DISPOSITION OF SUBSTANTIVE COMMENTS

1st Internal (Clearance Record)

1. **DATE FORM COMPLETED:** **4/28/08** **(This date is meant to ensure no duplicate reporting occurs in the AoD metrics)**

2. **TITLE OF DOCUMENT**: GUIDANCE MATERIAL FOR 14 CFR § 33.28, ENGINE CONTROL SYSTEM

3. **COMMENT PHASE: Internal FAA (Clearance Record):** **X** **OR** **Public:** _____

4. **HOW MANY CLEARANCE RECORDS ARRIVE *AFTER* THE DUE DATE:** _____

SUBSTANTIVE COMMENTS. Substantive comments must be resolved in the format below. Substantive comments are any comment other then those which:

- correct grammar or sentence structure
- correct spelling
- correct term use
- make simple text changes to clarify the intent, meaning or to improve readability
- change format/structure of the overall document

DISPOSITION OF THE INTERNAL COMMENT PHASE (FAA)

	Name of Person & mail stop	Page & Paragraph	Comment:	Comments Accepted? YES, NO, or IN PART	Disposition:
1	ASW-112	6	Add definition and acronym for LOTC/LOPC	Yes	Will add definition of LOTC/LOPC.
2	ASW-112	9	Is there a section that addresses Time Limited Dispatch (TLD)? Also, which paragraph covers TLD in the draft AC?	No	TLD is covered by policy. The discussion in the AC is there to provide a link to the policy and to address any possible pitfalls to doing TLD later that might be set during certification. See Paragraph 9 b (5).
3	ASW-112	17(3)(a)	Please spell out LOTC/LOPC. Similar to page 19, section 11, a (1).	In part	Added a definition of LOTC/LOPC.
4	K. Brane ACE-118A	Page 1, Sect. 1.	Purpose should be revised to indicate that this AC replaces both AC33.28-1 and AC33.28-2. (The content of the draft appears to replace both ACs, but the lack of a clear statement as to the current material results in confusion.)	No	At this time it is not planned to replace AC33.28-2 with this AC
5	James Galstad, ACE-116Wp	Page 1, par 2	Add a sub-paragraph to address the applicability of this AC to the engine installer. Due to the integration of engine and engine installation functions, the engine installations certification is intertwined with the engine certification with related installation regulations appropriately included in par 3.a.	Yes	Will add the following to Para 2.a: "The guidance provided in this document is also intended to assist the engine installer in understanding the interface between the engine certification and aircraft certification and the assumptions made by the engine manufacturer concerning the engine/aircraft interface. .
6	James Galstad, ACE-116Wp	Page 2, par 3b	Include PS-ANE100-1994-00008 and PS-ANE33-ACE23-2006-1.	No	It is unclear what the connection is to these Policy Statements. The rule only covers 30 sec OEI.

7	ACE-111 P. Rouse	Page 4, para 4	Add: "APR: Automatic power reserve system, means the entire automatic system used only during takeoff, including all devices both mechanical and electrical that sense engine failure, transmit signals, actuate fuel controls or power levers on operating engines, including power sources, to achieve the scheduled power increase and furnish cockpit information on system operation." Part 23 does not use ATTCS in the regulatory material.	No	Will add this to the definitions and add reference to APR in the text if we go forward with replacement of AC 33.28-2.
8	James Galstad, ACE-116Wp	Page 4, par 4	Clarify ATTCS definition to exclude power changes in accordance with PS-ANE100-1994-00008 and PS-ANE33-ACE23-2006-1 and add definition for OEI Takeoff Thrust Rating.	No	These two PS have no impact on the material in this AC. OEI have nothing to do with the takeoff phase of flight.
9	James Galstad, ACE-116Wp	Page 4, par 4	Clarify whether the Back-up Mode is intended to include the channel not in control or whether it is a function(s) that are included in addition to the two primary channels of control in an EEC system.	In Part	Mode may benefit from clarification that it is not associated with a channel. Will add a second sentence to clarify the definition in response to this comment; "The alternate channel in a dual channel system with identical channels is not considered a backup mode. Any additional backup means provided differing from the two channels would be considered as Back-up Modes under the definition. "
10	James Galstad, ACE-116Wp	Page 5, par 4	Define satisfactory within Control Mode such that it is clear that Part 33 only, or Part 33 and Part 23/25/27/29 requirements are met, or dispatch / no dispatch but continued safe flight and landing capability is intended. Delineation may not be intended in which case replace satisfactory control with an Engine Installation defined level of engine control.	In Part	Reference to continued safe flight and landing does not clarify this anymore than does the statement of satisfactory. It is being left a bit loose to allow for the application of reason. However, words are added to say the Satisfactory may include evaluation in the aircraft/rotorcraft.

