

DISPOSITION OF PUBLIC COMMENTS

Draft Policy No. PS-ANM-25.981-02

Policy on Issuance of Special Conditions and Exemptions Related to Lightning Protection of Fuel Tank Structure and Systems

No.	Comment	Requested Change	Disposition
Commenter: Bombardier Aerospace			
1	Page 1, Introductory paragraph. Bombardier concurs that some system aspects are impractical particularly considering a system component or transfer element being installed onto structure and with this policy may reduce discussion as to what is system versus what is structure	None. Bombardier supports the policy as written.	Thank you.
2	Page 1, Second paragraph. Bombardier encourages the noted further rule change process to be accomplished in a timely manner as the subject rule is a very complex and costly in addressing the lightning aspects and further clarity can only improve the process with less debate on design acceptance	None. Bombardier supports the policy as written but encourages the proposed rule change action to avoid the noted need for Special Conditions & Exemptions	Thank you.
3	Page 3 ‘...designs be protected from lightning with failure tolerant features.’ Bombardier concurs with the above statement but not with the interpretation that dual fault tolerance is required, assuming a lightning strike (probability of 1). Single fault tolerance (two design features) for lightning, of a robust, well designed structure / system and even a conservative assumption of a lightning strike can provide a level of safety well beyond extremely improbable.	Identify that a single fault tolerant design may satisfy the intent of the rule, with adequate substantiation	<p>The reference the commenter makes is in the Background section, specifically regarding the history of Amendment 25-102. The rule does not dictate the level of fault tolerance.</p> <p>However, with this revised policy, the ultimate goal is to prevent fuel tank explosion due to lightning, and applicants may develop design features so that catastrophic ignition is shown to be extremely improbable supported by adequate substantiation data (which must include considerations for latent failures if they exist.)</p>

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4	<p>Page 7, Eligibility for consideration under this policy.</p> <p>This paragraph appears to take no credit for the required low flammability exposure in the fuel tank; or for the low probability of a direct lightning arc attachment to the airplane. Bombardier recommend that the FAA specify that in respect of lightning protection, a design with two reliable, independent and redundant features to prevent ignition sources is considered reasonably practicable.</p>	<p>Paragraph to read:</p> <p>“This policy may be applied to the design of lightning protection features in fuel tank structure, since two reliable, independent, and redundant protective features to prevent ignition sources provides a safety level commensurate with other systems. Application of the policy to fuel tank systems may also be considered when compliance with 25.981(a)(3) is shown by the applicant to be impractical and determined by the FAA to be impractical. All other potential fuel tank ignition sources must still show compliance with §25.981(a)(3).”</p>	<p>Disagree. We do not intend to specify the number of redundant features. It is the applicant’s responsibility to show how their design meets § 25.981(a)(3) or present rationale for exemption/special conditions in accordance with this policy.</p>
5	<p>Page 7, Guidance for alternative requirements.</p> <p>Bombardier supports this definition of practicality. It would assist the industry if generic examples can be shared, particularly those that have provided the reason to update this policy.</p>	<p>Provide generic examples of system installation areas that have not been considered practical to meet the rule.</p>	<p>The intention of the policy is to provide general guidance for the applicant to design features appropriate for their specific program requirements.</p> <p>We are not aware of any specific examples of system installation that aren’t practical.</p>
6	<p>Page 12, section 4, first paragraph.</p> <p>Bombardier is encouraged that the FAA recognize that in some design cases extreme measures have been taken to satisfy the rule (re: lightning) that have achieved a level of safety beyond that of</p>	<p>Bombardier supports the policy as written but as noted above it is requested that the FAA provide at least one example of where single fault tolerance is acceptable for a systems component.</p>	<p>Same applies here as in #5 above. The intention of the policy is to provide general guidance for the applicant to design features appropriate for their specific program requirements.</p> <p>It has been the FAA’s experience that while</p>

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	other systems. However small in number they might be, it is requested that impracticability examples regarding fuel tank systems be listed.		examples may be helpful for some, they can be limiting for others.
7	Page 12, section 4, second paragraph This paragraph appears to indicate that any change to what has been done to demonstrate compliance may be considered practical, even though previous material in the policy notes that perhaps the safety level demanded, may be beyond that of other systems and not commensurate with the cost & complexity of that required to show compliance. Again Bombardier supports fault tolerant design, including for lightning, but would like the opportunity to limit this to single fault tolerance where justifiable.	Propose re-wording of the first sentence in this paragraph as follows: “Fuel tank system compliance with 25.981(a)(3) has in general been found reasonably practicable to demonstrate. However, it does not necessarily need to be demonstrated if: the safety level is commensurate with other systems; and the safety level improvement is not appreciably improved considering the cost and complexity of the required design features required to show compliance.”	Disagree. This paragraph was included purposely to emphasize that it is the applicant’s responsibility to demonstrate the impracticality of providing redundant protective features in their fuel tank structure and system.

