note 1	Garmin's understanding is that the alleviation mentioned in this Note was intended for P23 aircraft only. Since propeller driven engines can be installed on P25 aircraft and the term "small propeller-driven" could be subjective, the text should be clarified so there is no confusion to its application. Also, the testing referred to not being needed should be aircraft testing. This would be consistent with the lightning section.	Suggest modifying the Note 1 text as follows: Note 1: Using these HIRF test levels and the design requirements in paragraph (6) below, reciprocating engines with EECSs intended for use on ~~small~~ propeller-driven Part 23 airplanes should be acceptable without further airplane HIRF testing.	Agreed

44	Garmin	7	Page 7, 4-2.d.(1)(c)	RTCA/DO-160F Table Rotorcraft Conducted Levels	General comments… The HIRF environment III (that would be applicable to FADECs for rotorcraft) per AC 20-158, has at least twice the levels for fixed wing aircraft which does not seem to be factored in when compared with the fixed wing aircraft levels. Note that the Cat W levels are also less than the Level A Display requirement per AC 20-158 Fig A1-4 extrapolated to the ENV I (in the upper freq) used for IFR and ENV III used for VFR. Since these levels have to be validated by aircraft HIRF tests it may not matter.		No change. The commenter is correct. The HIRF test values for rotorcraft in this section need to be verified for the specific rotorcraft installation. For some installations with lower effective HIRF shielding, higher HIRF test values may be required. This is noted in paragraph (a) of this section. No change was suggested, nor is a change required.

45	Garmin	7	Page 7, 4-2.d.(1)(d)	"The waveform set that includes single stroke, multiple stroke, and multiple burst waveforms for shielded wire bundles should be Category A3J33 in RTCA/DO-160F Section 22."	Shielded test levels are provided but 4-2.d.(1)(e).2 recommends testing with shields removed. Also, need to reference correct DO-160F Category.	Suggest modifying the text as follows: "Testing shall be completed with shields removed although the installation is shielded and overbraided. The waveform set that includes single stroke, multiple stroke, and multiple burst waveforms for unshielded wire bundles should be Category A3G33 in RTCA/DO-160F Section 22."	Disagree. The recommended lightning test waveforms and levels in paragraph 4-2.d.(1)(d) are for engine control systems in general, and should be applied to the system as designed, with shields installed if required. For some installations with lower effective lightning shielding, higher lightning test values may be required. This is noted in paragraph (a) of this section. The recommended lightning test waveforms and levels in section 4-2.d.(1)(e).2 are for reciprocating engines specifically, and are based on testing the engine control system with shields disconnected.
46	Garmin	7	Page 7, 4-2.d.(1)(e)	Garmin's understanding is that the "propeller-driven" alleviation was intended for P23 aircraft only.	Since propeller driven engines can be installed on P25 aircraft and the term "small propeller-driven" could be subjective, the text should be clarified so there is no confusion to its application.	Suggest modifying the text as follows: ….reciprocating engines with EECS intended for use on ~~small~~ propeller-driven Part 23 airplanes should be acceptable for airplane installation without further airplane lightning tests …..	Agreed

82	Williams 09	7	Paragraph 4-2.d.(1)(b), Second sentence	should be deleted. First it is confusing as to who is identifying the protective measures as the identifying organization is referred to as 'you' and 'you' is clearly not the engine applicant as they referred to seperatly in the same sentence. In addition second sentence is redundant as the previous sentence encompasses the protective measures without regard to the identifying source.			Agreed.
83	Williams 10	7	Paragraph 4-2.d.(1)(d) last sentence	should be deleted. The physics of the installation does not change whether an airframe component provides the remote load impedance or the engine. If the Installation Instructions define the tested or minimum required impedance and the Installation Instructions are followed, as the rules require, this sentence unnecessarily restricts the EECS design and testing.		… unless the remote load impedance is in a component included as part of the engine *or the remote load impedance is specified in the engine installation instructions.*	Agreed. The concern is whether the engine cert applicant can control the lightning-related impedance of the components that are not provided as part of the certified engine. Unfortunately the commenter did not provide a suggested change. Our suggested additional words in italics are to the left.
152	GE	7	(P-7) 4-2.d.(1)(b)	The engine installation instructions may reference a detailed wiring diagram with the information. If it does, the wiring diagram itself should not need to be issued as part of the installation instructions.	Allow industry procedures that are used today and provide the required documentation & coordination between the engine manufacturer and the installer.	After the words engine installation, add “or other engine and installer interface documentation”.	Based on comment item 139 a note was added to Appx 1.

153	GE	7	(P-7) 4-2.d.(1)(b)	["HIRF and Lightning Tests. (1) Test Levels" (b)] In the 2nd sentence, the terminology "required protective measures" is used. Please explain the extent of these measures.	The team considers this to mean measures involved with the engine installation, not within a particular component. Is the agency looking for more data, than is already in the manuals?	Request clarification of the terminology "required protective measures."	Agreed. The sentence has been deleted.
154	GE	7	(P-7) 4-2.d.(1)(c) Table	The units of Volts should be an upper case of V, not lower case.	Consistency with international standards on engineering units.	Replace use of v for Volts with V.	Agreed.

17	Librantz, Helio SAE AE-2 Lightning Committee	8	Add Paragraph 4-2 d.(1)(f)	(f) Alternate Lightning Test Levels and Test Setup Criteria for Turbofan Engines with EECS that are intended for Use on 14 CFR Part 23 Airplanes. Using the lightning design and test requirements below, fuselage mounted jet engines with EECSs intended for use on Part 23 small airplanes should be acceptable for airplane installation without further airplane lightning tests. The minimum levels for system laboratory lightning tests should be RTCA/DO-160F Section 22 and Category B3H33 for unshielded wire bundles. This calls for the waveform set that includes single stroke, multiple stroke, and multiple burst waveforms in RTCA/DO-160F Section 22. Engine applicants should ensure that the engine control system tests, design, and the engine installation or operating instructions required by § 33.28 and § 33.5 meet the requirements listed in the following items 1) to (7), excluding item (6):			Agreed with the intent. The intent of the commentor has been agreed but it has been captured in paragraph (e)

34	Thielert	8	4-2 d. (1) (e), page 7-8	Please explain why a 200kA lightning strike into a propeller is more severe on a reciprocating engine than on a turbine engine			Agreed. The following was added:Lightning commonly strikes the propeller on airplanes with propellers. This results in all lightning current directly conducted on the engine, and a large portion of the current on engine control system wiring. Lightning strikes to turbofan engines result in current conducted on the engine cowls and fairings, so typically a smaller portion of the lightning current is conducted on the engine control system wiring.
35	Thielert	8	4-2 d. (1) (e) (1), page 7-8	It is up to the choice of the applicant to disconnect the shielding during the cable bundle tests.	Testing G33 with shielding connected is quite harmless whereas testing G33 with shielding disconnected is severe.	Require shielded engine looms for lightning protection. Require cable bundle testing G33 with shielding completely removed, not just disconnected. Don't allow shielding connected at all. This would be the most sever test.	Disagree. While we agree that removing the shielding is effective, FAA has also accepted disconnecting the shields at every termination. We disagree that the shielding must be removed.
36	Thielert	8	4-2 d. (1) (e) (1), page 7-8	I'm not sure if G33 is appropriate. G means testing waveforms 2 and 3. Our measurements in an aircraft lead to testing waveform 3 and 4. Waveform 2 and 4 are very different. J on the other hand is waveform 1 and 3. Waveform 1 and 4 have identical shapes and levels with the only difference that 1 is a current waveform and 4 is a voltage waveform.			Agree. The information used to develop the proposed tests was based on a compilation of test results. At the time of the draft AC, the waveform sets in DO-160E section 22 category A3G33 included waveform 4. In DO-160G, this should be waveform set H, for A3H3L3.

47	Garmin	8	Page 8, 4-2.d.(1)(e)	"The minimum levels for system laboratory lightning tests should be RTCA/DO-160F Section 22 and Category A3G33 for unshielded wire bundles."	A3G33 (for unshielded) or A3J33 (shielded) which is aperture coupling for metal aircraft does not seem to consider composite aircraft where resistive coupling may be present. The transients from resistive coupling could have much higher amplitude and energy levels.		Agree. See comment 36.

