Federal Aviation Administration

Memorandum

Date:	May 26, 2009
To:	See Distribution
From:	Manager, Transport Airplane Directorate, Aircraft Certification Service
Prepared by:	Victor Wicklund, ANM-112
Subject:	Policy on Issuance of Special Conditions and Exemptions Related to Lightning Protection of Fuel Tank Structure
Memo No.:	ANM-112-08-002
Regulatory Reference:	14 CFR 11.81; 14 CFR 21.16 and 21.101; 14 CFR 25.954, 25.981, 25.1309; Appendix M to part 25, Appendix N to part 25; 14 CFR 26.33, 26.35, and 25.37; Special Conditions Issued for Boeing Model 737 and 747 Fuel Tank Flammability Reduction Means (FRM)
Policy Reference:	AC 25.981-1C

Summary

This memorandum provides additional Federal Aviation Administration (FAA) policy on the fuel tank safety provisions of Title 14, Code of Federal Regulations (14 CFR) 25.981(a)(3), as amended by Amendment 25-102, for lightning protection of fuel tank structure. The FAA developed this policy because we determined that compliance with current regulatory standards applicable to lightning protection of fuel tank structure may be impractical in some cases for some areas of structural design. In addition, the FAA has now issued standards for fuel tank flammability reduction that may offset some reduction in the ignition prevention standards of § 25.981(a)(3). The FAA therefore plans further rulemaking to address the practicality issues with § 25.981(a)(3). Meanwhile, the FAA will consider the use of the changed product rule (14 CFR 21.101), special conditions, or exemptions to set a proper certification basis for new and changed type designs. This policy memorandum provides the conditions under which special conditions or exemptions should be applied and the alternative requirements that we will

apply instead of § 25.981(a)(3) when we use special conditions or exemptions. These alternative requirements consider the fact that, based on technical advances that the FAA did not envision when Amendment 25-102 was adopted, the FAA has issued new regulations which set specific performance standards for fuel tank flammability, including a revised § 25.981(b) as amended by Amendment 25-125. This policy memorandum also discusses the conditions under which we will use the exception provision of § 21.101 for type design changes to allow application of § 25.981(a) at an amendment level earlier than Amendment 25-102.

Definition of Key Terms

In the policy statement below, the formatting (*italics*, plain text, or [square brackets]) and terms used ("must," "should," or "recommend") have a specific meaning that we explained in Attachment 1.

For this policy, "fuel tank structure" includes structural members, such as airplane skins, joints, ribs, spars, stringers, and associated fasteners, brackets, coatings and sealant.

Current Regulations and Advisory Material

Before Amendment 25-102 to part 25, § 25.954 was the regulation applied to lightning protection of fuel tanks. As it was normally applied, that regulation only required prevention of ignition of vapors in the tank with no consideration of expected design failures, aging, wear, or maintenance errors for airplane structure. After a catastrophic fuel tank explosion accident on a large transport airplane in 1996, the FAA pursued a dual approach to precluding fuel tank explosions. These included (1) reducing the probability of ignition sources occurring in the fuel tanks, and (2) reducing the flammability of the fuel tanks.

At the time we developed Amendment 25-102 (i.e., 1998-2001), the FAA and industry were still exploring the dynamics of tank flammability and the fleet average flammability exposure for transport airplane fuel tanks. Evaluation of the technical and economic viability of fuel tank inerting systems for commercial transport airplanes was also in its early stages then. As a result, the FAA adopted changes to § 25.981(a) that applied the existing safety analysis principles of §§ 25.901(c) and 25.1309(b) to fuel tank system ignition sources.

Amendment 25-102 also added § 25.981(c), which required that fuel tank flammability be minimized, or that effects of an explosion be mitigated such that any damage from a fire or explosion would not prevent continued safe flight and landing. It was intended that this requirement be separate from, and in addition to, the requirement to prevent ignition sources.