11	James Galstad, ACE-116Wp	Page 5, par 4	Dispatchable Configuration needs to become Part 33 Dispatchable Configuration. When the engine is installed, a dispatchable to Part 33 requirement may not be dispatchable to be compliant with Part 23/25/27/29 requirements.	In Part	It is recognized that when installed the installer may place additional restriction on dispatch. This is also addressed in PL-45, the official FS policy letter on MMEL/MEL construction/standardization. The following is taken from PL-45, Revision 2, March 04, 2004 "In those instances where both the engine and aircraft manufacturer provide TLD restrictions, the FOEB must use the more restrictive requirements. If the aircraft manufacturer mandates more restrictive requirements than the engine manufacturer with regard to TLD time limits or with the categories into which some FADEC system faults have been assigned by the engine manufacturer, the aircraft manufacturer should explicitly state this when specifying the aircraft's TLD related limitations." This PL has been added to the references in paragraph 4.
12	James Galstad, ACE-116Wp	Page 5, par 4	Clarify the distinction that the EECS includes components approved during installation of the engine in addition to those components approved in Part 33.	Yes	Text modified to clarify. Added the following: "Components of the system provided by the installer may still be considered part of the system."
13	James Galstad, ACE-116Wp	Page 6, par 4	Add a definition for the engine control system that meets the requirements of the engine's minimum thrust power setting deck.	No	As this rule applies to any control system, including a old style hydromechanical system, it can not be assumed that it includes engine rating limitation or guarantee. This rule and this AC do not establish guaranteed thrust
14	James Galstad, ACE-116Wp	Page 7, par 5c1	Include in this paragraph the need for Engine Installation Manual to identify the engine installation functions imbedded within the EECS. Installation functions that may be imbedded within the EECS require Part 23/25/27/29 certification.	Yes	Added the following: ..."These functions that are added to the EECS, which are not required for compliance with part 33, but are required for installation compliance should be documented in the Installation Manual."
15	James Galstad, ACE-116Wp	Page 11, par 8b	Clarify that: "enables selected values of relevant control parameters..." includes all applicable values that affect the engine governor setting.	No	Although the commenter identifies his comment to Para 8.b, the clause he wishes to modify, i.e. "enables selected values of relevant control parameters.." is in Para.8.a.(1)(i) which is part of the Rule, i.e. 33.28(b)(1)(i). Hence it can not be modified as he suggests.
16	James Galstad, ACE-116Wp	Page 11, par 8b1	Include within the Installation Manual the non-dispatchable modes, identification of the engine's operating conditions for which continued safe operation and landing is foreseeable and those for which continued safe operation and landing is better served by shutting down the engine.	No	Any of these issues are more appropriate in the TLD documents. TLD is covered by policy rather than as a part of certification. This document is largely for full-up dispatch. All of the references to dispatchable modes within this AC are just setting the minimum standard. A discussion of those modes that are not considered dispatchable would not add much to this AC.

17	James Galstad, ACE-116Wp	Page 12, par 8b2	Replace "two additional aspects of power or thrust modulation should be considered." with "two aspects of power of thrust modulation included within 'adequate sensitivity' are inversions and flats within the thrust modulating range." If inversions or flats are not now included within the definition of 'adequate sensitivity' then add the definition to the rulemaking process as we cannot do the rule within the AC.	No	This is not rule making it says that it is undesirable, not out of regulatory compliance. Inversion is not allowed now.
18	ACE-111 P. Rouse	Page 12, para 8.b.(2)	Please clarify the paragraph. The paragraph seems to imply that there should be a direct relationship between increasing power lever and increasing engine power. A little clarification would be beneficial.	Yes	Modified to read as follows: (original text in italics) *In the evaluation of adequate sensitivity in compliance with § 33.28(b)(1)(iii), two additional aspects of power or thrust modulation should be considered. No inversions should be present in any of the power or thrust setting regions. In addition, 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 a fixed power settings, such as, maximum climb or cruise power settings. The intent of the rule is that there should be a continuous and positive relationship between increasing power lever and increasing engine thrust or power, unless it can be demonstrated by the applicant that in special applications safety can be enhanced by deviating from this intent.
19	James Galstad, ACE-116Wp	Page 12 par 8	Add a par to clarify that the engine installation approval includes performance to the minimum engine deck definition and also the maximum over thrust produced by the engine. Consequently, installation of the engine control system requires identification of each fault / failure conditions that results in thrust less than the minimum engine thrust and in excess thrust.	No	These conditions are considered to be a part of the SSA and do not need to be delineated here. Performance to the minimum guaranteed thrust is not the subject of the Rule or AC.
20	James Galstad, ACE-116Wp	Page 12 par 9b1	Clarify that FAA data approval, conformity, and test witness requirements are applicable when the test procedures are based on MIL-STD-810.	No	FAA data approval, conformity, and test witness requirements are applicable to any means of compliance.