48	Garmin	8	Page 8, 4-2.d.(1)(e)1	"We also recommend that the applicant perform the cable bundle injection test with the EECS wire bundle shields disconnected."	Note that with the guidance of section 4-2.d.(1)(e)2 the wire bundles must be overbraided. Therefore the overbraid should also be disconnected. The default level in 4-2.d.(1)(e)1 is only for unshielded wires. The text in 4-2.d.(1)(e)2 is only recommended, and therefore may not be followed, in which case there is no guidance for the shielded wire situation. Consequently, it seems like the recommendation should be a "must" if using the default level of A3G33 for shielded cables.	Suggest modifying the text as follows: ~~We also recommend that~~ When the applicant performs the cable bundle injection test, ~~with~~ the EECS wire bundle shields and any overbraid must be disconnected.	Agree. Text was revised.

84	Williams 11	8	Paragraph 4-2.d.(1)(e)1 last sentence	should be deleted. The physics of the installation does not change whether an airframe component provides the remote load impedance or the engine. If the Installation Instructions define the tested or minimum required impedance and the Installation Instructions are followed, as the rules require, this sentence unnecessarily restricts the EECS design and testin		… unless the remote load impedance is in a component included as part of the engine *or the remote load impedance is specified in the engine installation instructions.*	Agreed. The concern is whether the engine cert applicant can control the lightning-related impedance of the components that are not provided as part of the certified engine. Unfortunately the commenter did not provide a suggested change. Our suggested additional words in italics are to the left.

5	Krodel, James PW	9	Pg 9, Para 4-2d.(4)(a)	I am a bit confused. Specifically in the section titled "4-2 Guidance: Environmental conditions include temperature, vibration, humidity, EMI, HIRF and lightning. " in section [4-2 d. (4) a] you state… *(4) Test Considerations.* *(a) If special engine control system test software is used, the applicant must ensure that the software was developed and implemented by guidelines defined for software levels of at least Level 2 in DO-178A, Level C in DO-178B, or equivalent. In some cases, the application code is modified to include the required test code features. "*	Level C requires statement coverage and data & control coupling, a bunch of design reviews, code reviews, reqs reviews, etc. Is the "special engine control system test software" you are referencing the test software that is embedded in the target for EMI/HIRF testing? Or are you saying this test software is the software that is used to collect the results of this testing. I think it is the former, but the current text is not clear in that area.	Clarify	Agreed.

37	Thielert	9	4-2-d-(5) (b), Page 9	Allow for reciprocating engines a change of 10% power as in AC 33.28-2	We are conducting our HIRF and lightning tests at a propeller test bench with take-off power. Since accurate power measuring is difficult in this configuration, a 3% power change could be detected even without HIRF influence (although the actual power change is less)	Use wording from AC 33.28-2: A greater than +/-10% change of rated power or thrust change from the normal control governing capability for a period of more than one second;	Partially agree. Why would the bench record a 3% power change at steady state conditions – with no environmental "input" changes. Sounds like a bench set-up difficulty. When HIRF/lightning is introduced to a recip, a less than 10% power change is acceptable, but that has nothing to do with the "bench's" accuracy in measuring power. The bench should be accurate. We don't allow a 10% change – because we can't measure things accurately on the bench. We allow a 10% change because we consider that to be acceptable. Text is changed. We used, "…a change greater than 10% of power at the operating point for a period of more than 2 seconds."
155	GE	9	(P-9) 4-2.d.(3)	["Open Loop and Closed Loop Testing"] The statement is made, "HIRF and lightning tests should be conducted with the ECS controlling at the <u>most sensitive operating point</u>, as selected and detailed in your test plans." Unsure of what is meant by the "most sensitive operating point."	HIRF and Lightning tests are currently conducted over a range of conditions. Need to understand the Agency's intent with this statement, in order to assure adequate testing.	Request the Agency provide guidance on determining the appropriate "most sensitive" operating condition.	Agreed. Added text to help clarify

18	Librantz, Helio SAE AE-2 Lightning Committee	10	Paragraph 4-2 d.(6)	Modify		(6) Applicants of reciprocating engines with EECSs intended for use on small propeller-driven airplanes should ensure that the ECS design and the engine installation or operating instructions required by § 33.28 and § 33.5, specify the following protection features:	Disagree. This paragraph applies to all engines not just recips.
19	Librantz, Helio SAE AE-2 Lightning Committee	10	Paragraph 4-2 d. (7)	Add paragraph (7) and (a) thru (f)		(7) Applicants of fuselage mounted jet engines with EECSs intended for use on Part 23 small airplanes should ensure that the ECS design and the engine installation or operating instructions required by § 33.28 and § 33.5, specify the following protection features:	Partially agree. This has been included, in a modified form, into section 4-2 d.(1)(e)
20	Librantz, Helio SAE AE-2 Lightning Committee	10	Paragraph 4-2 d. (7)	Add paragraph (7) and (a) thru (f)		(a) The engine and full authority electronic engine control system must be installed in an airplane in which the fuselage, engine cowling, pylon, and firewall incorporate electrically conducting materials. The conducting materials include aluminum, copper, steel or carbon fiber composites with conductive mesh. The engines must be installed on the aft fuselage and the full authority electronic engine control system must be installed either on the engine or within the airplane fuselage. All bundles containing level A control functions and connecting directly to the engine control system must be tested per the guidelines of the present document, regardless of their location.	Agreed with the intent. All of this has been captured but it is formated a bit differently. This is true of a number of the following comment dispositions.

21	Librantz, Helio SAE AE-2 Lightning Committee	10	Paragraph 4-2 d. (7)	Add paragraph (7) and (a) thru (f)		(b) Electrical bonding requirements for the engine and full authority electronic engine control system must be specified. The engine installation must include at least three distributed electrical bonding jumpers between the engine and the airplane and be preferrably installed at forward and aft extremities of the engine mounting provisions . The bonding jumpers must be flat braided copper or aluminum wire or flat solid conductors, with at least 16 mm2 conducting cross section. The bonding jumpers should be as short as possible but must be less than 30 cm long. The maximum bonding jumper length and minimum conducting cross section must be specified in the engine installation manual. The engine installation manual must define the maximum allowed resistance between the engine, engine mounting frame and the airframe. The engine mounting frame must provide a low-resistance conducting path from the engine to the airframe and be capable of safely carrying direct lightning current. All shielded wiring bundles and conductive tubing between the engine and airframe must be electrically bonded at the engine firewall. All other electrical bonding related requirements must be agreed upon between engine OEM and installer and defined within the engine installation manual. For full authority electronic engine control system components that are installed on the airframe or firewall, the maximum allowed electrical bonding resistance between these components and airplane firewall or airframe must be specified in the engine installation manual. The features required for this electrical	Agreed with the intent. . This has been included, in a modified form, into section 4-2 d.(1)(e)

22	Librantz, Helio SAE AE-2 Lightning Committee	10	Paragraph 4-2 d. (7)	Add paragraph (7) and (a) thru (f)		(c) All wire bundles between the various electronic engine control system components and aircraft interfaces must specify the use of individually shielded wires along the entire length of the bundle. These shields should cover power and signal wires and their returns. Individual shields must be terminated to airframe at each connector break and not carried through on pins.	Agreed with the intent. This has been included, in a modified form, into section 4-2 d.(1)(e)
23	Librantz, Helio SAE AE-2 Lightning Committee	10	Paragraph 4-2 d. (7)	Add paragraph (7) and (a) thru (f)		(d) All wire bundles routed external of the fuselage shall use low impedance overbraid up to the fuselage interface and incorporate metal connectors with 360 degree backshell shield terminations at both ends.	Agreed with the intent. This has been included, in a modified form, into section 4-2 d.(1)(e)
24	Librantz, Helio SAE AE-2 Lightning Committee	10	Paragraph 4-2 d. (7)	Add paragraph (7) and (a) thru (f)		(e) The shields shall be conductive, have a minimum of 90% optical coverage, and must be terminated to each connector. The connector shells and backshells must provide a low impedance to the engine components, FADEC ECU, and airplane firewall or structure. Features required for electrically bonding the connectors to the airplane firewall or structure, such as surface preparation, must be specified in the engine installation manual.	Agreed with the intent. This has been included, in a modified form, into section 4-2 d.(1)(e)
25	Librantz, Helio SAE AE-2 Lightning Committee	10	Paragraph 4-2 d. (7)	Add paragraph (7) and (a) thru (f)		(f) The engine or engine mounting frame should not be used for power returns or low-power signal returns.	Agreed with the intent. This has been included, in a modified form, into section 4-2 d.(1)(e)

85	Williams12	10	Paragraph 4-2.d.(6)(a)	should be deleted and replaced with " The installation instructions should state the tested levels of Lightning and HIRF which the EECS has met ". This guidance is designing the aircraft and is inappropriate in the engine installation instructions and this AC. This paragraph allows no consideration for the advancements in Lightning/HIRF protection. The proposed wording allows the Installation Instructions to identify the level of threat the EECS has demonstrated resistance to so the airframe manufacturer can design the cowling and/or airframe to provide the necessary attenuation (if any) necessary for the environment.			Disagree. The requirement in this paragraph is to assure that direct attachment is not a factor. The EECS is not tested for direct attachment.
156	GE	12	(P-12) 5-2.a.(4)	This statement appears to be redundant to the items (2) and (3). What value does it add?	Items (2) and (3) essentially say the same thing as item (3).	Delete item (4).	Disagree. (4) clarifes the relationship to dispatchable conditions.