While Amendment 25-102 added § 25.981(c) to require minimization of flammability or mitigation of damage from vapor ignition events, Amendment 25-102 primarily focused on the prevention of ignition sources since significantly reducing the level of fuel tank flammability was believed to be impractical then. The amended ignition prevention requirements in § 25.981(a)(3) require consideration of factors such as aging, wear, and

maintenance errors as well as the existence of single failures, combinations of failures not shown to be extremely improbable, and single failures in combination with latent failures to account for the cause of many ignition sources in fuel tanks and deficiencies in the existing regulations. This amendment to § 25.981, which applies to the fuel tank system, requires the designs be protected from lightning with failure tolerant features.

The policy for showing compliance with the ignition prevention requirements of § 25.981 was based on the long-standing practice that fuel tank vapor should be assumed to be flammable at any time (probability of flammability = 1). However, in the preamble to Amendment 25-102, the FAA also suggested we might consider fuel tank flammability exposure in the future in meeting the requirements of § 25.981(a)(3) for ignition prevention. The FAA stated –

"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."

Amendment 25-102 introduced § 25.981(a)(3) –

> **25.981(a):** *" No ignition source may be present at each point in the fuel tank or fuel tank system where catastrophic failure could occur due to ignition of fuel or vapors. This must be shown by:*
>
> *"(3) Demonstrating that an ignition source could not result from each single failure, from each single failure in combination with each latent failure condition not shown to be extremely remote, and from all combinations of failures not shown to be extremely improbable. The effects of manufacturing variability, aging, wear, corrosion, and likely damage must be considered."*

This specific requirement affecting fuel systems is based on the combined requirements of §§ 25.901(c) and 25.1309(b). As stated in Advisory Circular (AC) 25.981-1C, "in order to eliminate any ambiguity as to the restrictions on latent failures, § 25.981(a)(3) explicitly requires that any anticipated latent failure condition not leave the airplane one failure away from a catastrophic fuel tank ignition."

The policy for showing compliance with § 25.981(a)(3) described in AC 25.981-1C also stated that applicants should assume that a lightning attachment could occur at any time (probability of lightning = 1). In addition, industry and FAA practice has been to assume that a defined set of severe lightning current components would be associated with every lightning strike to the aircraft.

After promulgation of Amendment 25-102, the FAA and industry continued research and discussion of the measurement and modeling of fuel tank flammability, and development of practical means to reduce or eliminate flammability in transport airplane fuel tanks. This eventually led to the certification of practical retrofit designs for center wing fuel tank nitrogen generation systems on two existing transport airplane models. Those systems use nitrogen enriched air that is generated onboard the airplane to displace oxygen in the fuel tank. This results in inerting the fuel tank throughout most of the flight and ground operations. An applicant for a new type certificate involving composite

wing structure included a nitrogen generation system for all fuel tanks in the proposed design, including the main fuel tanks.

Amendment 25-125 (part of the fuel tank flammability reduction (FTFR) rule issued in 2008) revised § 25.981(b) and (c) to introduce specific performance based standards for the maximum flammability allowed in various fuel tanks. Amendment 25-125 maintained the alternative adopted by Amendment 25-102 allowing ignition mitigation means. Amendment 25-125 established a new fleet average flammability exposure limit of 3 percent for all fuel tanks, or that of an equivalent conventional unheated aluminum fuel tank. Fuel tanks that are not main fuel tanks and that have any portion located within the fuselage contour must be limited to 3 percent fleet average exposure and 3 percent warm day exposure. As an alternative, an applicant may install a means to mitigate the effects of a fuel tank vapor ignition event in fuel tanks such that no damage caused will prevent continued safe flight and landing. Amendment 25-125 did not change the ignition prevention standards of § 25.981(a).