21	James Galstad, ACE-116Wp	Page 12 par 9b	Add clarification that minimum envelopes definitions exist within the installation requirements and identify each requirement that is applicable. The necessity for limiting nacelle paint colors to achieve installation certification for engine EEC's should not be necessary when following the rules and applicable guidance. *Asked commentor for clarification, his reply follows:* In the context of (excerpt from the draft AC): *(quoted 9a, 9b, and 9b(1))* Para 9.b addresses a pertinent topic. Additionally, the engine installation has minimum installation requirements (excerpt from Part 25): *(Quoted Sec. 25.1043 Cooling tests.)* While this regulatory minimum of 100 degrees F is set forth, the temperature envelope for Part 25 airplanes often exceeds 100 degrees F. Nacelle temperatures / airplane compartment temperatures are significantly dependant on the color of the nacelle / airplane and at times are significantly higher than ambient temperatures. The temperature envelopes for components of the airplane (including the components of the engine) can and have required re-certification to increase their temperature envelope to enable the airplane temperature envelope to be achieved. It is true that airplane limitations for white / light colors only can assist in closing the gap though I do not see this as a practical or preferred approach to be fostered. The minimum regulatory environmental envelopes for an airplane may be expanded to become suitable for the airplane manufacturer during airplane certification. Certification of the engine installation requires that the engine environmental envelopes are inclusive of the installation envelope. Therefore, compatibility of the engine and engine installation environmental envelopes requires coordination.	No	The commentors final sentence sums it up. Coordination between the applicant and the intended installer is required. This does not require further justification.

22	James Galstad, ACE-116Wp	Page 12 par 9b	Add a section that clearly shows that environmental requirements, inclusive of HIRF and Lightning are applicable to the airframe supplied portions of the engine control system, hence EECS when applicable rather than just the ECS.	No	The airframe supplied portions of the engine control system must be addressed by the airframer relative to their compliance with environmental requirements. The installer is responsible for showing that the components he provides meet the suitable environmental requirements for the areas in which those components are installed. HIRF and Lightning qualification testing is somewhat different in that components having suitable likeness to the aircraft supplied components must be used in these tests, as appropriate, for showing the declared capability of the entire engine control system. The installer supplied components are considered part of the system, and the system and system behavior must be analyzed or demonstrated considering those elements provided as a part of the installation. This does not go as far as qualifying all aspects of these elements.
23	ACE-111 P. Rouse	Page 12, para 9.b.(3)	Recommend that prescriptive HIRF and Lightning levels be used. Currently EPD (M. Rumizen) and SAD (P. Rouse) are working with D. Walen to establish prescriptive levels of HIRF and Lightning for reciprocating engines. Recommend that the same be used for turbine engines to eliminate ambiguity in determining the hazard severity. Currently, coupled with the no CATASTROPHIC engine failure policy, an applicant could use HIRF and Lightning test levels that will not be adequate and result in a non-installable engine.	No	This confusion seems to be limited to the recips. If we decide to have this AC cover recips we will address the prescriptive issue. HIRFand lightning are aircraft level requirements, not engine level requirements. The AC does contain suggested default levels when the aircraft attenuation characteristics are not known. Para 9.b.(3) provides guidance for test levels for HIRF and Lightning. Minimum test levels are provided if the engine installation levels are not known and when known, test levels defined for the installation are to be used. The guidance points out the importance of working closely with the installer to adequately test the EEC system at the engine level in order to avoid the need to retest the system when the engine is installed.

24	James Galstad, ACE-116Wp	Page 14 par 9e	The Pass/Fail Criteria is of necessity written for the test environment. Clarify that control system effects from HIRF and Lightning are based on installed engine operating criteria. Consequently, variation in surge bleed valve, variable guide vanes, etc may be determined to be acceptable based on installed engine operating characteristics rather than on an arbitrary control system response.	No	A standard has been established. The thrust/power has to be within +/- 3% of takeoff thrust/power (or so much of the operating point) and the engine/control must return to normal operation within 2 seconds of the cessation of the event. The testing should be completed at the sensitive operating points of the engine/control system. This is a recognized standard. Having each installation establish a much larger level associated with what he believes to be critical to his airplane would be taking us away from a recognized and well established standard. The AC provides guidance and if an applicant is able to justify an approach such as that suggested and the ACO engineer agrees, then it will be accommodated.
25	James Galstad, ACE-116Wp	Page 17 par 10b3a	The level of safety for certification and the level of safety for a COS unsafe condition appear intermixed. If the system continues to operate safely, why would it not be dispatchable? Given the discussion that the operation is already determined to not be dispatchable, suggest rephrasing to address the operation as acceptable for continued safe flight and landing. A determination of landing at the planned airport, next suitable airport, or next available airport is applicable.	No	Safe engine operation does not solely determine dispatchability, i.e., just because it operates safely at an isolated point in time does not address adequate operability. The end of paragraph 10b3a gives a good example of a case for continuing to operate safely. However the case is not intended to represent a dispatchable configuration and that has been clarified. Landing and at which airport is not an issue for Part 33.
26	James Galstad, ACE-116Wp	Page 18 par 10b4f1	Should §33.28(c)(3) be §33.28(c)(1)(iii)?	Yes	To be fixed
27	ACE-111 P. Rouse	Page 18, para 10.b.(4)(d)	The control mode transition should be as transparent to the pilot, regardless of the reduced capability of the mode's capability (degraded mode operation). Basically, a "No Surprises" type of transition philosophy.	No	There is no requirement that control mode transitions be transparent to the flight crew, they simply have to be acceptable. This may require evaluation/demonstration in the intended aircraft/rotorcraft. A minimum change in thrust/power, associated with a mode change, is highly desirable. It may be necessary and appropriate to notify the flight crew of a mode change if different or alternate flight crew procedures are to be used, or awareness of the mode change is considered necessary.