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Commenter: SAE AE-2 and EUROCAE WG-31 Lightning Committees			
1	The SAE AE-2 and EUROCAE WG-31 Lightning Committees commend the FAA on the extensive effort expended to develop this policy. We believe that this effort has provided a much needed standardized and balanced approach,	N/A	Thank you.

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	ensuring that airplane designs will provide a high level of safety while allowing industry to certify fuel tank and system lightning protection designs that provide the proper balance of available means, economic viability, and proportional benefit to safety.		
2	Current Regulatory and Advisory Material section. Since both Section 25.954 and the lightning environment are referenced in this policy, it is recommended that AC 20-53B and AC 20-155A be added as references. Also, AC 20-107B is referenced in the policy but not included in the reference list.	Suggest addition of Advisory Circular 20-53B, <i>Protection of Aircraft Fuel Systems Against Fuel Vapor Ignition Caused by Lightning</i> , Advisory Circular 20-155A, <i>SAE Documents to Support Aircraft Lightning Protection Certification</i> and Advisory Circular 20-107B, <i>Composite Aircraft Structure</i> to the Current Regulatory and Advisory Material section.	Agree. These references will be added. (pg. 3)
3	Section 3(b). Since the material properties do not themselves have electrical current densities, rewording is suggested for clarification.	Suggest revision of Section 3(b) to: “Analysis of the electrical current densities of the material properties of within the fuel tank structure considering its material properties and configuration;”	Agree. Changes will be made. (pg. 12)
4	AE-2 and WG-31 concur with the draft policy approach regarding lightning protection related AWL (CDCCL and/or inspections), and Cautions as described in Section 2, Paragraph 2.b.(8) and Section 5 paragraphs 5.a.(4)(a) and (c). Any	Suggest revision of Policy Section 2, second paragraph, to: “Critical lightning protection features are those that are required to achieve a compliant design or that are needed to provide protection as a condition of a special	Agree. Similar to comment #6 from Boeing below. (pg. 8) Text revised as follows: “Critical lightning protection features are those that are required to achieve a compliant design or that are needed to provide protection as a condition of

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	<p>lightning protection CDCCL must be identified and captured in the AWL and necessary Caution information should be provided in the working level maintenance documentation for the benefit of those performing the maintenance actions. It is recommended that the wording in the second paragraph of Section 2 be clarified as shown to ensure consistent application of the policy.</p>	<p>condition or exemption. CDCCL identifying the presence of these features should be included in the Airworthiness Limitations section. Cautions should be included in the maintenance documentation must be developed and included as CDCCL for these critical lightning protection features that might not be obvious as lightning protection to avoid inadvertent modification or damage during maintenance.”</p>	<p>special conditions or exemption. Cautions must be developed and included as CDCCL <u>identifying the presence of</u> for those critical lightning protection features and <u>should be included in the Airworthiness Limitations section of instructions for continued airworthiness and in the maintenance documentation that might not be obvious as lightning protection.</u> Cautions should be included in the maintenance documentation to avoid inadvertent modification or damage during maintenance. <u>Instructions for restoration and repair methods that are necessary to maintain design of the fuel tank structure and systems should be included in the FAA-approved structural repair manual.”</u></p>
5	<p>Similar to Comment 4 above, AE-2 and WG-31 concur with the draft policy approach regarding lightning protection related AWL (CDCCL and/or inspections), maintenance documents, and SRM as described in Section 2, paragraph 2.b.(8) and Section 5 paragraphs 5.a.(4)(a) and (c). Mandatory maintenance actions necessary to ensure maintained compliance with the lightning protection requirements should be included in the Airworthiness Limitations section and repair methods documented in the SRM. It is recommended that the wording in Section 2, paragraph 2.b.(9) be clarified as shown to ensure consistent application of the</p>	<p>Suggest revision of Policy Section 2, paragraph 2.b.(9) to: “Mandatory maintenance actions necessary to ensure maintained compliance with the lightning protection requirements should be included in the Airworthiness Limitations section of the instructions for continued airworthiness as required by appendix H25.4. CDCCL identifying the presence of lightning protection features and requiring any repairs or restorations be done in accordance with the FAA approved SRM would also be included in the Airworthiness Limitations section. These Instructions for restoration and</p>	<p>Agree. Change will be made as suggested. (pg. 10)</p>