86	Williams 13	13	Paragraph 5-2(a)(7)	This paragraph is vague. It is not clear what the FAAs expectation is for the course of the endurance test. IE should one 14CFR§33.87 endurance test for each alternate mode of operation be run or would a percentage of the cycles run during the 14CFR§33.87 endurance test in each alternate mode be acceptable? If the expectation is that the 14CFR§33.87 endurance test would be repeated for each alternate mode it would most likely make alternate modes of operation cost prohibitive to certification. If the 14CFR§33.87 endurance test was not the intended target of this language then paragraph should be reworded.			Agreed.

87	Williams 14	15	Paragraph 5-2d.(4)(c) last sentence.	The flight demonstration for control mode transition should not necessarily be tied to a specific aircraft TC program. We propose rewording the last sentence to "Therefore, applicants should propose a flight test program to demonstrate the ECS controls the engine during control mode transitions." If there is a subsequent need for this feature to be evaluated on every aircraft installation then the evaluation should be added as a requirement to the installation instructions.			Partially agree. Slight variation on the proposed rewording. Rewording below "Therefore, applicants should propose a flight test program to demonstrate that the ECS controls the engine acceptably during in-flight control mode transitions"
88	Williams 15	15	Paragraph 5-2d.(5) last sentence.	This sentence should be deleted. While the statement is true it does not affect the Means of Compliance for 14CFR§33.28. The guidance belongs in an a Part 23, 25, 27, and/or 29 AC.			Partially agree. Sentence was reworded to: "The acceptability of these delays may need to be assessed during aircraft certification."
9	Delamaide, Jean-Luc EASA	16	Chapter 6-1	This section should introduce that the development and design of an ECS is robust to development and design error	Development error may be introduced during the development and the design of an ECS as a system and not only at software and AEH (Airborne Electronic Hardware) level.	EASA would like the FAA to introduce the concept of design and development error at ECS level.	Agreed

27	Turbomeca	16	§ Chapter6-1. Rule text. Section 33.28(d) (2), Page 16	"*in the full-up configuration, the system is single fault tolerant, as determined by the Administrator, for electrical or electronic failures with respect to LOTC/LOPC events*". In the CS-E 50(c) (2) equivalent paragraph, there is a different writing: "the system is single fault tolerant" is changed by "the system is essentially single fault tolerant" which is a significant difference. Could you clarify if it is allowed to have some rare simple electrical or electronic failures cases that directly leads to an LOTC/LOPC? This would be more in line with § Chapter 6, 6-2, h (1) (b) and (2) page 21, and (10) (d) page 23.			Disagree. This is covered in Paragraph 6-2 h.(1)(a)
89	Williams 16	16	Paragraph 6-2b.(1)(b).	This sentence needs to provide the specific location of the power oscillation reference. The reference to the entire Chapter 6 is too vague.			Agreed.
92	Williams 19	16	Paragraph 6-2b.(1)	should be updated to "...part 25/23 installations ..." These sections are redundant to each other and should be combined			Agreed.

118	PW	16	Chapter 6, section 33.28(d), Paragraph 6-1 d. (2):	The AC does not clarify what the "as determined by the administrator" in 33.28(d) (1) refer to.	What guidelines will the administrator use so that it is consistent between applicants?	The AC should indicate the process by which the applicant will need to request acceptability from the administrator if the 100% coverage for single electrical/electronic fault is not achieved.	Disagree. This aceptability has been in use for many years. It is not likely that any change will be made.The AC only lines out a method of compliance, the applicant needs to define their process.
119	PW	16	Chapter 6, section 33.28(d), Paragraph 6-2 b:	Criteria for an LOTC/LOPC Event. Industry practice over the past twenty (20) years has resulted in the following generally accepted criteria for defining a LOTC/LOPC event	Update required.	Industry practice for nearly 30 years.	Agreed
28	Turbomeca	17	§ Chapter6-2 Guidance: Engine Control System Failures, b (2) (c) 2	"*For multi-engine rotorcraft, the LOPC definition typically includes the ability to meet the operability regulations in the alternate mode(s). This may be acceptable because when one engine control transitions to an alternate mode that may not have robust operability, that engine can be left at reasonably fixed power conditions*." The LOPC definition includes the inability to meet the operability specifications. Do you agree that LOPC definition may not need to include the inability to meet the operability specifications in the Alternate Mode(s) ?			Partially agree. Rewrote the referenced paragraph to clarify. We do not agree that LOPC or LOTC can exclude operability . However, because of the current implementation of multi-engine rotorcraft allowing one in an alt mode to exclude operability constraint on LOPC is acceptable.

90	Williams 17	17	Paragraph 6-2b.(2)(b).	This sentence needs to provide the specific location of the power oscillation reference. The reference to the entire Chapter 6 is too vague.			Agreed.
91	Williams 18	17	Paragraph 6-2b.(3)	should be deleted			Agreed.
93	Williams 20	18	Paragraph 6-2b.(4)(b).	This sentence needs to provide the specific location of the power oscillation reference. The reference to the entire Chapter 6 is too vague.			Agreed.
94	Williams 21	18	Paragraph 6-2b.(5)	The reference to LOPC should be changed to LOTC/LOPC as a propeller can be mounted on turbine or reciprocating engines.			Disagree. Propellers produce Power not Thrust
157	GE	18	(P-18) 6-2.c.	A thrust change larger than 10% should also be allowed if accepted by the installer.	Only the installer can determine the level of unacceptable change in thrust for the application.	In 3rd sentence change “more restrictive requirements” to “a more or a less restrictive requirement”.	Agreed
202	Andy Ward	18	5	For engines incorporating functions for propeller control integrated in the EECS	There appears to be some inconsistencies between EECS in some places and ECS in other places		Disagree. EECS is used if the system in consideration is definitely Electronic. If the system is potentially mechanical or hydromechanical then the term ECS is used.
203	Andy Ward	18	e	Reliability Assessment Plan (RAP)	Instead, for Safety it might be better to point to the Safety Program Plan of ARP 4754A		Disagree. A RAP is more fundemental to the source of the values used within the SSA. Chapter 7 will be revised to reference ARP4754A and ARP4761.

158	GE	19	(P-19) 6-2.f.(4)	Airframe reliability "numbers" should not be included in engine provided installation instructions.	The engine manufacturer has no control over the value or if/when design changes impact the reliability. Also, putting the information in the engine documentation generates business and legal complications.	In the 4th sentence delete "assumed reliability and". Then add sentence, "The SSA should include the assumed reliability requirements for these non-type design elements."	Disagree. The proposal does not inform the installer of the min reliability for the parts that they are supplying. If their parts do not meet this min level then the ECS SSA is not valid.
159	GE	20	(P-20) 6-2.g.(4)(b)	The required additional cooling may not be provided by the installer.	The cooling provisions for commercial grade parts may be done within the engine manufacturer supplied equipment and be transparent to the installer.	In 2nd sentence add "if required" at end of sentence.	Agreed.