28	ACE-111 P. Rouse	Page 18, para 10.b.(4)(e)	The time delay for control mode transitions should occur in a timely manner, similar to the criteria for unacceptable power loss during lightning and HIRF events (2 seconds). The 8 second automatic to manual control mode transition of a previously certificated engine control was not really a desirable feature.	No	The issue of time delay was discussed at great length by the drafters of this AC. It was determined that specifying an acceptable time delay was beyond the authority of Part 33 certification and that this responsibility was an aircraft certification decision. However, Para 10.b.(4)(d)3, above, was provided for guidance in the engine certification process to assure that time delays acceptable under Part 33 would also be acceptable for aircraft certification in most cases Once again the main point is that this may require evaluation/demonstration in the intended aircraft/rotorcraft
29	James Galstad, ACE-116Wp	Page 18 par 10d2	Include The acceptability of the power or thrust change is determined in part by Part 33 certification and in part by Part 23/25/27/29 certification.	In part	Add the following text to the existing text; "The magnitude of the changes in these parameters impacts the installation and therefore this magnitude should be reasonably assured to be acceptable for installation." However, the authors of this AC determined that acceptability of the specific magnitude of these changes was beyond the authority of Part 33 and the acceptability of the change(s) has to be made by aircraft authority. As noted in Para 33.28(c)(2) of the Rule the magnitude of these changes must be included in the engine installation instructions and the engine operating instructions.."
30	ACE-111 P. Rouse	Page 20, para 11.b.(2)(b)3	There should be very definitive operability criteria in the LOPC definition for rotorcraft due to the engine essentially being unusable due to compressor stall events with power transients, while the engine is still able to produce power. The operability criteria for rotorcraft are more severe due to the drive train being coupled to the engines, and the susceptibility for drive train damage due to operability issues.	No	The operability requirements for engine in Part 33 are adequate for aircraft as well as rotorcraft. The LOPC definition is a steady state condition, not a transient one. The operability criteria for the alternate mode is waived only in special cases where it can be demonstrated that compliance with the operability criteria is not required. This was pointed out by the rotorcraft engine manufacturers represented on the committee drafting this AC. Their input was agreed by the committee. The case of the multi-engine rotorcraft is given as an example in Para. 11.b.(2)(b)3.
31	ACE-100M Pendleton	Page 24, Paragraph (9)(b)	Recommend that this paragraph include a single source aircraft battery as an example of a common mode threat. There are likely other areas of the proposed AC that could benefit from identifying a single aircraft battery as a common mode threat but I think that page 24 is adequate.	Yes	This will be addressed as follows at the end of the current paragraph: "An example of a single, common mode fault are single source batteries in multi engine applications. Another example, is the use of identical software in multi engine, dual channel systems. In the case of both of these examples as well as in other cases, extra design, testing or maintenance precautions are taken to ensure safety. "
32	ACE-111 P. Rouse	Page 25, para 11.b.(9)(e)	The "Local Events" include fire in the definition, but do not expand upon it in the guidance. Please include some guidance regarding local fire events.	No	In the subsequent paragraph, Para11.b.(9)(f), guidance for fire that is requested by the commenter is provided.