Amendment 26-2 (also 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. At the same time, Amendments 121-340, 125-55 and 129-46 added operational requirements for installation and operation of flammability reduction means on certain airplanes manufactured after 1991. As stated in the FTFR rule preamble, the FAA made these changes because we recognized that measures in Amendment 25-102 aimed at ignition source prevention would not alone be enough to prevent future fuel tank explosions on transport airplanes. That preamble stated,

> Predicting the effectiveness of ignition prevention actions is challenging, since many ignition sources are the result of human error, which cannot be precisely predicted or quantitatively evaluated. Despite extensive efforts by the FAA and industry to prevent ignition sources, we continue to learn of new ignition sources. Some of these ignition sources are attributable to failures by engineering organizations to identify potential ignition sources and provide design changes to prevent them. Others are attributable to actions by production, maintenance, and other operational personnel, who inadvertently compromise wiring and equipment producing ignition sources. Regardless of the causes, we believe that ignition prevention actions, while necessary, are insufficient to eliminate ignition sources.

Relevant Past Practice

Existing composite and aluminum structural technology can generally provide the ability to withstand single faults and still prevent ignition sources in the event of lightning attachment for most areas of the design. However, systems with potentially catastrophic failure modes typically meet requirements such as §§ 25.901 and 25.1309 through a design architecture that can withstand multiple independent failures without a catastrophic effect. As it applies to fuel tank lightning protection for basic airplane structure, compliance with § 25.981(a)(3) would typically need a design with three highly

reliable, independent, and redundant protective features to prevent ignition sources. However, for certain certification programs conducted since Amendment 25-102 became effective, applicants have shown that it was impractical to provide multiple redundant protective features for some aspects of aircraft structural lightning protection using state-of-the-art technology for both composite fuel tank structure and traditional aluminum fuel tank structure.

A design architecture that can withstand single failures, but not multiple failures, that could result in an ignition source, could potentially comply with § 25.981(a)(3) when combined with either regular inspections at sufficiently short intervals, or when combined with a monitoring device to verify the functionality of the protective features. However, inspections and monitoring features for the various structural design features may not be feasible. Confirming the continued functionality of structural lightning protection features can be difficult because of the significant challenges of providing continual health monitoring of the features. It can also be difficult because of the limited capability to inspect the features without significantly impacting aircraft performance, efficiency, or other features critical to safety. While some concepts involving monitoring aids attached external to the wings have been considered, the protective features are often integral to the fuel tank structure or internal to the fuel tanks. Inspection of features inside fuel tanks requires access to the fuel tanks, which is usually only scheduled a few times during the life of the airplane. Increasing the frequency of internal fuel tank inspections could also have the undesirable effect of increasing the possibility of damaging the lightning protection features or other design features during the inspection process.

Finally, applicants have also argued that it is not practical to provide effective fault tolerance for certain design areas of fuel tank structure. Certain known single failure conditions can create an ignition source in the event of a critical lightning attachment. These areas include cracking of structural elements, complete fracture of a bolt with high tension loading that causes gapping or departure of one or both ends of the bolt from the bolt hole and simultaneously compromises sealant over the bolt, and failures of sealant where the sealant is the primary feature needed to prevent an ignition source. Design changes to provide fault tolerance for these design areas to prevent ignition sources have been found to be impractical.

After examining some of these problematic design areas with applicants, the FAA has agreed that it can be impractical to meet the specific requirements of § 25.981(a)(3) for certain areas of structural design. We will consider granting exemptions, (or exceptions under § 21.101, when applicable) for design features if the applicant shows that compliance is impractical. Two applicants with airplanes using conventional aluminum structure have requested exemptions from § 25.981(a)(3) for structural lightning protection and have received partial exemptions. For another applicant for winglet installation design changes, the FAA found under § 21.101 that an exception applied, allowing application of an earlier amendment of § 25.981(a) for fuel tank structure.

In addition, special conditions to be used instead of § 25.981(a)(3) may be developed for proposed designs that include features to reduce flammability significantly below the level required by § 25.981(b) as amended by Amendment 25-125. Special conditions are

under development for a proposed design using composite wing structure with a flammability reduction system for all fuel tanks.

We developed the following policy to promote a standardized approach to these special conditions and exemptions.