10	Delamaide, Jean-Luc EASA	21	Chapter 6-2.h	This section should introduce that the Single Fault Accommodation should take into account potential development error at ECS level and mitigate that threat	Development error may be introduced during the development and the design of an ECS as a system and may create a failure and finally contribute to a hazardous FC. Mitigation are necessary at that level to reduce that risk. For example, current FCS take into account that potential development error in designing dual channel ECS with sufficient independence. It could be interesting to promote this state of art development.	EASA would like the FAA to introduce the concept of design and development error in section 6-2.h	Disagree. Chapter 6 is addressing failures within a system. It is not about design or development errors.
29	Turbomeca	21	Chapter 6-2. i. Local events (1) (e) Mechanical disruptions page 21	For all types of aircraft, could you please give examples of mechanical disruption to be considered ?			Agreed. Term clarified.

120	PW	21	Chapter 6, section 33.28(d), Paragraph 6-2 h. (1) (b):	The second to last sentence states: " Although these systems may have some single faults (that are not covered faults) which lead to LOTC/LOPC events, they have demonstrated excellent in-service safety and reliability and have proven to be acceptable." The last sentence states: "Therefore, configurations such as these may be found to be compliant."	Consistency.	Revise the last sentence to state: "Therefore, configurations such as these will be found to be compliant."	Disagree. These are to be judged on a case by case basis.
121	PW	21	Chapter 6, section 33.28(d), Paragraph 6-2 h. (3)	Single failures which result in a high thrust failure condition, with no throttle response, may be catastrophic for some aircraft operating conditions.	It is difficult for the engine manufacturer to identify what these conditions of high thrust are … this is more appropriately dealt with at the aircraft cert level.	FAR 33 certification should note the potential concern at the aircraft level and alert the applicant to need to define in the instructions for installation provision, if any, against the failure mode of concern.	Partially Agree. Reworded as a cautionary note. "As a cautionary note, engine certification applicants should be aware that in this case, either a modification of the engine control or an independent aircraft system will be needed for aircraft certification."

208	Airbus	21	§ 6-2 (i) 'local events'	The AC should include a provision to request coordination with the aircraft manufacturer when assessing local events, in particular fire & overheat.	Although they are limited to one engine, local events affecting EECS should not generate hazards to the aircraft. So the potential effects to consider go beyond FAR 33 engine hazardous effects. Airbus considers that the current version of the AC wording is more appropriate. Airbus understands that the rule is now referring to engine hazardous effect rather than unsafe condition. Airbus however strongly advises that a note be added to the AC to advise that local EEC events, in particular fire and overheat are dependent on installations and also addressed as part of aircraft certification and that coordination with the installer is required.		Agreed. Paragraph added.

30	Turbomeca	23	Chapter 6 § i. Local events (9), page 23	Where it can be demonstrated that a local event failure condition is lower than 1.10-8pfh, can it be considered as "reasonably non-foreseeable" and out of the scope of the "Local event" definition to be addressed?			No change proposed. No change.
11	Delamaide, Jean-Luc EASA	25	Chapter 7	This section should introduce the ARP4761 as an acceptable method to establish a system safety assessment	Engine manufacturers are currently attending the SAE S18 committee about the update of ARP4761 and find this standard suitable.	EASA would like the FAA to introduce the ARP4761 as an acceptable method to establish a system safety assessment	Agreed. Added reference to this chapter.
~~12~~	~~Delamaide, Jean-Luc EASA~~	~~25~~	~~Chapter 7~~	~~This section should introduce the ARP4761 as an acceptable method to establish a system safety assessment~~	~~Engine manufacturers are currently attending the SAE S18 committee about the update of ARP4761 and find this standard suitable.~~	~~EASA would like the FAA to introduce the ARP4761 as an acceptable method to establish a system safety assessment~~	Repeat of 11
160	GE	25	(P-25) 7-2.a.(3)	SSA should only include the installation effects as defined by the installer and those failures that can be projected by the engine manufacturer.	Engine manufacturer has limited information about installer designs and failure modes. The SSA should not be perceived as a system review of the airframe designs by the engine manufacturer.	In 2nd sentence, after "malfunctions in aircraft signals" add "(including electrical opens, shorts, data validation signal input errors and any other malfunction defined by the installer)"	Agreed. Added text.

209	Airbus	25	Chapter 7 SSA	The AC should keep the same recommendations as the current version for § c.(4) and c.(6), i.e. recommend an order of 10-5 instead of 10-4.	There is no rationale available justifying the change from 10-5 to 10-4 in paragraph c.(4). The rationale in paragraph c.(6) is making an assumption of a classification of failure at aircraft level which is not pertinent. In the absence of a requirement derived from a specific Aircraft installation safety assessment, the AC should give a 'generic' recommendation that is on the conservative side. Airbus therefore request to maintain the 10-5 recommendation.		Agreed.

31	Turbomeca	26	Chapter 7 -2 § b. Criteria (3) page 26	In this subparagraph (3), we suggest to delete the second sentence "*In the SSA, these failures should be assumed to cause LOTC/LOPC events*", for it seems contradictory to the first one "*For failures affecting engine operability but not necessarily leading to LOTC/LOPC events, only the rate of occurrence of the fault that could lead to an operability limitation should be documented*." Why would those failures be necessarily assumed to cause LOTC/LOPC events ? It would be more logical to document in the SSA the cases where the failure causes an LOTC/LOPC event and the cases where it does not (together with respective occurrence rates)			Agreed.
95	Williams 22	26	Paragraph 7-2 a.(7)(c) Last Sentence	"proposed" should be "propose"			Agreed. Corrected.

96	Williams 23	26	Paragraph 7-2 a.(9)	does not address the case where the engine is developed without a specific airframe customer. We propose an additonal sentence that says, " If the engine is developed without a specific aircraft customer, the engine applicant should make reasonable assumptions concerning the criticality of implemented functions. These assumptions should be documented in the installation instructions and validated by the aircraft applicant during their certification."			Disagree. This is largely covered in Chapter 1. In addition, the types of functions referred to here are most often at the request of an installer.
122	PW	26	Paragraph 7-2 a. (7) (c) last sentence	'…applicants may proposed…".	Typo	As suggested.	Agreed
123	PW	26	Paragraph 7-2 a. (7) (d)	Failures affecting aircraft functions included in the engine control system, for example, propeller control, thrust reverser control, control of cooling air, control of fuel recirculation.	Editorial	Failures affecting aircraft functions included in the engine control system, for example, propeller control, thrust reverser control, control of cooling air, and/or control of fuel recirculation.	Agreed
124	PW	26	Paragraph 7-2 b. (3)	In the SSA, these failures should be assumed to cause LOTC/LOPC events.	Appears to be inconsistent with Paragraph 7-2 a. (7) (b)	Clarify/correct as appropriate.	Disagree. This is not a conflict. A.(7)(b) is in reference to LOTC/LOPC. B.(3) is in reference to the SSA

97	Williams 24	27	Paragraph 7-2 c. (5):	APR as defined by 14CFR§23 should be added to the list of functions specifically identified wherever ATTCS is identified.			Agreed
161	GE	27	7-2.(c)(1)	A thrust change larger than 10% should also be allowed if defined by the installer.	Only the installer can determine what is an unacceptable change in thrust for the application	Add new sentence that says "A thrust change larger than 10% of take-off power and/or thrust may be acceptable if authorized by the installer."	Agreed
162	GE	28	7-2.(c)(6)	A thrust change larger than 10% should also be allowed if defined by the installer.	Only the installer can determine what is an unacceptable change in thrust for the application	Add new sentence that says " A thrust change larger than 10% of take-off power and/or thrust may be acceptable if authorized by the installer	Agreed
125	PW	29	Paragraph 8-2 (a) (1)	The applicant usually provides the engine control devices, systems and instruments referred to in § 33.28(f) in engines of recent design, by overspeed protection and/or circuits.	Clarification required.	Reword as appropriate.	Agreed. Reworded for clarity "In engines of recent design, the applicant usually provides overspeed protection, or circuits, or both, utilizing the engine control devices, systems and instruments referred to in § 33.28(f). Although they may be independent devices, the overspeed protection and circuits are generally part of the EECS"
204	Andy Ward	29	3(a)	Hence, a potential rotor burst due to overspeed should only be possible as a result of a first control system fault causing an overspeed and an independent second fault preventing the overspeed protection system from operating properly	It is more likely to be the protection that fails first		Agreed