33	James Galstad, ACE-116Wp	Page 28 par 12b3	The Malfunctions or Faults Affecting Thrust or Power needs additional explanation. For example, the loss of thrust below the minimum engine deck thrust is not acceptable when combined with complete loss of thrust from the opposite engine. Clarification for loss of thrust below the certified installed performance is needed. I.e. a dispatchable engine control system fault will not result in less than minimum thrust engine deck performance for a minimum engine.	No	What is considered dispatchable has nothing to do with what is a minimum thrust engine. None of the allowed dispatch configurations affects minimum thrust conditions. There is no link between this rule / AC and minimum thrust guarantees. The drafters of the AC recognized the aircraft requirement that within the takeoff envelope the surviving engine must have sufficient thrust to permit the aircraft to clear takeoff path obstacles. See Paragraph 12.(3)(c)
34	ACE-111 P. Rouse	Page 33, para 14.b.(3)(a)	Please add 14 CFR part 23 to the paragraph. Currently EPD (M. Rumizen) and SAD (P. Rouse) are working to establish prescriptive levels of software for reciprocating engines (DO178 Level C). Recommend that the same be used for turbine engines to eliminate ambiguity in determining the hazard severity (DO178 Level A).	No	If we decide to have this AC replace AC 33.28-2 we will address the prescriptive issue. Added words: Rotorcraft certifying to Part 27 & 29, category B and some Part 23 aircraft may be allowed lesser levels of Software Development Assurance Rather we need to point to Table 2 in AC23.1309 search 27 & 29 for equivalent to table 2
35	ACE-111 P. Rouse	Page 35, para 14.b.(6)(c)1	The use of "Catastrophic" contradicts the EPD policy of no catastrophic engine failures.	In part	The "catastrophic" is in reference to xx.1309, so add "...at the aircraft level"
36	K. Brane ACE-118A	Page 35, Sect. 14. b. (6) (b) & (c)	Add a section relative to software changes for reciprocating engines. The new section should include criteria for major/minor change determination specific to non-turbine engines. (The overall lower level certitude requirements for non-turbine engine software based upon criticality of function combined with the definitions presented relative to change impact would appear to slant design change evaluation toward minor. This predisposition toward minor change classification would minimize FAA involvement relative to software changes post TC.)	No	If we decide to have this AC replace AC33.28-2 we will address the prescriptive issue. See solution on item 34
37	ACE-111 P. Rouse	Page 40, para 16.a.	Given recent events, the loss of aircraft power should not result in any power loss. The sole reliance upon aircraft power for engine power has not been as successful as envisioned.	No	The commenter's concern was well recognized by the drafters of this AC. The issue was discussed at length both domestically and internationally. It was agreed that aircraft power could be the sole source of power for the EECS system provided the aircraft power was at the level of robustness required for fly-by-wire flight control systems that are as critical as the ECCSs. When aircraft-supplied power is not at this level of robustness, a dedicated power source would be required for the EECS. Para.16.(4)(d)2 provides this guidance.

38	James Galstad, ACE-116Wp	Page 44 par 16b6c	Clarification is urgently needed to address an issue created by the NPRM and referred to here as Non-critical functions that are primarily performance enhancement functions that, if inoperative, do not affect the safe operation of the engine. This perspective needs to be limited to only the §33.75 perspective. From an installation perspective the minimum level of safety requirements are applicable to engine restart, ignition, engine anti-icing, fuel shut-off, over-speed protection, and in many cases, thrust reverser deployment.	No	The dedicated power source for the EECS, usually an engine-driven alternator, is limited in its power capability because of size and drive limitations. Therefore only sufficient power for safe operation of the engine is provided. Loss of aircraft-supplied power affects the functions noted, but this loss does not affect control of the engine. Hence, this approach has been successfully used since onset of the use of EECSs in commercial aviation and has demonstrated the ability to meet the installation safety requirements.
39	James Galstad, ACE-116Wp	Page 45 par 19	Add a paragraph that clarifies that the ECS is intended to include each ECS function and that engine shutdown is considered an ECS function and not an EECS function. Transition of the ECS components to the EECS does not reduce the Part 33 certification task for those ECS components not included within the engine type design and transferred to the installation via the Installation Manual. The firewall shutoff valve's intended function is for fire protection, not for engine shutdown. Should firewall shutoff valve's intended function include engine shutdown, the engine's shutdown must include requirements for them to be tolerant of fuel starvation shutdowns in day to day operations.	In Part	If this is required a new rule is needed under Part 23. Currently 33.75 allows the use of the aircraft shutoff valve. AC 33.75-1A section 19o.(2) Guidance says, "Allowing for aircraft-supplied equipment (fuel cutoff means, etc.) to protect against the "complete inability" to shut down the engine is acceptable" The following text will be added based upon this and other associated comments: "If the SOV is to be supplied by the installer in order to comply with 33.28(l) then the requirements for the SOV should be defined in the Engine Instructions for Installation.. For example, the component may have reliability requirements, response requirements, environmental requirements, fire requirements or other requirements. These should be defined in the Engine Instructions for Installation." For information purposes, the issue for using aircraft supplied SOV was raised by manufacturers of small engines for rotorcraft and general aviation who stated that installations were in service that used the aircraft-supplied SOV.