Policy

The FAA now has a better understanding of the flammability exposure level of unheated aluminum wing tanks and the performance and availability of systems providing flammability reduction means. As shown by the issuance of the FTFR rule and as discussed in the preamble for that rule, the FAA has now determined that there are practical methods available to significantly reduce risk because of fuel tank flammability. In addition, the FAA has now determined that application of § 25.981(a)(3) to fuel tank structural lightning protection can be impractical for certain areas of structural design, and is therefore inappropriate for design features where the applicant shows compliance is impractical. Further rulemaking to revise § 25.981 to address this issue is under consideration. The FAA will seek public comment on any rulemaking through the normal rulemaking process.

Meanwhile, until any such rulemaking is completed, the FAA will propose special conditions or grant exemptions with conditions to define appropriate airworthiness requirements for fuel tank systems and changes to fuel tank systems. For design changes where we determine exceptions appropriate under § 21.101, the FAA will apply § 25.981(a) at an earlier amendment level. Specific policy on the application of § 21.101 for type design changes involving fuel tank structure is discussed below. Under § 21.101(g), requirements in part 26 on the certification basis for design change programs cannot be changed using the exception provisions in § 21.101(b).

Because of the impracticality issues discussed above, the FAA will consider proposals to depart from certain aspects of the policy currently contained in AC 25.981-1C for structural lightning protection. That AC calls for applicants to assume the probability of lightning and the probability of flammability are equal to 1. Unlike what was intended under that AC, the safety standards imposed by these special conditions and exemption, consider the likelihood of a fuel tank vapor ignition event, not the likelihood of an ignition source alone. For a vapor ignition event to occur because of a structural failure (or combination of structural failures), that failure must be combined with a critical lightning strike and with flammable conditions in the fuel tank. (A critical lightning strike is one where the strike location affects the failed feature and the amplitude of the strike is sufficient to create an ignition source when combined with that failed feature.)

Therefore, for practicality reasons, the FAA has determined that it is acceptable in this case to treat the required analysis as similar to a multiple failure probabilistic analysis performed under § 25.1309(b). Specifically, when complying with the proposed special conditions and exemptions described below, the FAA considers it acceptable to consider the probability of lightning strike, the statistical distribution of lightning strike amplitude, and the probability of fuel tank flammability when performing the required safety

analysis. The FAA has not yet approved specific methods to quantify the probability of lightning attachment or the distribution of lightning strike energy. Therefore, specific agreements on the quantification of these factors should be coordinated with the Transport Airplane Directorate (TAD) through the issue paper process. The FAA has adopted part 25 Appendix N as the required method to quantify fuel tank flammability when showing compliance to the flammability exposure requirements of Amendment 25-125. Alternative methods to quantify fuel tank flammability may also be acceptable for performing the safety analyses required by special conditions or exemptions issued under this policy. Any such alternative methods should be coordinated with the TAD through the issue paper process. This specific policy should not be interpreted as changing other current FAA policy on use of the probability of environmental or operational conditions in performing safety analyses.

Eligibility for Consideration Under This Policy

The relief from § 25.981(a)(3) provided by this policy is limited to areas of fuel tank structure for which compliance with § 25.981(a)(3) is shown by the applicant and determined by the FAA to be impractical. General design areas for which the TAD has determined compliance with § 25.981(a)(3) can be impractical include structural members and joints, fasteners, coatings, and sealants. System supporting structure that is intended and expected to remain undisturbed for the life of the airplane uses many of the same construction techniques and presents some of the same impracticality issues, and is therefore eligible for consideration as an "area of fuel tank structure." However, system supporting structure that is likely to be disturbed if maintenance is required on a system (even if that system would not normally require maintenance) is not eligible and should be required to comply with § 25.981(a)(3). For these design areas, disassembly and reassembly of electrical bonding elements is considered to present a significant additional risk that a bond will be compromised during the life of an airplane, which generally does not exist for structure that is intended to be permanent. In addition, the provisions for electrical bonding of an internally mounted fuel pump housing that is directly attached to wing structure, and is intended and expected to remain attached for the life of the airplane, are eligible for consideration.