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	policy.	should specify the appropriate repair methods, when applicable, that are necessary to maintain compliance to the lightning protection requirements features of the original design should be included in the FAA approved Structural Repair Manual.”	
6	Definitions, page 2. The definition appears to limit “systems” to fuel systems. Recommend the definition be changed to ensure all systems in the tanks are included.	Suggest revision as shown: “Fuel tank systems,” or “systems,” in the context of this policy statement, include tubing, components, and wiring associated with the fuel system that are penetrating, located within, or connected to the fuel tanks in a way that a critical lightning strike could lead to ignition of fuel vapors.	Agree. Deletion will be made as suggested. (pg. 2)
7	Section 3, last paragraph before subsection a., second sentence. Editorial comment. The word “tolerant” was inadvertently omitted.	Suggest revision to: “non-fault tolerant feature”	Agree. Word will be added. (pg. 12)

No.	Comment	Requested Change	Disposition
Commenter: Aerospace Industries Association (AIA)			
1	The Aerospace Industries Association (AIA) represents manufacturers of civil aviation aircraft, engines, avionics, and	No change requested.	Thank you.

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	<p>components who provide products and airworthiness and maintenance services to commercial and general aviation operators in the U.S. and throughout the world. AIA applauds the FAA for the development of this policy, and strongly agrees with this proposed standardized approach to ensuring that airplane designs will provide a high level of safety, while enabling industry to certify new and innovative fuel tank and system lightning protection designs. We fully endorse the FAA's issuance of this policy as an appropriate and prudent intermediate step to take before implementing changes to the related regulations. AIA also supports initiation of a subsequent rulemaking process to address the practicality issues with § 25.981(a)(3) that would formally adopt the recommendations of the Aviation Rulemaking Committee.</p>		

No.	Comment	Requested Change	Disposition
	Commenter: Boeing Commercial Airplanes		
1	<p>Summary: Boeing Commercial Airplanes commends the FAA on the extensive effort expended to develop this policy. This effort has provided a much needed</p>	<p>No change requested.</p>	<p>Thank you.</p>

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	<p>standardized and balanced approach, ensuring that airplane designs will provide a high level of safety while allowing industry to certify fuel tank and system lightning protection designs that provide the proper balance of available means, economic viability, and proportional benefit to safety.</p> <p>Key to Boeing’s support of the proposed policy is the appropriate standardized definition of the term “practical,” which should allow an applicant to certify designs that balance the level of complexity with safety. The standard for generally providing fault tolerance still raises the safety bar substantially above past lightning protection requirements that did not require fault tolerance. Thus, the proposed policy will ensure the safety of the jet transport fleet, which has not had a fuel systems-related lightning-caused accident since 1976 (before current design methods). Further, the allowance for the inclusion of “systems” under the proposed policy, will allow an applicant to propose designs for FAA approval that also balance complexity with safety.</p> <p>Consistent with the 2011 Large Airplane Fuel Systems Lightning Protection Aviation Rulemaking Committee, Boeing</p>		

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	<p>endorses FAA approval of this new proposed policy as an appropriate and prudent intermediate step before implementing changes to the related regulations. Boeing also encourages the FAA to proceed promptly with proposing formal regulatory changes to eliminate the need for exemptions and special conditions as it is not practical (possible) to comply directly with 14 CFR §25.981, Amendment 25-102 (or 25-125) for fuel systems lightning protection.</p>		
2	<p>Page: 2 Section: Definition of Key Terms (2nd bullet in this section) The proposed text states:</p> <ul style="list-style-type: none"> • <i>Fuel tank systems,” or “systems,” in the context of this policy statement, include tubing, components, and wiring associated with the fuel system that are penetrating, located within, or connected to the fuel tanks in a way that a critical lightning strike could lead to ignition of fuel vapors.</i> <p>The definition appears to limit “systems” to fuel systems. We recommend the definition be changed to ensure that all systems in the tanks are included.</p>	<p>We recommend revising the text to read as follows:</p> <ul style="list-style-type: none"> • <i>Fuel tank systems,” or “systems,” in the context of this policy statement, include tubing, components, and wiring associated with the fuel system that are penetrating, located within, or connected to the fuel tanks in a way that a critical lightning strike could lead to ignition of fuel vapors.</i> 	<p>Agree. Deletion will be made. (pg. 2)</p>