40	ACE-111 P. Rouse	Page 46, para 19.b.	The use of an aircraft mounted valve for shutdown when there is only a single valve in the engine control is not a desirable feature. This is a bad idea, as it transfers a normally provided engine function to the aircraft, and substantially increases the complexity of the engine aircraft interface. The aircraft mounted valve has to be close-coupled; otherwise the shutdown times are between 3-11 seconds. The criterion applied in previous cases was that the means of shutdown using the aircraft mounted valve required that the shutdown means was identical to the normal means and the shutdown commenced, once commanded, in the same time, or no more than 1 second more, as a normal shutdown. The use of an aircraft valve also requires additional latency checks to ensure no latent failures. Recommend that no single valve controls be allowed to be certificated.	In Part	Same as Above, see 39
41	K. Brane ACE-118A	Page 45, Sect. 19	Add information relative to fire resistance/fire protection of the "shut down means." (Though 33.17 addresses fire prevention, additional detail or reference should be added to the guidance provided in Section 19 to assure the understanding of the applicant.)	In Part	Same as Above, see 39
42	K. Brane ACE-118A	General	Add data from AC 33.28-2 Section 3-3 d. Certification Data Interface Document. (Though the data presented in the draft AC would appear to be sufficient for long time electronic controls applicants, we continue to have new companies apply electronic controls to engines. At present many of the new entries are relative to non-turbine engine applications. The data presented in AC 33.28-2 adds much needed clarification for these non-experienced applicants.)	No	We must keep in mind that AC's are not intended to be primer for novices or an 'Idiots Guide". However, we may consider this addition if we are to delay the publication.
43	ACE-111 P. Rouse	General	Overall, the AC is very well written and comprehensive. The attached comments are for refinement and provided with the 14 CFR part 23 requirements in mind.	No	Thanks
44	ACE-111 P. Rouse	General	This AC is the replacement for AC33.28-1, which is a turbine engine control AC. This AC does address some aspects of reciprocating engine control requirements; however, the AC does not address them as thoroughly as AC33.28-2 does, nor does this AC replace AC33.28-2. Recommend that all references to reciprocating engines be deleted from this AC.	No	At this time it is not planned to replace AC33.28-2 with this AC

45	ACE-111 P. Rouse	General	There is philosophy that is based upon the Policy Statement, 1999-33/35-R0, in which there are no catastrophic engine failures. It is only when installed that the engine failures rise to the level of catastrophic. This policy is being perpetuated in the part 33 policy and guidance, yet it only transfers the burden to the installer to mitigate affects of the engine failures. The components that are installed on aircraft need to be cognizant of their failure modes and their associated affects when installed, and then design in appropriate mitigation and reliability to preclude the installation having to make up for a lower level of safety at the component level.	No	This is addressed in the requirement for the SSA. This assumes that we recognize a failure mode, make decision as to its effect on the aircraft and if this is a catastrophic or hazardous effect, then require a redesign to eliminate the failure mode. This is not typically economically feasible. For example, a high thrust or power failed fixed mode would require a dual metering valve design which has been shown to be too costly. The problem is that Part 33 can not make safety determinations for installed engines. The SSA provides the analysis of EECS failures and affects on the engine. This information can be used by the installer to design appropriate mitigation of the failures in his installation, if this is required.
46	ACE-111 P. Rouse	General	The AC contains the proposed 14 CFR Part 33, §33.28 guidance; however, the proposed rules are not included. It would be helpful if the proposed 14 CFR part 33, §33.28 rules were included, as there was some initial confusion in the AC references.	No	The 'proposed rules' are contained in the AC.
47	K. Brane ACE-118A	General	Add data from AC 33.28-2 Section 4-3 b. Failure of Aircraft Supplied Power. (We presently have a multitude of applicants that do not have dedicated power to the electronic controls. Additional detail relative to the use of aircraft supplied power and the reliability thereof is necessary.)	No	This is covered in paragraph 16
48	K. Brane ACE-118A	General	Add data from AC 33.28-2 Section 5-3 d. TLO Implementation Requirements. (The data presented in AC 33.28-2 adds a simplistic approach to non-turbine electronic controls relative to time limited dispatch.)	No	Maybe so, but TLD is not a part of the rule.
49	K. Brane ACE-118A	General	Add data from Appendix 1 of AC 33.28-2, Certification Compliance Documents. (Though the data presented in the draft AC would appear to be sufficient for long time electronic controls applicants, the data presented in the Appendix of AC 33.28-2 provides clarification of expectations for new or inexperienced applicants.)	No	See 42