Determinations of practicality are somewhat subjective and can be dependent on the proposed design and the "state of the art" at the time. Thus, if one applicant shows that it is practical to eliminate a potentially catastrophic single failure, any other applicant would typically not be able to show that eliminating that particular failure is impractical. In addition, the state of the art may evolve so that it becomes practical to provide fault tolerance for design areas or features for which fault tolerance currently is considered impractical. If this occurs, the FAA will consider revising this policy to address these advances. Practicality determinations that are outside the examples provided below should be sent to the TAD for review to ensure standardization.

Examples of FAA Practicality Determinations

Examples of design changes or features determined to be practical include:

- Installation of rivets and bolts in aluminum structure that are well bonded through strict control of fastener/hole fit, fastener and hole quality, and installation practices to prevent the creation of arcs, sparks or hot gas ejection in the event of a critical lightning strike;

- Installation of bolts in composite structure that are well bonded through strict control of fastener /hole fit, fastener and hole quality, and installation practices, and with additional design features to distribute current such as foil or mesh at the material surface, to prevent the creation of arcs, sparks or hot gas ejection in the event of a critical lightning strike;

- Installation of lightning protective sealant or cap seals over fastener heads/ends located inside fuel tanks to provide fault tolerance.

Examples of design areas and/or failure modes determined impractical to provide fault tolerance include:

- Fatigue cracking within structural elements such as spars, skins, stringers, and ribs;

- Failure of fasteners highly loaded in tension that lead to separation of the fastener or part of the fastener from the hole or gapping of the fastener head or nut, and consequent failure of a cap seal.

An example of a design change or feature to provide fault tolerance that has been determined to be impractical:

- Installation of double cap seals or structurally reinforced cap seals to retain a bolt that fails under tension.

Examples of design, manufacturing, and maintenance program measures determined to be practical are shown below. Although these practices themselves are not considered to be "independent features" for providing fault tolerance, they can be considered as measures to minimize the likelihood of failures or measures necessary to support assumptions about failure modes or rates in a safety analysis:

- A structured design review process to ensure that all relevant design features are reviewed to identify critical design areas, critical processes, and associated testing and analysis requirements;

- Engineering review of the proposed design to identify failure modes that may occur because of manufacturing variability (including errors or escapes), maintenance errors, repairs or alterations, aging, wear, corrosion, or likely damage;

- Engineering review of manufacturing processes to identify failure modes that may occur because of manufacturing variability (including errors or escapes);

- Engineering review of service history records to identify failure modes that may occur because of manufacturing variability (including errors or escapes), maintenance errors, repairs or alterations, aging, wear, corrosion, or likely damage;

- Implementation of practical manufacturing and quality control processes to address the issues identified through the required engineering reviews;

- Manufacturing and quality control processes that include measures typically used for other critical features of the airplane;

- Quality control processes that require inspection of critical features by a person other than the person that performed the manufacturing work;

- Provisions in instructions for continued airworthiness to identify critical design configuration control limitations, to require life limits or repetitive inspections for specific features to detect anticipated failures, and to perform maintenance on critical areas.

Note that quality control and design evaluation practices themselves are not considered to be "independent features" for providing fault tolerance. They are instead measures to minimize the likelihood of failures or measures necessary to support assumptions about failure modes or rates in a safety analysis.

Because non-fault-tolerant design features can be more easily addressed early in the certification process, applicants should identify any potential non-fault-tolerant design features early in their design development.

Special Conditions

The FAA will propose special conditions under § 21.16 to address lightning protection of fuel tank structure for fuel tank systems with flammability reduction means that meet or exceed the performance standards set in Appendix M to part 25 as amended by Amendment 25-125 for all fuel tanks on the airplane. Since compliance with § 25.981(b) as amended by Amendment 25-125 only requires compliance with the performance requirements of Appendix M for normally emptied fuel tanks within the fuselage contour, a flammability reduction system that complies with the Appendix M requirements for all fuel tanks is considered to be an unusual feature.