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3	<p>Page: 2 Section: Current Regulatory and Advisory Material.</p> <p>The proposed Policy Memo lists five reference materials. Since both § 25.954 and the lightning environment are referenced in this proposed policy, we recommend that AC 20-53B and AC 20-155A be added as references.</p>	<p>We suggest this section be expanded to include the following additional documents:</p> <ul style="list-style-type: none"> • FAA Advisory Circular (AC) 20-53B, “<i>Protection of Aircraft Fuel Systems Against Fuel Vapor Ignition Caused by Lightning;</i>” and • FAA AC 20-155A, “<i>SAE Documents to Support Aircraft Lightning Protection Certification.</i>” 	<p>Agree. References added. (pg. 3)</p>
4	<p>Page: 2 Section: Current Regulatory and Advisory Material.</p> <p>The text of the second bullet in this section states:</p> <ul style="list-style-type: none"> • <i>Section 25.981, Fuel tank ignition prevention, Amendment 25-125 ...</i> <p>Correction is needed. The title of § 25.981 changed at Amendment 25-125 to <i>Fuel tank explosion prevention.</i></p>	<p>We recommend revising the text to read as follows “• <i>Section 25.981, Fuel tank ignition explosion prevention, Amendment 25-125...</i>”</p>	<p>The title of § 25.981 was intended to be changed with Amendment 25-125, but due to a rulemaking issue, the change was not officially reflected in the printed CFR, which is the legal version. We are currently in the process of having the title corrected to read <i>Fuel tank explosion prevention</i>. Since the current printed CFR still uses <i>Fuel tank ignition prevention</i>, the policy statement will reflect that title.</p>
5	<p>Page: 5 Section: Background, Amendment 26-2 description</p> <p>The proposed text states: Amendment 26-2. Amendment 26-2 (also</p>	<p>We recommend revising the text to read as follows “<i>Amendment 26-2 26-3. Amendment 26-2 26-3 (also part of the FTFR rule issued in 2008) added regulations requiring compliance with the</i></p>	<p>Partially agree (pg. 5). The background related in this section refers to Amendment 26-2. Amendment 26-3 corrected the compliance date only. To clarify, we will add the following note after “September 20, 2010” in the referenced paragraph:</p>

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	<p><i>part of the FTFR rule issued in 2008) added regulations requiring compliance with the flammability standards in the new version of § 25.981(b) for certain existing type designs, for certain type design change programs, for pending new type certificate programs, and for future new production of existing type design airplanes after September 20, 2010. ...</i></p> <p>Correction is necessary. Amendment 26-3 is more current than 26-2. The date for compliance was changed to December 27, 2010, in Amdt. 26-3.</p>	<p><i>flammability standards in the new version of § 25.981(b) for certain existing type designs, for certain type design change programs, for pending new type certificate programs, and for future new production of existing type design airplanes after <u>December 27, 2010.</u> (Note that <u>Amendment 26-2 was part of the FTFR rule issued in 2008 and was amended at Amdt. 26-3 to correct an inadvertent error in the compliance date.)</u></i></p>	<p><i>“...for airplanes after September 20, 2010 (<u>Amdt. 26-3 corrected an inadvertent error in the compliance date.</u>)”</i></p>
6	<p>Page: 7 Section: Policy Paragraph: 2. Guidance for alternative requirements (2nd full paragraph)</p> <p>The proposed text states: <i>Critical lightning protection features are those that are required to achieve a compliant design or that are needed to provide protection as a condition of a special condition or exemption. Cautions must be developed and included as CDCCL for those critical lightning protection features that might not be obvious as lightning protection to avoid inadvertent modification or damage during</i></p>	<p>We recommend revising the text to read as follows:</p> <p><i>Critical lightning protection features are those that are required to achieve a compliant design or that are needed to provide protection as a condition of a special condition or exemption. <u>CDCCL identifying the presence of these features should be included in the Airworthiness Limitations section</u> <u>Cautions should be included in the maintenance documentation</u> must be developed and included as CDCCL for these critical lightning protection features that might not be obvious as lightning protection to avoid</i></p>	<p>Agree. See comment #4 from SAE AW-2 and EUROCAE WG-31 above. The text was revised as follows (pg. 8):</p> <p><i>“Critical lightning protection features are those that are required to achieve a compliant design or that are needed to provide protection as a condition of a special condition or exemption. Cautions must be developed and included as CDCCL <u>identifying the presence of for those</u> critical lightning protection features and <u>should be included in the Airworthiness Limitations section of instructions for continued airworthiness instructions and in the maintenance documentation that might not be obvious as lightning protection</u> <u>Cautions should be included in the maintenance documentation</u> to avoid inadvertent modification or damage during</i></p>