50	Mike McRae ANM-112	Pg.6	While I recognize how "full up configuration" is intended to be used, and hence why it is defined the way it is, but it still seems misleading in that it includes even anticipated latent failure configurations. It would seem more appropriate to use two different terms, such as "Full-up" to refer to a configuration with no failures and "Apparently Full Up" to refer to a configuration with no known faults.	In part	Full-up means no faults present that affect the LOTC/LOPC rate. Latent faults affect the LOTC/LOPC rate and the LOTC/LOPC analysis covers these faults in the form of the uncovered fault rate. So we will have to change the definition to : "An EECS that has no known faults or failures present that affect the LOTC/LOPC rate."
51	Mike McRae ANM-112	Pg. 12 Para. 9.b.1	You might want to advise the applicants that: "If an EEC is located such that it could present an ignition source for flammable fluid leakage, explosion proofness testing will be required in at least any full up configurations. Additional testing with known faults present may be necessary to meet aircraft certification standards."	In Part	We will add a paraghaph , 11b. (9) (g), under the basic topic of Local events. To do this para (g) and (h) have to be made (h) and (i). The new (g) will address in large part this comment. We will also add a sentence to 9b.(1) to draw attention to the new (g)
52	Mike McRae ANM-112	Pg. 14 Para. 9.b. 3 or 4	You might want to advise the applicants that: "Continued EMI qualification of an EEC may not only be dependent upon maintaining the integrity of the dedicated protection features (e.g. shielding, fuse resistor networks, filter pins, transorbs, etc.), but also on maintaining some nominal circuit characteristics of the system. For example, if a normally very low/high impedance circuit within a bundle were to fail open/shorted, the redistribution of the lightning induced current within the bundle could impact the continued environmental qualification of the EEC."	No	Applicants must show that the engine control meets the new paragraph 33.28(d). This leads to engine control designs that are robust and reliable, and that consider faults and failures of the components that make up the engine controls. If this comment were added, it would significantly increase the analysis and test required for lightning, HIRF and EMC compliance. This is not consistent with the words in 33.28(b)(2) that state "Environmental Limits. The applicant must demonstrate, when complying with §§ 33.53 or 33.91, that the engine control system functionality will not be adversely affected by declared environmental conditions, including electromagnetic interference (EMI), High Intensity Radiated Fields (HIRF), and lightning. The limits to which the system has been qualified must be documented in the engine installation instructions." or with currently accepted practice for lightning, HIRF and EMC qualification. In addition, in Para 9b. (5) we do call for testing to support the possible application of TLD to assure that these environmental conditions are still met. HIRF testing is generally completed with one channel inoperative, as that is considered to be the most susceptible configuration.

53	Mike McRae ANM-112	Pg. 15 Para. 9.b.5 & Pg. 22 Para. 11.b.6	I understand that TLD is only one "optional" means of establishing an acceptable MMEL. Nevertheless, whatever means is used to establish the MMEL, that means should take into account any ICA restrictions on the MMEL. ICA restriction on the MMEL should be established whenever an airworthiness finding is dependent upon an exposure assumption that could be invalidated by more liberal MMEL relief. For example, if the conclusion of a critical SSA is dependent upon the assumption of a maximum one flight exposure to a detectable failure condition, then an Airworthiness Limitation should be established to assure that no dispatch relief is granted for this failure condition. Conversely, if the conclusion of that same critical SSA was unaffected by an assumed exposure equal to the maximum permissible MMEL relief (I know, there really is no such thing, but I use 120 days as a sensitivity test point), then the ICA's could remain silent about MMEL relief for that failure condition. My point is, if we are relying on the TLD results as the source of our assumptions regarding exposure times in our certification SSA's, then limiting the MMEL based on that TLD approval should become part of the ICA's and hence mandatory.	No	When TLD is applied for and approved, the approved time limits are contained in the engine ICA's in accordance with the TLD Policy Letter. If an applicant chooses to petition for FADEC items to be MMEL'ed, the applicant would be in violation of the policy. TLD is the only approved means to operate without being 'Full-up'. The time limitations for TLD operations are required to be placed in Chapter 5 of the engine MM. That is the Limitations section, which is part of the engine ICA's. Engine ICA stand by themselves. Aircraft maintenance instructions cannot override or displace them. If the installer has a more restrictive limitation, then that limitation should be placed in the ICAs for the aircraft. The more restrictive of the limitations should govern. This is covered in FS policy letter PI-45.
54	Mike McRae ANM-112	Pg. 24 Para. 11.b.8.b	Using the "essentially" modifier to the single fault tolerance requirement appears to be rulemaking by AC.	No	Legal agreed that this is the best approach. They suggested the following in the rule text to allow this judgement be made during certification. "*...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...*". The phrase, "as determined by the Administrator" allows the AC to define what the expectation is.

55	Mike McRae ANM-112	Pg. 32 Para. 13.b.2.c	Since the reference in the Note at the bottom of page 31/top of page 32 is to what is required at the airplane level, the term "engine" should be removed from the parenthetical statement (i.e., 10^{-9} events per ~~engine~~ flight hour).	Yes	Change
56	Mike McRae ANM-112	Pg. 42 Para. 16.b.4.d.2	The engine installation instructions should strive to minimize limitations on the "how" the airplane provides adequate power and focus on "what" adequate power is. Statements like: "The instructions should also state that any emergency power sources must be known to be operational at the beginning of the flight. Any emergency power sources must be isolated from the normal electrical power system in such a way that the emergency power system will be available no matter what happens to the normal generated power system." is inappropriate and could result in an engine being unmarketable or necessitate an ESF to §25.903(a). It would be much better to say something like: "The instructions should require that no single failure or combinations of failures not shown to be (whatever was assumed in the engine analysis) should result in loss of adequate power to the EECS".	No	We could state that each engine's power supply must have a failure rate less than 10E-05 events per hour, AND they must be independent from one another. However it is doubtful that the aircraft could meet the independence requirement. It was decided that deleting the sentences suggested by the commentor leaves Part 33 concerns unclear to the applicant. The problem here is that Part 33 is only certifying one engine. The requirement for having aircraft power be supplied with adequate reliability is an aircraft SSA determination. The Part 33 responsibility is to specify the quality of the power, not its reliability. We have indicated in the AC that if the reliability of aircraft power is good enough for a fly-by-wire system, then it's good enough for EEC power.