In addition, the FAA considers the requirements in § 25.981(a)(3) inappropriate for fuel tank structural lightning protection features where applicants show that application of those requirements is impractical. The FAA also finds that an equivalent level of safety can be achieved with less stringent ignition source prevention requirements. Specifically,

meeting the Appendix M standard for all fuel tanks would reduce fuel tank flammability significantly below the maximum level that would otherwise apply to the main tanks on airplane designs that are required to meet Amendment 25-125. This additional risk reduction would be considered a compensating feature that offsets some relaxation of the requirements contained in § 25.981(a)(3).

When the FAA determines that special conditions are appropriate instead of § 25.981(a)(3), the special conditions will typically include requirements addressing the following areas. The FAA has determined that these alternative requirements would be applicable and sufficient for most designs.

1. The airplane design must meet or exceed the requirements of Appendix M of part 25 as amended by Amendment 25-125 for all fuel tanks installed on the airplane.

2. Instead of compliance with the requirements of § 25.981(a)(3), the applicant must show that the design includes at least two independent, effective, and reliable lightning protection features (or sets of features) such that fault tolerance to prevent lightning-related ignition sources is provided for each area of the structural design area proposed to be exempt from the requirements of that regulation. Fault tolerance is not required for any specific design feature if:

    a. providing fault tolerance is shown to be impractical for that feature, and

    b. fuel tank vapor ignition because of that feature and all other non-fault-tolerant features, when their fuel tank vapor ignition event probabilities are summed, is shown to be extremely improbable.

3. The applicant must perform an analysis to show that the design, manufacturing processes, and airworthiness limitations section of the instructions for continued airworthiness include all practical measures to prevent, and detect and correct, failures of structural lightning protection features because of manufacturing variability, aging, wear, corrosion, and likely damage.

The intent of paragraph 2b above (and the identical paragraph 1b in the exemption section below) is to require a structured, quantitative assessment of fleet average risk for a fuel tank vapor ignition event because of all non-fault-tolerant design features included in the design. This will require determination of the number of non-fault tolerant design features, estimates of the probability of the failure of each non-fault-tolerant design feature, and estimates of the exposure time for those failures. This analysis must include failures because of manufacturing variability, aging, wear, corrosion, and likely damage. It is acceptable to consider the probability of fuel tank flammability, the probability of a lightning strike to the airplane, and a distribution of lightning strike amplitude in performing the assessment provided the associated assumptions are acceptable to the FAA. The analysis must account for any dependencies among these factors, if they are used. The assessment must also account for operation with inoperative features and systems, including any proposed dispatch relief. This risk assessment requirement is intended to ensure that the potential for failure of non-fault-tolerant features is minimized

and that an excessive number of non-fault-tolerant design features does not exist in the design.

Exemptions for New Type Certificate Programs

For new type certificate programs, the FAA will consider granting exemptions from § 25.981(a)(3) for lightning protection of fuel tank structure on airplanes with fuel tank systems that do not comply with that regulation, but which do comply with the applicable fuel tank flammability performance standards of § 25.981 as amended by the applicable amendment level. To grant such an exemption, the FAA must find that the approval of the proposed design would provide an acceptable level of safety, and would be in the public interest.

Note: Title 14 CFR 26.37 addresses pending type certification projects as of the effective date of the rule. That section states, for new type certificates for airplanes with 30 passengers or more or payload of 7500 pounds or more for which application was made prior to the effective date of the rule, and for which the certificate was not issued by that same date, § 25.981 as of the effective date of the rule (Amendment 25-125) applies. For pending type certificate projects as of the effective date of the rule that do not exceed either the passenger or payload threshold, the flammability requirements of § 25.981 as amended by Amendment 25-102 would apply.

The FAA does not expect to be able to make the findings required for an exemption from § 25.981(a)(3) for a new aircraft type that does not meet the applicable flammability requirements of § 25.981. Therefore, it is not envisioned that the FAA would grant exemptions to both §§ 25.981(a)(3) and the flammability requirements of § 25.981 for a new type certificate program.