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	<p><i>maintenance.</i></p> <p>We concur with the draft policy’s approach regarding lightning protection- related Airworthiness Limitations (AWL) (CDCCL and/or inspections), and Cautions, as described in paragraph 2.b.(8) and paragraphs 5.a.(4)(a) and (c). Any lightning protection CDCCL must be identified and captured in the AWL and necessary Caution information should be provided in the working level maintenance documentation for the benefit of those performing the maintenance actions. We recommend that the proposed text be clarified as we have indicated above to ensure consistent application of the policy.</p>	<p><i>inadvertent modification or damage during maintenance.”</i></p>	<p>maintenance. <u>Instructions for restoration and repair methods that are necessary to maintain design of the fuel tank structure and systems should be included in the FAA-approved structural repair manual.”</u></p>
7	<p>Page: 9 Section: Policy Paragraph: 2.b.(9)</p> <p>The proposed text states: <i>(9) Mandatory maintenance actions necessary to ensure maintained compliance with the lightning protection requirements should be included in the Airworthiness Limitations section of the instructions for continued airworthiness as required by appendix H25.4. These instructions for should specify the appropriate repair methods, when</i></p>	<p>We recommend revising the text to read as follows:</p> <p><i>(9) Mandatory maintenance actions necessary to ensure maintained compliance with the lightning protection requirements should be included in the Airworthiness Limitations section of the instructions for continued airworthiness as required by appendix H25.4. <u>CDCCL identifying the presence of lightning protection features and requiring any repairs or restorations be done in accordance</u></i></p>	<p>Agree. Text will be changed as suggested (also the same as SAE AE-2 and EUROCAE WG-31 Lightning Committees comment #5).</p>

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	<p><i>applicable, that are necessary to maintain compliance to the lightning protection requirements of the original design.</i></p> <p>Similar to our Comment #6 of 8, above, we concur with the draft policy’s approach regarding lightning protection-related AWL (CDCCL and/or Inspections), maintenance documents, and SRM as described in paragraph 2.b.(8) and paragraphs 5.a.(4)(a) and (c). Mandatory maintenance actions necessary to ensure maintained compliance with the lightning protection requirements should be included in the Airworthiness Limitations section and repair methods documented in the SRM. We recommend that the text in paragraph 2.b.(9) be clarified as we have indicated to ensure consistent application of the policy.</p>	<p><i>with the FAA approved SRM would also be included in the Airworthiness Limitations section. These Instructions for restoration and should specify the appropriate repair methods, when applicable, that are necessary to maintain compliance to the lightning protection requirements <u>features of the original design should be included in the FAA approved Structural Repair Manual.</u></i></p>	
8	<p>Page: 11 Section: Policy Paragraph: 3.b. (Evaluating non-fault tolerance of airplane fuel tank structure)</p> <p>The proposed text states: <i>b. Analysis of the electrical current densities of the material properties of the fuel tank structure;</i></p>	<p>We recommend revising the text to read as follows:</p> <p><i>b. Analysis of the electrical current densities of the material properties within the fuel tank structure <u>considering its material properties and configuration.</u></i>”</p>	<p>Agree. This is the same change suggested by SAE AE-2 and EUROCAE WG-31 Lightning Committees. Change will be made. (pg. 12)</p>

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	Since the material properties do not themselves have electrical current densities, our indicated rewording is suggested for clarification.		

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Commenter: Cessna Aircraft Company, Carlos Ayala, International Certification and Regulatory Affairs			
1	Cessna commends the FAA on the extensive effort expended to provide a standardized and balanced approach to fuel tank and system lightning protection, ensuring that airplane designs will continue to provide a high level of safety while properly balancing available means, economic viability, and proportional benefit to safety. All other clarification comments have been harmonized into the SAE AE-2 / EUROCAE WG-31 Lightning Committees submission.	No change requested.	Thank you.

No.	Comment	Requested Change	Disposition
Commenter: NATCA			
1	Background reference to full-time inerting: Both the 2009 policy memorandum and this proposed policy statement justify the	Revise the Background of the proposed policy statement to include the following after the preamble discussion	Disagree. The information provided in the background section of the policy statement is for information only. Additionally, the text suggested