163	GE	31	8-2.b.(4)	["Other Protective Functions"] states, "...we recommend that applicants evaluate them earlier *(than at the aircraft level)* and present that evaluation at engine certification."	What format and what documentation is expected from the applicant at the time of engine certification?	Team requests the Agency clarify the terminology, "present that evaluation at engine certification."	Agreed Clarified
49	Garmin	32	9-2.a.(2)	"However, if applicants use the software level appropriate for the criticality of the performed functions …"	Use of the phrase "software level" seems to presume that DO-178B will be used. While DO-178B is subsequently specified as an approved method in 9-2.b, this paragraph seems to put the cart ahead of the horse in this regard.	Suggest changing "the software level" to "a software design"	Agreed
50	Garmin	32	9-2.a.(2)	"In some installations, the possibility of digital logic errors common to more than one ECS may determine the criticality level of the software design."	Use of the phrase "criticality level" is inconsistent with other current guidance.	Suggest changing "criticality level" to "design assurance level".	Agreed Clarified
51	Garmin	32	9-2.b	References Order 8110.49. As noted in the comment on 3.b.(1), applicants are not obligated to follow Orders nor are FAA Orders written for applicants.	FAA presentations at the 2011 SW/AEH Conference have acknowledged the confusion between ACs and Orders with respect to the applicant.	Suggest referencing only AC 20-115B, not Order 8110.49.	Disagree However the text has been clarified to say: "The primary FAA guidance on software methods is found in AC 20-115C. In addition, the FAA must also follow FAA order 8110.49."
52	Garmin	32	9-2.b	References DO-178B.	DO-178C has been approved by RTCA SC-205, so this AC may soon need revision.	Comment for information purposes only. No suggested change.	Agreed

53	Garmin	32	9-2.b	"The applicant may also propose alternative methods for developing software."	FAA has published an AC providing guidance on an alternative method for developing software.	Suggest referencing AC 20-171, *Alternatives to RTCA/DO-178B for Software in Airborne Systems and Equipment*.	Agreed
54	Garmin	32	9-2.c and its subparagraphs	Use of the phrase "software level" seems to presume that DO-178B will be used.	While DO-178B is specified as an approved method in 9-2.b, this paragraph seems to put the cart ahead of the horse in this regard.	Suggest revising the text in these sentences to indicate the software design assurance should be consistent with the failure condition categories of Catastrophic, Hazardous, Major, etc. rather than specifying DO-178B software levels. Consider the following as language that might help resolve this comment: The failure condition classification appropriate for engine EECS will depend on the intended use of the equipment in a specific aircraft. You may utilize the functional hazard assessment process outlined in SAE ARP 4761, *Guidelines and Methods for Conducting the Safety Assessment Process on Civil Airborne Systems and Equipment*, to determine the appropriate failure condition classification. Develop the software to the design assurance level consistent with the failure condition classification.	Disagree This AC makes it clear that software level A is required for Turbine engine FADECs and that software level C is acceptable for Reciprocating engine FADECs.

55	Garmin	32	9-2.c.(1)(b)	"For a reciprocating engine EECS, software implemented in accordance with Level C is the minimum acceptable requirement."	The software level should be determined based on the safety assessment. Additionally, use of the phrase "Level C" seems to presume that DO-178B will be used. While DO-178B is specified as an approved method in 9-2.b, this paragraph seems to put the cart ahead of the horse in this regard.	Suggest changing "is the minimum acceptable requirement" to "is normally needed" to be consistent with the 9-2.c.(1)(a) text. Additionally, suggest changing "Level C" to "Level C (DO-178B)" to be consistent with the 9-2.c.(1)(a) and 9-2.c.(1)(c) text.	Disagree See Comment 54 The Small Airplane Directorate has made a determination that software level C is the minimum for Recip engines
56	Garmin	32	9-2.c.(1)(c)	"For EECS installed in airplanes approved under part 23 commuter or part 25, the minimum software level is Level A (DO-178B)."	The software level should be determined based on the safety assessment. Additionally, part 25 was already covered in 9-2.c.(1)(a).	Suggest changing "part 23 commuter or part 25, the minimum software level is Level A (DO-178B)" to "part 23 commuter, the normal software level is Level A (DO-178B)" to be consistent with the 9-2.c.(1)(a) text.	Disagree c.(1)(c) has been deleted by an earlier comment
57	Garmin	33	9-2.c.(2)	"This demonstration should consider whether the protected/partitioned lower software levels are appropriate for any anticipated installations. If the criticality level will be higher in subsequent installations, the applicant should meet all requirements for the higher software level."	The second sentence of the quoted text is already covered by the phrase "anticipated installations" in the first sentence. Additionally, use of the phrase "criticality level" is inconsistent with other current guidance.	Suggest removing the second sentence from the quoted text. If the second sentence is not removed, suggest changing "criticality level" to "design assurance level".	Agreed

58	Garmin	33	9-2.d.(2)	References Order 8110.49. As noted in the comment on 3.b.(1), applicants are not obligated to follow Orders nor are FAA Orders written for applicants.	FAA presentations at the 2011 SW/AEH Conference have acknowledged the confusion between ACs and Orders with respect to the applicant.	Suggest removing the last sentence of this paragraph.	Disagree This is just pointing out additional info that the FAA will utilize and that might be helpful to the applicant.
59	Garmin	33	9-2.e.(1)	Includes multiple references to 21.607(d).	21.607 is under Subpart O--Technical Standard Order Approvals. The reference to 21.607(d) assumes that the EECS is TSO equipment, which may not be the case. Additionally, 21.607 under Amdt. 21-92, Eff. 4/16/2011 is titled "Quality system" and does not refer to part marking. There is also no paragraph (d) in the current 21.607.	Suggest revising the reference to 45.15, which specifies the "Marking requirements for PMA articles, TSO articles, and Critical parts", and/or 21.616(d), which includes the TSO marking requirements (which point to part 45).	Agreed Clarified
60	Garmin	33	9-2.e.(1)	References Order 8110.49. As noted in the comment on 3.b.(1), applicants are not obligated to follow Orders nor are FAA Orders written for applicants.	FAA presentations at the 2011 SW/AEH Conference have acknowledged the confusion between ACs and Orders with respect to the applicant.	Suggest removing the last sentence of this paragraph.	Disagree Highlighted as "information only"

98	Williams 25	33	Paragraph 9-2 e. (1) first sentence	misquotes the requirements of Order 8110.49, chapter 5 by placing TSO Marking requirements on an EECS that has no TSO standard. Firstly there is no appropriate TSO for an electronic engine control. Secondly the order clearly restricts this marking requirement to TSO equipement. I propose modifying the sentence to read "When Field Loadable Software (FLS) is used in EECS and the applicant wants to use electronic part marking for the FLS, verify the airborne equipment software part number with onboard equipment, carry-on equipment, or other appropriate means." Also the paragraph should end with a period instead of a colon.			Disagree Changed reference to 45.15(c)
164	GE	33	9-2.(e)(1)	It states, "…part marking requirements of 21.607(d)." 21.607 is simply titled quality system.	There is no such regulation paragraph item (d) about part numbering.	Identify the correct regulation section for part marking and use it to replace "21.607(d)."	Agreed See Comments 59 & 98

32	Turbomeca	34	Chapter 9 § Software change category (2)	We do not understand the sentence "*The failure effect of FADEC software is always assumed to be at least a major effect because an error could result in the total loss of thrust*.". This assumption is indeed contradictory to Part 33.75 Safety analysis § (g) which says *(g) Unless otherwise approved by the FAA and stated in the safety analysis, for compliance with part 33, the following failure definitions apply to the engine:* *(1) An engine failure in which the only consequence is partial or complete loss of thrust or power (and associated engine services) from the engine will be regarded as a minor engine effect*. Can you please clarify it ? Please clarify also if it is also valid for the "total loss of power" (not only thrust)			Agreed Clarification added. The point is a software failure effect could impact all engines on an aircraft.