Title 14 CFR 11.81 lists the information that must be included in a petition for exemption. A petitioner seeking an exemption under this policy must include in their petition all of the information required by that regulation. In providing that information, petitioners should address the following:

1. In responding to § 11.81(c), petitioners seeking an exemption under this policy should refer to this policy memorandum as acknowledging that compliance with § 25.981(a)(3) is impractical for some areas of structural lightning protection design. The petitioner should identify the specific design features for which an exemption is sought. The petitioner should show that all practical measures have been taken to meet the requirements of § 25.981(a)(3) for the fuel tank structure. For the design features for which an exemption is sought, the petitioner should show what potentially compliant design changes were examined, and what design changes were ruled out based on impracticality.

2. In responding to § 11.81(e), a petitioner seeking an exemption under this policy should address each of the safety requirements listed below and reference this policy memorandum as acknowledging that an acceptable level of safety is

expected to be provided if those safety requirements are met. In addition, the petitioner should include any other information they believe supports a finding that an acceptable level of safety will be provided.

If the FAA determines that it is in the public interest to grant an exemption, the FAA would typically apply the following ignition source prevention conditions to ensure that an acceptable level of safety is provided. The FAA has determined that these alternative requirements would be applicable and sufficient for most designs.

1. Instead of compliance with the requirements of § 25.981(a)(3), the applicant must show that the design includes at least two independent, effective, and reliable lightning protection features (or sets of features) such that fault tolerance to prevent lightning-related ignition sources is provided for each area of the structural design area proposed to be exempt from the requirements of that regulation. Fault tolerance is not required for any specific design feature if:

    a. providing fault tolerance is shown to be impractical for that feature, and

    b. fuel tank vapor ignition because of that feature and all other non-fault-tolerant features, when their fuel tank vapor ignition event probabilities are summed, is shown to be extremely improbable.

2. The applicant must perform an analysis to show that the design, manufacturing processes, and airworthiness limitations section of the instructions for continued airworthiness include all practical measures to prevent, and detect and correct, failures of structural lightning protection features because of manufacturing variability, aging, wear, corrosion, and likely damage.

Exemptions for Certain Type Design Change Programs on Amendment 25-102 Airplanes

For type design change programs on Amendment 25-102 airplanes, the FAA will consider granting exemptions from § 25.981(a)(3) as described above for new type certificates. The same ignition source prevention conditions described above will be applied. For pre-Amendment 25-125 airplanes, the fuel tank flammability standards for the design change will be those required under §§ 26.33 and 26.35 as adopted in Amendment 26-2.

Use of Exceptions Under § 21.101 for Type Design Change Programs on Pre-Amendment 25-102 Airplanes

For type design changes on pre-Amendment 25-102 airplanes that are classified as "significant product level changes" under § 21.101, the FAA will consider allowing applicants to show compliance with an earlier amendment level of § 25.981(a) for lightning protection of fuel tank structure, under the provisions of § 21.101. The FAA determination will be based on the potential impact on fuel system safety that would result from application of Amendment 25-102. If the change would not result in a significant reduction in the risk of a lightning related fuel tank vapor ignition event were it required to comply with § 25.981(a)(3) as amended by Amendment 25-102, the "would

not materially contribute to the level of safety of the changed product" exception provision of § 21.101(b)(3) will be used to allow application of an earlier amendment of § 25.981(a). For example, the FAA has found that compliance with an earlier amendment was acceptable for projects involving the installation of winglets, in which a limited number of stringers and fasteners were added within the fuel tank and for which all new fasteners were cap-sealed to provide fault tolerance. Any exception would be limited to aspects of lightning protection of fuel tank structure where no material benefit from compliance is shown.