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	<p>use of alternative requirements that are not as stringent in preventing fuel tank ignition sources as those required by 14 CFR 25.981(a)(3) by referring to an extract from a response to comments in the preamble to Amendment 25-102. That response to comments is from the Federal Register (66 FR 23113) and is provided below in its entirety:</p> <p><i>"FAA's Response: As noted by the commenter, we affirmed that we are not considering a change to the current philosophy of assuming a flammable ullage. However, if technological changes are developed, such as full-time fuel tank inerting, and prove to be a superior method of eliminating the risk of fuel tank ignition, the FAA could consider a change in this philosophy in future rulemaking."</i></p> <p>With regard to that preamble discussion, the FAA implemented the 2009 policy without rulemaking. In addition, the FRM requirements adopted by Amendment 25-125 and used in 14 CFR and the 2009 policy and proposed policy are not "full-time fuel tank inerting" requirements. Those FRM requirements are based on using the FAA standardized Monte Carlo model that assumes certain parameters based on the standard distribution of the</p>	<p>from Amendment 25-102 referencing full-time inerting:</p> <p>"The FRM requirements referenced in the policy are based on the charter for the 2001 ARAC Fuel Tank Inerting Harmonization Working Group to study a highly reliable single string system that would be allowed to be dispatched inoperative under the FAA Master Minimum Equipment List (MMEL). Therefore, the FRM is a "part-time" fuel tank inerting system. Full time full-time fuel tank inerting systems, which are only used by the military for aircraft exposed to combat threats, were determined to be impractical by the 1998 ARAC Fuel Tank Harmonization Working Group. Full-time inerting systems have still not been determined to be practical for transport category commercial airplanes."</p>	<p>by the commenter is not entirely accurate at this time. There are commercial airplanes flying today equipped with mature and reliable inerting mechanisms.</p> <p>At the time of Amdt 25-102, full-time inerting was not practical; however, in the future, more reliable inerting systems may be available.</p> <p>The ultimate goal is to prevent the fuel tank explosion from occurring. This ultimate goal can be achieved by means such as eliminating the ignition sources, flammability, or their combination. A full-time (100% of the time) reliable fuel tank inerting can be one means to consider.</p>

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	<p>parameter for the purposes of a comparison tool. The Monte Carlo analysis was never designed to determine actual flammability of a fuel tank. The FRM requirements are based on the charter for the 2001 ARAC Fuel Tank Inerting Harmonization Working Group to study for highly reliable single string system that would be allowed to be dispatched inoperative under the FAA Master Minimum Equipment List (MMEL). The FRM is a "part-time" fuel tank inerting system. Full time full-time fuel tank inerting systems, which are only used by the military for aircraft exposed to combat threats, were determined to be impractical by the 1998 ARAC Fuel Tank Harmonization Working Group. Therefore, no FAA policy should consider the FRM requirements of Amendment 25-125 to represent a "full-time fuel tank inerting" as discussed in the preamble to Amendment 25-102.</p>		
2	<p><i>2. Guidance for alternative requirements:</i> The policy does not define an acceptable mean for demonstrating the practicality or impracticality of fault tolerant features. This could result in significant differences in fault tolerance designs of transport airplanes.</p>	<p>Add specific guidance for demonstrating the practicality or impracticality of fault tolerant features in either: Section 2. Guidance for alternative requirements or in a new section or attachment with specific guidance on compliance means that provides specific guidance on the type of analysis and considerations that must</p>	<p>Even though the Policy Statement provides some general examples of features which we believe practical, the specific examples are purposely avoided. This is mainly due to the wide variation in the designs and programs. Thus, it is the ultimate responsibility of the applicants to determine the practicality/impracticality of the protective features for their applications and provide the necessary evidence to the FAA in</p>

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		be addressed. Republish the proposed policy for public comment.	showing compliance with the regulations.
3	<p>All references in the policy to the FRM requirements in Appendix M to part 25:</p> <p>The FAA has granted Equivalent Level of Safety (ELOS) findings that allow Design Approval Holders to use slower alternative descent rates in place of the fixed decent rate required by Amendment 25-125. The use of a slower descent rate gives the FRM additional time over the fixed descent rates required by Amendment 25-125 to provide nitrogen enriched air (NEA) to the fuel tank and thereby lower the flammability exposure of the fuel tank before landing. Therefore, if the standardized descent rate specified in Amendment 25-125 were used, the flammability exposure of the fuel tanks utilizing the ELOS descent rates would be higher than they calculate using the slower descent rates. This would likely result in those fuel tanks exceeding the limits of Amendment 25-125; otherwise there would be no need for a DAH to request an ELOS finding for slower alternative descent rates.</p>	<p>Add the following requirement to the policy whenever the policy requires using an FRM that meets the requirements of Appendix M to part 25, Amendment 25-125:</p> <p>"Credit will only be given for FRMs that demonstrate compliance to Amendment 25-125 using the descent rate required by the "Fuel Tank Flammability Assessment Method User's Manual, dated May 2008, document number DOT/FAA/AR-05/8" that is incorporated in 14 CFR 25Sec. 25.981 and Appendix N by 14 CFR 25.5. Credit will not be allowed for FRMs that use alternative slower descent rates or descent profiles that include holds. "</p>	<p>Disagree. Inerting systems that meet the flammability requirements of § 25.981 limit flammability exposure time. The rule does not require eliminated fuel tank flammability under all conditions. The equivalent safety findings noted by the commenter require monitoring of any impact of increased descent rates used by the airplane fleet, and incorporation of modifications into the fleet if the average flammability exposure exceeds the levels needed to comply with the rule.</p>
4	<p>Section 2.a.(1), <i>Design changes or features determined to be practical:</i></p>	<p>Add the following under Section 2.a.(1), <i>Design changes or features determined to be practical:</i></p>	<p>No change needed. The use of metallic foil is listed in that paragraph.</p>