61	Garmin	34	9-2.e.(5)	"For an EECS that will be onboard/field loaded, the configuration control system and the use of electronic part marking must be approved. The drawing system must provide a compatibility table that tabulates the combinations of hardware part numbers and software versions that have been approved by the Administrator."	It is unclear where this approval is supposed to take place. At the certificate level? At the equipment level?	Clarify the reason for requiring "approval by the Administrator" for the configuration control and drawing system. Clarify what is so special about configuration control of the software that requires such specificity about "approval by the Administrator" when there is no similar requirement for AEH or any other aspect of the guidance within this AC.	Partially Agree The timing of the approval is tied to engine certification. The reference to the administrator is to link this to FAA approval. The paragraph was reworded to provide the clarification requested by this commentor.
62	Garmin	34	9-2.f.(3)	References Order 8110.49. As noted in the comment on 3.b.(1), applicants are not obligated to follow Orders nor are FAA Orders written for applicants.	FAA presentations at the 2011 SW/AEH Conference have acknowledged the confusion between ACs and Orders with respect to the applicant.	Suggest removing this paragraph.	Disagree Again this is additional information. See comments 58 & 60
165	GE	34	9-2.e.(5)	It states, "...the configuration control system and the use of electronic part marking must be approved." This sounds like a specific approval. Yet this should be covered by the PSAC for the software.	A separate approval is not issued for the configuration management system or the use of electronic part numbering.	Supplement this statement with "…as part of the software approval."	Partially agree Clarified as a part of engine certification See comment 61
63	Garmin	35	9-2.g.(2)(b)1	References Order 8110.49. As noted in the comment on 3.b.(1), applicants are not obligated to follow Orders nor are FAA Orders written for applicants.	FAA presentations at the 2011 SW/AEH Conference have acknowledged the confusion between ACs and Orders with respect to the applicant.	Suggest removing the last sentence of this paragraph.	Disagree Again this is additional information. See comments 58 & 60 & 62

64	Garmin	35	9-2.g.(2)(b)3	References Order 8110.49. As noted in the comment on 3.b.(1), applicants are not obligated to follow Orders nor are FAA Orders written for applicants.	FAA presentations at the 2011 SW/AEH Conference have acknowledged the confusion between ACs and Orders with respect to the applicant.	Suggest removing the last sentence of this paragraph.	Disagree Again this is additional information. See comments 58 & 60 & 62 & 63
166	GE	36	10-2.b.(3)	Guidance has no limit on which events need to be in the Installation instructions.	Only the events that are observable by the flight crew need be identified in the installation instructions.	Add at end of 2nd sentence "if the event can be observed by the flight crew."	Agreed
167	GE	36	10-2.b.(3)	Inconsistent terminology … "operating and installation instructions."	Elsewhere uses "engine installation and operating instructions."	For consistency with rest of document use engine installation and operating instructions.	Agreed
99	Williams 26	37	Paragraph 10-2 c.(1)(b) 3,	the phrase "or electrical power" should be deleted. This topic is covered in Chapter 11			Agreed
126	PW	37	Paragraph 10-2. b. (4):	Last sentence states: "…The new requirement is that the ECS provide fault accommodation against single failure of aircraft-supplied data." It is assumed that failure of aircraft-supplied data includes data corruption (per parag. 10-2. a and 10-2. c.). Paragraph 10-2. h (1) allows an exception for Thrust and power commands signals.	However there are other Aircraft supplied data signals which do not fall under that category and for which the EEC may have no validation capability. Examples: IGNITION, AUTO, CRANK selector, landing gear status, Slats/Flaps status, Wing Anti ice, ECS Pressure Demand, Universal Time, Date, Aircraft ID, Flight number.	The AC should have a means to allow exception for those. Revise as follows: The new requirement is that the ECS provide fault accommodation against single failure of aircraft-supplied data for which such accommodation is possible.	Agreed

127	PW	37	Paragraph 10-2 c. 1(b) design assessment:	Requires an evaluation of common mode faults that may affect more than one engine. What type of evaluation is required?	It seems that this activity should be coordinated by the airframe supplier.	FAR 33 certification should note the potential concern at the aircraft level and alert the applicant to need to define in the instructions for installation provision, if any, against the failure mode of concern.	Disagree This is addressed via this paragraph
128	PW	37	Paragraph 10.2. c. (2)	When the particular aircraft air data failure mode(s) are unknown, the engine applicant should assume typical failure modes for loss of data and erroneous data. The engine applicant should assume that erroneous data is being transmitted to the EECS and identify for the installer the impact of this data on engine operation.	Shouldn't the requirement be on the airframer to provide the various failure modes to the engine applicant, rather than the applicant guessing at conceivable failure modes.	FAR 33 certification should note the potential concern at the aircraft level and alert the applicant to need to define in the instructions for installation provision, if any, against the failure mode of concern.	Disagree This is addressed via this paragraph
168	GE	37	10-2.c.(1)(b)	The engine installation and operating instructions are not the appropriate place to document airframe designs and failure modes and consequences.	The engine manufacture does not define and control airframe systems and failure modes. He should also not document his understanding of those systems in the engine definition.	Change "The installation and/or the operating instructions should identify..." to "The SSA should consider…"	Disagree If the engine manufacturer does know of failure conditions that can be caused by data transmission from the aircraft then that needs to be provided to the potential installer.
100	Williams 27	38	Paragraph 10-2 c.(4)	The first sentence is confusing. We propose deleting the phrase "the engine applicant must require recognize that" from the sentence.			Agreed

101	Williams 28	38	Paragraph 10-2c. (4) first bullet:	We recommend deleting this bullet. It is in apparent opposition to paragraph 10-2 d.(4)			Disagree No conflict is identified The 10-2d(4) reference is to a potential triple redundant ADC system.
129	PW	34	Paragraph 9-2 f. (2):	The failure effect of FADEC software is always assumed to be at least a major effect because an error could result in the total loss of thrust.	Clarification.	The failure effect of FADEC software is always assumed to be at least a major effect because an error could result in the total loss of thrust to the aircraft.	Agreed Clarification has been added See comment 32
130	PW	38	Chapter 10, section 33.28(h), Paragraph 10-2 c. (4):	"… then the engine applicant must require recognize … "	Typo.	"… then the engine applicant must ~~require~~ recognize … "	Agreed Phrase has been deleted
169	GE	38	10-2.(c)(4)	Probably a typographical error in first sentence.	"require recognize" is not appropriate wording.	Delete "require".	Agreed Phrase has been deleted
170	GE	38	10-2.(c)(4)	Allow other documents besides the engine installation and/or operating instructions to provide the required definition.	The engine installation and/or operating instructions are often not the proper document for design, fault, and performance related requirements. If this is provided in other contractually required documentation between the engine manufacturer and the installer, it should not be repeated in engine manuals.	Change 2nd sentence to "To maintain compliance with 33.28, the applicant must provide the following information in the engine installation and/or operating instructions or other engine and installer interface documentation, that:"	Agree with the intent. This has been addressed in Appendix 1 See comment 139
205	Andy Ward	38	4	the engine applicant must require recognize that	The word 'require' is a surplus word!		Agreed Phrase has been deleted

102	Williams 29	39	Paragraph 10-2 f. (1):	Delete ";generally through a loss of all aircraft generated power", How the systems degrades adds no value to this discussion.			Agreed
103	Williams 30	39	Paragraph 10-2 f. (1)	This guidance is far more restrictive than the rule which only requires that single failures be covered. We do agree that the rule applies to all dispatchable configurations as specified by paragraph 10-2 a.		We propose the first sentence replace the phrase "not functional" with "in it's most degraded dispatchable configuration "	Partially agree. See comment 171 (next page). We deleted everything after '…not functional.' This is the clear demonstration that the ECS is independent of the aircraft system.The proposed wording change would make the task more difficult and would require significantly increased coordination with the installer.
131	PW	39	Paragraph 10-2 e.:	Applicants should ensure that their ECS system is capable of ensuring that the engine provides the declared minimum rated thrust or power throughout the engine operating envelope.	Redundant.	Applicants should ensure that their ECS ~~system~~ is capable of ensuring that the engine provides the declared minimum rated thrust or power throughout the engine operating envelope.	Agreed
171	GE	39	10-2.f.(1)	It states "…when the aircraft air data system is not functional;" The ECS may receive data from other aircraft systems. Does this issue only apply to air data parameters, or should it be broadened to cover other sources?	Scope of validation effort is unclear.	Determine if the intent is to account for all aircraft data sources, or only the air data system is the intent.	Agreed The second sentence in 10-2 – f(1): should be deleted. We cannot demonstrate this "by test" - the accommodation for air data losses. This logic is too complex to demonstrate by test. . The paragraph is specifically referring to air data losses.