Exemptions for Type Design Change Programs on Pre-Amendment 25-102 Airplanes

For type design change programs that include § 25.981(a)(3) at Amendment 25-102 as a result of application of the certification basis upgrade provisions of § 21.101, and for which an exception under § 21.101 is not appropriate, the FAA will consider granting exemptions from § 25.981(a)(3). For example, for a design change that adds wing reserve tanks to an airplane, or that redesigns a significant portion of the wing structure, compliance with § 25.981(a)(3) as amended by Amendment 25-102 would have a material impact on fuel system safety. In such cases, the exemption conditions described above will be applied to set appropriate standards for that potential additional risk. For pre-Amendment 25-125 airplanes, the fuel tank flammability standards for the design change will be those required under the applicable provisions of §§ 26.33 and 26.35 at Amendment 26-2.

Methods of Compliance

Specific requirements and methods of compliance to address the above considerations 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.

Applicability of § 25.954

Applicants should note that the airplane design must comply with the provisions of § 25.954. The policy discussed in this memorandum is not intended to affect or eliminate the requirement to comply with that regulation.

Effect of Policy

The FAA individual implementing this policy should follow this policy when it is applicable to a specific project. If the implementing office becomes aware of reasons an applicant's use of this policy should not be approved, the office must coordinate its response with the policy issuing office.

Applicants should expect that certificating officials would consider this information when developing certification options relevant to new certificate actions.

Implementation

This policy discusses administrative design approval options available to applicants for type certificate, amended type certificate, supplemental type certificate, and amended

supplemental type certification programs. These administrative compliance options are currently available and will continue to be available until regulatory changes preclude the need for these administrative design approval options.

/s/

Ali Bahrami

Attachment 1: Definition of Key Terms

Distribution List:
Manager, Los Angeles Aircraft Certification Office, ANM-100L
Manager, Denver Aircraft Certification Office, ANM-100D
Manager, Seattle Aircraft Certification Office, ANM-100S
Manager, Anchorage Aircraft Certification Office, ACE-115N
Manager, Wichita Aircraft Certification Office, ACE-115W
Manager, Chicago Aircraft Certification Office, ACE-115C
Manager, Atlanta Aircraft Certification Office, ACE-115A
Manager, Ft. Worth Airplane Certification Office, ASW-150
Manager, Ft. Worth Special Certification Office, ASW-190
Manager, New York Aircraft Certification Office, ANE-170
Manager, Boston Aircraft Certification Office, ANE-150
Manager, International Branch, ANM-116
Manager, Brussels Aircraft Certification Staff, AEU-100
Manager, Standardization Branch, ANM-113
Manager, Rotorcraft Directorate Standards Staff, ASW-110
Manager, Small Airplane Directorate Standards Office, ACE-110
Manager, Engine and Propeller Directorate Standards Staff, ANE-110
Manager, Military Certification Office, ACE-100M

Attachment 1

Definition of Key Terms

Table A-1 defines the use of key terms in this policy statement. The table describes the intended functional impact, and the formatting used to highlight these items.

- The term "must" refers to a regulatory requirement that is mandatory for design approval. Text communicating a requirement is in *italics*.
- The term "should" refers to instructions for a particular method of compliance. If an applicant wants to deviate from these instructions, he has to coordinate the alternate method of compliance with the Transport Standards Staff using an issue paper. There is no special text formatting used for methods of compliance.
- The term "recommend" refers to a recommended practice that is optional. Enclose recommendations in [ ] brackets.

Table A-1 Definition of Key Terms

	Regulatory Requirements	**Acceptable Methods of Compliance**	**Recommendations**
Language	Must	Should	Recommend
Format	*Italics*	Regular text (No special formatting)	[Square brackets]
Functional Impact	No Design Approval if not met	Alternative has to be approved by issue paper.	None, because it is optional

Examples from policy on Power Supply Systems for Portable Electronic Devices (PSS for PED):

- *Even though PSS for PED systems may use wiring that is produced for the consumer market, the wiring must meet the flammability requirements of § 25.869.*
- Although multiple power control switches may be used (e.g., zonal control of system power), there should be a single master switch that allows for the immediate removal of power to the entire PSS for PED
- [We recommend that you provide a means of indication to enable the cabin crew to determine which outlets are in use or which outlets are available for use.]