57	Mike McRae ANM-112	Pg. 42 Para. 21.a.2	Several statements in this document like: *"When this type of integration is pursued, the EECS becomes part of, and should be included in, the aircraft's SSA"*; may help foster a problematic misconception that the EECS (as well as the rest of the engine BOM) need not be part of, and included in, the aircraft's SSA. While we draw heavily upon the SSA's accomplished during engine certification in performing transport airplane SSA's, the EECS and the rest of the engine should always be treated as part of the airplane under §25.901(c), §25.1309, etc.. I recognize that this is not always the case for other aircraft types, so you might not even want to get into this issue here, but I wanted to at least bring it up.	No	In the full context of paragraph 21 the quote is clear.
58	ANM-140L Tom Phan	Page 2	AC should not reference FAA Policy Memo, PS-ANE100-1993-00131 and Policy Memo, PS-ANE100-2001-1993-33.28TLD-R1. Recommendation: REMOVE References	No	I do not see why an AC can not reference a long standing Policy.
59	ANM-140L Tom Phan	Page 3	RTCA DO-178A was superseded by RTCA DO-178B Recommendation: REMOVE Reference	No	The references back to A covers any recertification of legacy hardware.
60	ANM-140L Tom Phan	Page 14 par (d)	DO-178B should be used in lieu of DO-178A Recommendation: DELETE: Level 2 in DO-178A	No	See above response to comment 59
61	ANM-140L Tom Phan	Page 15 Par (5)	AC should not reference FAA Policy Memo Recommendation: Incorporate the applicable section of PS-ANE100-2001-1993-33.28TLD-R1 into this section	No	The policy covers an issue that is not a regulatory item.
62	ANM-140L Tom Phan	Page 33 Par (d)	For engine control systems that have multiple software levels (critical and non-critical), applicant should consider safety features such as protection and partitioning methods to prevent software data corruption between software levels Recommendation: Add safety features such as protection methods in addition to partitioning methods	Yes	Paragraph (d) modified. The second sentence was modified to read; 'The applicant should demonstrate the adequacy of the partitioning method as well as the protection and isolation features provided to prevent corruption between the two levels of software."

63	ANM-140L Tom Phan	Page 35 Par (b)(2)	Upgrade or downgrade of Level C software is not MAJOR software change Recommendation: DELETE: Level C	In part	Tom expanded his comment with the following: "Part 21.93 states ".... ***minor change*** *is one that has no* ***appreciable effect***..."; therefore, I think upgrade or downgrade to SW Level C is considered minor type design change to the engine TC unless the change could adversely affect safety. However, to classify sotware changes as MAJOR or MINOR, a change impact analysis (CIA) should be performed using criteria in Order 8110.49, Chapter 11." The beginning of the paragraph says: "When a change is made to software produced in accordance with the guidelines of RTCA DO-178B, the change should be classified as major if any of the following applies, and the failure effect is Catastrophic, Hazardous or Major. The failure affect of FADEC s/w is always at least Major, because an error could result in the total loss of thrust. Therefore, s/w changes should "virtually" always be considered major. There are exceptions – depending on the s/w change being applied, but that is decided on a case-by-case basis. We will add the above at the beginning of paragraph 14b.(6)(b) that reflects the statement above.
64	ANM140L	Page 17 par 10. b(3)(a)	Definition for the acronym LOTC/LOPC is not given (definition is given on page 19)	Yes	Added definition. Added a note on Page 17 "...LOTC/LOPC (See Para.11.b.(2) for definition)..."
65	ANM140L	Page 19 par 11. b.(2)(a)	First bullet: Why 90%? Why not from idle to maximum rated power or thrust	No	This is a long established level. Much of the background is established in the TLD policy memo.
66	ANM140L	Page 23 par 11. b.(7)(b)	Why is electronic parts selection and procurement guidance under "ECS Failures"? A parts management plan should include quality assurance, qualification, life cycle analysis, part selection, design analysis, data management, operations control, failure tracking, and others as required.	In part	Will draw the connection in the AC as to why we bring up the ECMP under ECS Failures. The following explanation has been included in (7)(a). "The grade and handling of electronic parts is such an important contributor to the reliability of the EEC that this guidance was deemed appropriate to include in this section."

SUBSTANTIVE COMMENTS. Substantive comments must be resolved in the format below. Substantive comments are any comment other then those which:
- correct grammar or sentence structure

- correct spelling
- correct term use
- make simple text changes to clarify the intent, meaning or to improve readability
- change format/structure of the overall document