172	GE	39	10-2.f.(1)	It states "…generally through a loss of all aircraft generated power." It is not exactly clear what the intent is of this statement. Is this intended to address total loss of air data parameters? And elsewhere in this chapter, it addresses loss of individual parameters. This should be reconciled.	Clarify the intent. Is this to cover total loss of the air data parameters? And what about individual parameter loss?	The intent of this sentence is confusing and may not fully cover the desired failure modes of the aircraft data.	Agreed.
173	GE	39	10-2.f.(2)	It states "...the next single fault in the EECS…" Is this really intended to cover all EECS faults, or only those of the aircraft data?	EECS failure accommodation is already addressed in another chapter 6. This should not be repeated here.	Clarify if the intent is for failures in the aircraft data.	Agreed Added clarification
174	GE	39	10-2.g.	Engine manufactures can never "direct" the installer.	It is inappropriate business and legal policy for the engine manufacturer to "direct" the installer regarding installation of the engine.	Change to "…should show that their installation instructions or other contractually required documentation provides guidance with certain aspects …"	Agree with the intent. This paragraph is significantly reworded.
104	Williams 31	40	Paragraph 10-2 g.(2);	We suggest deleting this paragraph. Requiring the engine applicant to require from the installations instructions that the aircraft applicant must use engine data to show compliance to part23/25/27/29 is a tortuous way of requiring compliance to the aricraft certification standards. While certainly good practice this guidance is better placed in an xx.1309 AC.			No change. Comment withdrawn.

105	Williams 32	40	Paragraph 10-2 g.(3);	We suggest deleting this paragraph. This is redundant to paragraph 10-2 g.(1) Whether the aircraft is going through its initial certification or a design change it must continue to meet the engine installation instructions.			Agreed
106	Williams 33	40	Paragraph 10-2 g. (6)	We suggest deleting this paragraph. It is a subset of the requirements from paragraph 10-2 g. (7)			Disagree It is a specific case and does not harm
107	Williams 34	40	Paragraph 10-2 h. (4):	Delete first 3 sentences. These sentences have to do with the certification activities of the aircraft. This guidance is best implemented in association with a part 23, 25, 27, or 29 AC		. Reword last sentence from "Hower, failures..." to "Failures..."	Disagree This point needs to be made based on previous program failures to do so.
132	PW	40	Paragraph 10-2 h. (4):	However, failures in the throttle position sensing system and thrust command system must be included in the engine's LOTC/LOPC analysis.	More precise to point to the definition of "the system" used in the LOTC analysis.	Revise: However, failures in the throttle position sensing system and thrust command system must be included in the engine's LOTC/LOPC analysis as defined in the LOTC analysis system description.	Agreed
175	GE	40	10-2.g.(4)	Aircraft SSA information is inappropriate in engine documentation.	It is inappropriate business and legal policy for the engine manufacturer to discuss and/or document aircraft level SSA results.	Delete item (4)	Disagree This paragraph is only stating that the engine installation instructions need to indicate to the installer that they have responsibilities with regards to these interfaces as they can impact the engine certificate. Some of the items under 10-2 g. have been reworded for clarity.

176	GE	40	10-2.g.(7)	Allow other documents besides the engine installation and/or operating instructions to provide the required definition.	The engine installation and/or operating instructions are often not the proper document for design, fault, and performance related requirements. If this is provided in other contractually required documentation between the engine manufacturer and the installer it should not be repeated in engine manuals.	After "...engine installation..." add the words "...or other engine and installer interface documentation..."	Agree with the intent. This has been addressed in Appendix 1 See comments 139 & 170
133	PW	41	Paragraph 11-2 a.:	In addition, this configuration is typically single fault tolerant including common cause/mode fault tolerant. However, other options do exist, and are discussed below.	Clarification of assumed intent.	In addition, this configuration is typically single electrical fault tolerant including common cause/mode electrical fault tolerant. However, other options do exist, and are discussed below.	Agreed
177	GE	41	11-2.a.(2)	If the EECS power is self-contained then there must be an alternator, and no connection to the aircraft power. It would help to clarify this description.	The concept of a self-contained power system is vague.	Clarify that the self-contained power system has an alternator and no connection to aircraft power.	Agree with the intent. Clarification added.

108	Williams 35	42	Paragraph 11-2 a. and 11-2 a.(2):	What is the difference between an engine mounted alternator and the Self-Contained Electrical Power System? Based on the reference to other options it seems there is a difference but it seems that the definition of the engine mounted alternator would meet the same definition of the Self-Contained Electrical Power System.			Partially agree Clarification added. "This is acknowledging that there are means other than an alternator that may be used. However, an engine driven alternator based system does fit into this type of system."
134	PW	42	Paragraph 11-2 a (2) (c).:	… because credit toward achieving system reliability based on back-up power from the aircraft has not been allowed.	Would credit be given if the ECS demonstrated acceptable operation on backup power from the aircraft as noted on Page 44?	Clarify as required.	Partially agree Clarification added. Added the phrase " ...not typically been allowed."
178	GE	42	11-2.a.(2)(b)	Based on the definition for a self-contained electrical system, why is aircraft back-up power then described herein? This is very confusing. See prior comment.	Inconsistent definition.	Reconcile differences in the definition of a self-contained power system.	Disagree The fact that the system is self-contained is typically in reference to critical functions. In addition, we do not prohibit a provision for back-up power from the aircraft system. A bit of clarification has been added.
179	GE	42	11-2 a.(2)(b)	It states "…interface requirements in the engine installation instructions." This could equally be contained in a FICD.	Why not account for a FICD?	Alternative is a FICD for this information.	Agree with the intent. This has been addressed in Appendix 1 See comments 139 & 170 &176
180	GE	42	11-2.c.	Design architecture analysis. It appears that this section should actually be b., not c. Also subsequent sections would then be adjusted.	Consistency in section lettering and numbering.	Confirm that this section should become b.	Agreed

109	Williams 36	43	Paragraph 11-2 c. and on:	Because there is no Paragraph 11-2 b. paragraph 11-2 c. should be 11-2 b. and all subsequent paragraphs should be renumbered accordingly.			Agreed
135	PW	43	Paragraph 11-2 d. (4)(c):	Reword the following: "… specify the following to endure the installer …."	Typo.	Reword the following: "… specify the following to ensure the installer …."	Agreed
181	GE	43	11-2d.	["Aircraft-Supplied Power System(s)."] The term, "single bus failure rate" is used at the beginning of this section, followed by numerous failure scenarios, but no details as to the particular rate to be considered.	Vagueness of the requirement	Request clarification of the intent of the statement, "The Applicant should consider the single bus failure rate."	Disagree It is not a specific failure rate for the bus. It is a rate that in combination with all other failure rates within the system allows the system to achieve the acceptable SSA criteria.
182	GE	43	11-2.d.(2)	The engine installation instructions may reference a detailed wiring diagram with the information. If it does, the wiring diagram itself should not need to be issued as part of the installation instructions.	Allow industry procedures that are used today and provide the required documentation & coordination between the engine manufacturer and the installer.	After the words "engine installation," add "or other engine and installer interface documentation."	Agree with the intent. This has been addressed in Appendix 1 See comments 139 & 170 &176 &179
183	GE	43	11-2.d.(3)	Failure rate data of aircraft systems should not be included in engine data, if it does not lead to a LOTC/LOPC.	The requirement assumes that loss of aircraft power leads to an LOTC/LOPC	Before "The applicant..." insert (If required to meet the declared LOTC/LOPC failure rate) "	Agreed

206	Andy Ward	43	11-2.d.(3)	Aircraft-Supplied Power System(s). Applicants should consider the single bus failure rate. This inclusion of failure rate data insures that as installed the ECS still satisfies the allowable rates.	An acceptable alternative presumably is to not take any credit for aircraft power		Agreed Covered by the change introduced under comment 183
207	Andy Ward	43	11-2.d.(4)(c)	the following to endure that the installer	The word 'endure' should be 'ensure'		Agreed See comment 135
184	GE	44	11-2.e.(1)	Allow other documents besides the engine installation and/or operating instructions to provide the required definition	Allow industry procedures that are used today and provide the required documentation & coordination between the engine manufacturer and the installer.	After the words “engine installation,” add “or other engine and installer interface documentation.”	Agree with the intent This has been addressed in Appendix 1 See comments 139 & 170 &176 & 179
185	GE	45	11-2.f.	Allow other documents besides the engine installation and/or operating instructions to provide the required definition.	Allow industry procedures that are used today and provide the required documentation & coordination between the engine manufacturer and the installer.	After the words “engine installation,” add “or other engine and installer interface documentation.”	Agree with the intent This has been addressed in Appendix 1 See comments 139 & 170 &176 & 179 & 184