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	<p>The list should include use of a metallic layer such copper foil near the surface of composite wings to dissipate electrical current during lightning strikes. This standard practice has been recommended by the FAA dating back to the 1989 Aircraft Lightning Protection Handbook (Report DOT/FAA/CT-89/22, dated September 1989), or "FAA Handbook." It includes the following information:</p> <p><i>"Metallic fabrics woven from small diameter wires of aluminum or copper can provide very effective protection for non-conductive surfaces. Quinlivan, Kuo and Brick [6.18], and King [6.19] investigated woven wire fabrics and metal foils primarily as protection for carbon fiber composite (CFC) materials, but their findings apply to the protection of non-conductive composites as well." (p. 144)</i></p> <p><i>"Expanded foils are better than wire fabrics at draping over compound curves since they call be stretched somewhat. They can be bonded to composite laminates as well as wire fabrics and, like fabrics, tend to promote arc root dispersion. Thus. much less expanded foil will be burned away at a strike attachment point. than would be the case for an equal thickness of solid foil." (p. 145)</i></p>	<p>"Use of a conductive metallic layer (e.g., expanded copper foil / mesh) near the surface of composite wing fuel tanks to dissipate electricity during a lightning strike event." Include references regarding expanded metal foil shown in adjacent column in the policy memo.</p>	

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	<p>Public information demonstrates the information in the 1989 FAA Handbook is relevant for today's composite fuel tank structure. It shows one manufacturer of a transport category airplane with composite wing fuel tank surfaces chose not to include a copper layer in the fuel tank composite layers. This design decision may have resulted in difficulty in obtaining a fault tolerant fuel tank lightning protection design. However, information on the internet also shows other manufacturers of transport airplanes with composite wing fuel tank structure are following the 1989 FAA Handbook and including a copper layer near the surface of the composite wing fuel tank structure. As stated in the news articles and in FAA Handbook, including a copper layer significantly reduces the electrical current levels in the structure. The reduced current flow helps both the fault tolerance of the structure and provides a Faraday cage affect protecting the systems inside a fuel tank from the higher current flow that would be present without the copper layer. Therefore, use of a conductive metallic layer (e.g., expanded copper foil / mesh) near the surface of composite wing fuel tanks to dissipate electricity during a lightning strike event is practical.</p>		

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5	Section 2 b. Examples of practical design, manufacturing, and maintenance processes: Lead the fleet inspections	<p>Add subparagraph that requires “lead the fleet inspections” of fuel tank features to identify any unanticipated failures that invalidate the failure modes and rates assumed in the system safety assessment. This is particularly important for any critical features whose failure is latent.</p> <p>Add a second paragraph that mandates special inspections for any non-fail safe features such as cap seals or cracking of airplane structure. These inspections are needed to validate assumption concerning failures that were not anticipated at the time of the original</p>	<p>Partially agree. Inspection programs are discussed in the policy, so we do not intend to add “lead the fleet” inspections. The concern of the commenter is addressed by the language in paragraph 3e. Additional considerations are:</p> <ol style="list-style-type: none"> 1) The maintenance processes, such as fleet surveillance, are addressed by the guidance in place, aside from this policy statement (e.g., AC 20-136A). 2) Existing continued operational safety processes (e.g. Order 8110.107) are used to assess unexpected failures in service and impose corrective actions accordingly.
6	Section 3 <i>Evaluating non-fault tolerance of airplane fuel tank structure</i> : This section states “The goal of these alternative requirements is to demonstrate that the occurrence of a lightning strike generating an electrical current of sufficient density (to cause ignition) at a non-fault tolerant structural detail located within a flammable fuel tank environment will not be anticipated over the life of the airplane fleet.” The section also states “Once the flammable fuel tank zones are defined (with probability of occurrence) along with the determination of the probability of a critical lightning strike occurring within	Add new section or attachment with specific guidance on compliance means that provides specific guidance on the type of analysis and considerations that must be addressed, and republish the proposed policy for public comment.	Disagree. It is not the intention of the policy statement to provide specific and detailed methods that may sufficiently address the design features of one application but not be sufficient for all applications. We understand the need for guidance on methods of compliance. We are developing advisory material in support of the future rulemaking that will contain methods of compliance.