136	PW	46	Paragraph 11-2 g (2):	Aircraft power supply conditions. These conditions may lead to engine shutdown or an engine condition that is not automatically recoverable. In these cases, the engine should be capable of being restarted. Also, applicants should include in the operating instructions any special flight crew procedures for executing an engine restart during such conditions.	It is unclear what the guidance means by 'aircraft power conditions'	Reword to clarify.	Agreed Retitled : Aircraft low power condition
186	GE	46	11-2.g.(3)	["All Engine Out Restart."] "...the engine applicant should define the battery power requirements and demonstrate them during engine certification."	Currently battery power requirements for an all-engine out restart are demonstrated by engineering testing. Does this guidance impose a new certification test?	Request clarification of the official intent of this statement.	Agreed Reworded to be verified via test. Removed the reference to engine cert

110	Williams 37	47	Section 11-2 g. Paragraphs (1), (2), and (4)	do not apply to systems which use PMA/PMG as primary power. The primary PMA/PMG will maintain the control system during aircraft power transients. We suggest renumbering the section as follows: Create new paragraph (1) entitled Primary Aircraft power recovery. Paragraphs (1), (2), and (4) become subparagraphs to the new paragraph (1) and Paragraph (4) becomes Paragraph (2)			Agreed. Section reworded and reorganized.
187	GE	47	11-2.j.	Allow other documents besides the engine installation and/or operating instructions to provide the required definition.	Allow industry procedures that are used today and provide the required documentation & coordination between the engine manufacturer and the installer.	After the words "engine installation," add "or other engine and installer interface documentation."	Agree with the intent This has been addressed in Appendix 1 See comments 139 & 170 &176 & 179 & 184 & 185
188	GE	47	11-2.j.	Installation Requirements. This appears to be redundant with the earlier statements in this chapter and could be removed.	Does this add any new information? If not, then it is redundant and can be deleted.	Delete this item j. entirely.	Agreed Paragraph deleted
189	GE	50	14-1	33.28(1) reads, "...shutting down the engine rapidly." The guidance states, "...a pilot initiated means of rapid shutdown..." and "...pilot's capability to rapidly select this function." The term "rapidly" is not defined.	"Rapidly" is not quantified and could be open to judgment. The shutdown means is a function of valve response time, lever location, ECS and more.	Provide a reasonable expectation of response time or interpretation advice for "rapidly."	Disagree. This requirement was based on the Harmonization of the JAR, not EASA, rules with the FARs. There is no definition of rapid in the current EASA AMCs.

65	Garmin	51	Chapter 15	FAA Order 8110.105 introduced the term "custom micro coded devices", which includes PLDs. This AC only uses PLDs, which is inconsistent.	Consistency with the Order.	Suggest adding the definition and terms from 8110.105 for custom micro coded devices into chapter 15, and the definitions section. (not suggesting to reference 8110.105 but rather include the applicable text)	Disagree This suggestion is a good one however it could be considered an expansion of the rule as presented in 15-1.
66	Garmin	51	Chapter 15	AEH is defined as all hardware, but only PLDs are covered in the document.	Other AEH, besides PLDs, are not covered.	Suggest adding a paragraph to chapter 15, stating that the broader scope of AEH, including COTS, is verified at the system/appliance level.	Agreed
190	GE	51	15-2	Last sentence "However, AC 33.28-1A ….": Wording clarification may be in order and help statement flow.	Expect that the intent is to both supplement/reinforce AC 20-152 AND provide engine control specific guidance.	Change "or" to "and" in last sentence. Consider re-wording last sentence to say "…guidance in AC20-152 and provides guidance specific to engine controls."	Agreed
191	GE	51	15-2, a. Objective	Statement is that objective is to 'prevent' logic errors. This is somewhat inconsistent with statement in 15-2, a, (2) that the requirement is to "minimize errors".	Clarification of the objective/requirement that the applicant is working to.	Use consistent wording in first sentence of 15-2, a. and in last sentence of 15-2, a, (2). State that the objective/requirement is to minimize errors.	Agreed
192	GE	51	15-2, a., (2)	Paragraph numbering issue: 15-2, a., (1) is missing.	Correct format.	Renumber sub-paragraphs of 15-2, a.	Agreed
193	GE	51	15-2, a., (3)	Not sure why software is mentioned in this paragraph since the topic is hardware (PLDs).	Clarifies guidance is associated with hardware (PLDs).	Recommend removing the word 'software'.	Agreed
194	GE	51	15-2, a., (3)	This paragraph provides guidance on determining the hardware DAL. Should this information go in the subparagraph (15-2, c. "Level of hardware design assurance") associated with hardware DAL?	Consolidate guidance for determining HW DAL in one sub-paragraph.	Move content of present 15-2, a. (3) to 15-2, c "Level of hardware design assurance".	Agreed Paragraph a.(3) has been deleted

195	GE	51	15-2, a., (3)	An example would be helpful in how HW DAL could be affected by consideration of "digital logic errors common to more than one engine control system".	Helps applicants understand what items should be examined when considering the impact of common logic errors.	Provide a short example of how the possibility of logic errors common to more than one ECS can affect determination of HW DAL.	Disagree An example here would only inflame the risk concerns. In addition, it could lead to applicants not evaluating all possible outcomes which is what is intended.
67	Garmin	52	15-2.b	Order 8110.105 is referenced here. As noted in the comment on 3.b.(1), applicants are not obligated to follow Orders nor are FAA Orders written for applicants.	FAA presentations at the 2011 SW/AEH Conference have acknowledged the confusion between ACs and Orders with respect to the applicant.	Suggest referencing only AC 20-152, not Order 8110.105.	Disagree Again this is additional information. See comments 58 & 60 & 62 & 63 & 64
111	Williams 38	52	paragraph 15-2 a. (3)	If the paragraph is deleted as suggested the indenture level of paragraph 15-2 a. (2) should be reduced. If not 15-2a.(2) should become 15-2 a. (1)			Agreed See comments 112 & 194
112	Williams 39	52	Paragraph 15-2 a. (3)	is repeated at paragraph 15-2 c. (2) We suggest deleting Paragraph 15-2 a. (3)			Agreed See comments 111 & 194
196	GE	53	16-1.b.	PSCIP is inappropriate information to be added to the engine installation information.	PSCIP is by definition a "plan" and does not provide compliance information.	Replace sentence about including SCIP as an appendix to the installation instructions with "The SCIP may provide valuable information to the installer and should be provided to him for his use."	Agreed
197	GE	54	16-1.b.(2)	Allow other documents besides the engine installation and/or operating instructions to provide the required definition.	Allow industry procedures that are used today and provide the required documentation & coordination between the engine manufacturer and the installer.	After the words "engine installation," add "or other engine and installer interface documentation."	Agree with the intent This has been addressed in Appendix 1 See comments 139 & 170 &176 & 179 & 184 & 185 & 187

113	Williams 40	55	Paragraph 16-2 b.	should be deleted. It is providing guidance on propeller and aircraft certification. This guidance should not (from the perspective of a propeller manufacturer or aircraft manufacturer) be buried in guidance for engine certification. It should be in a an appropriate AC for the aircraft or Propeller certification standards.			Disagree While it is understood what the comment says, it is included because we are providing guidance to the engine applicant who is implementing a portion of the control function required for engine certification into the aircraft. In this circumstance the engine manufacturer is responsible for assuring implementation in the aircraft system.
137	PW	55	, Paragraph 16-2 b (2):	… Avionics Electronic Hardware (AEH)	Typo.	… Airborne Electronic Hardware (AEH)	Agreed
198	GE	A1-1	Appendix 1	Table A.1-1: Repeat the column headers on the second page.	Table column headers should appear on all pages.	Repeat the table headers on all pages of the table.	Agreed
199	GE	A1-1	(P A1-1) Introductory paragraph	Allow other documents besides the engine installation and/or operating instructions to provide the required definition.	Allow industry procedures that are used today and provide the required documentation & coordination between the engine manufacturer and the installer.	After the word “installation,” add “or other engine and installer interface documentation.”	Agree with the intent. This has been addressed in Appendix 1 See comments 139 & 170 &176 & 179 & 184 & 185 & 187 & 197
138	PW	A3-5	Page A3-5, Table A3-2:	Should the number under the heading “Total System Maximum” be < 0.003?	It appears this number is inconsistent with the same requirement in Table A3-1.	To be confirmed.	Agreed