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	<p>the flammability zones, an evaluation of the potential for the occurrence of a structural discrepancy (non-fault tolerant feature) within the flammable fuel tank zones can be performed. By determining the probable occurrence of a critical lightning strike, the structure can then be evaluated against the predicted rate of occurrence. For example, if it is shown that the probability of such a lightning strike may occur every x flight hours, the specified structural discrepancies can then be evaluated against that. For example, will inspections be able to reliably detect cracks (at or exceeding gap size required to create arcing) before the probability of occurrence is exceeded.”</p> <p>These statements infer there is a requirement to do a quantitative safety assessment. However the policy does not specifically state a quantitative assessment is required and does not provide specific guidance on the type of analysis and considerations that must be addressed.</p>		
7	<p>Section 3 Evaluating non-fault tolerance of airplane fuel tank structure: The policy issued in 2009 allows single failures, as well as latent plus an additional failure, to result in ignition sources. For airplanes with flammability reduction</p>	<p>Add a requirement to the policy that the type design of any design that has non-fault tolerant ignition prevention features includes an airworthiness limitation that requires the fuel tank FRM to be operational when the</p>	<p>Disagree. As stated in the policy statement, the goal is that the occurrence of a lightning strike generating an electrical current of sufficient density at a non-fault tolerant structural detail located within a flammable environment will not be anticipated over the life the airplane fleet. Thus</p>

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	<p>means (FRM) the FAA has issued special conditions that rely on the FRM in combination with ignition prevention features to prevent a fuel tank explosion caused by lightning. When the FRM is inoperative a single failure in the lightning protection features, such as missing sealant could result in an accident. The FAA has accepted operation of airplanes with the FRM inoperative for many flights, even on warm days when the fuel tanks are commonly flammable. What this means to the flying public is the FAA is allowing dispatch of airplanes on a warm day, with the FRM inoperative, with the possibility of any one of hundreds of single failures existing inside a fuel tank that where there is no indication the failure is present. The fuel tanks are sealed and entry is only scheduled several times during the life of the airplane. Operation of the airplane one failure away from a catastrophic failure is contrary to the fundamental “fail safe” principle on which the current transport fleet safety is based. This should not be allowed. The FAA has not provided any public information showing why such an approval is in the public interest or analysis justification why it is not practical to require the fuel tank FRM to be operative when the airplane is dispatched on warm days when the fuel tanks are</p>	<p>airplane is dispatched on days when the fuel tanks will be flammable based on the dispatch ambient conditions.</p>	<p>applicants are required to achieve this goal in their design by evaluating combined probability in accordance with a flammable condition within a fuel tank, a lightning strike generating an electrical current density within a fuel tank flammability zone, and the presence of a structural discrepancy resulting in a non-tolerant feature with a flammable fuel tank zone.</p>

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	flammable.		
8	<p data-bbox="197 391 751 678"><i>Section 6. Methods of Compliance, states "Specific requirements and methods of compliance to address the design features covered under this Policy will be developed for each specific design by the applicable special conditions or exemption and by the issue paper process until the rulemaking discussed above is completed."</i></p> <p data-bbox="197 721 751 1477">A similar statement is in the 2009 Policy Memo under "Methods of Compliance. Since 2009 the FAA has issued a number of exemptions and special conditions under the 2009 policy. Therefore, the FAA has already developed several methods of compliance issue papers that have been applied to certification projects during the last four years. Those issue papers would provide detailed compliance means information and guidance. The FAA should provide that already developed methods of compliance information in the public domain as part of this policy statement. Without details of the compliance methods the public cannot effectively determine the affect of the policy safety and whether it is in the public interest. It should also be noted that any proprietary information in existing FAA issue papers can be removed and the issue</p>	<p data-bbox="783 391 1299 605">Add new section or attachment with specific requirements and guidance on methods compliance means that are currently the subject of project specific issue papers and republish the proposed policy statement for public comment.</p>	<p data-bbox="1325 391 1990 570">Disagree. We understand the need for guidance on methods of compliance. We are developing advisory material in support of the future rulemaking that will contain methods of compliance.</p>

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	paper compliance means generalized so it can be provided for public comment in this policy.		