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Reduction of Fuel Tank Flammability in Transport Category Airplanes; Proposed Rule

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Parts 25, 91, 121, 125, and 129

[Docket No. FAA–2005–22997; Notice No. 05–14]

RIN 2120–A123

Reduction of Fuel Tank Flammability in Transport Category Airplanes

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Notice of proposed rulemaking (NPRM).

SUMMARY: This NPRM proposes new rules that will require operators and manufacturers of transport-category airplanes to take steps that, in combination with other required actions, should greatly reduce the chances of a catastrophic fuel-tank explosion. The proposal follows seven years of intensive research by the FAA in collaboration with industry into promising technologies designed to make fuel tanks effectively inert, thus preventing electrical and other systems from igniting flammable vapors in the fuel tank ullage (vapor space). The result of that research is that fuel tank inerting, originally thought to be prohibitively expensive, can now be accomplished in a reasonably cost-effective fashion and protect the public from future calamities which, we have concluded, are otherwise virtually certain to occur. The new rules, if adopted, would not actually direct the adoption of specific inerting technology either by manufacturers or operators but would establish a performance-based set of requirements that do not specifically direct the use of fuel-inerting but rather set acceptable levels of flammability exposure in tanks most prone to explosion or require the installation of an ignition mitigation means in an affected fuel tank. Technology now provides a variety of commercially feasible methods to accomplish these vital safety objectives.

DATES: Send your comments on or before March 23, 2006.

ADDRESSES: You may send comments, identified by Docket No. FAA–2005–22997, using any of the following methods:

DOT Docket Web site: Go to *http://dms.dot.gov* and follow the instructions for sending your comments electronically.

Government-wide rulemaking Web site: Go to *http://www.regulations.gov* and follow the instructions for sending your comments electronically.

Mail: Docket Management Facility; U.S. Department of Transportation, 400 Seventh Street, SW., Nassif Building, Room PL–401, Washington, DC 20590–001.

Fax: 1–202–493–2251.

Hand Delivery: Room PL–401 on the plaza level of the Nassif Building, 400 Seventh Street, SW., Washington, DC, between 9 a.m. and 5 p.m., Monday through Friday, except Federal holidays.

For more information on the rulemaking process, see the **SUPPLEMENTARY INFORMATION** section of this document.

Privacy: We will post all comments we receive, without change, to *http://dms.dot.gov*, including any personal information you provide. For more information, see the Privacy Act discussion in the **SUPPLEMENTARY INFORMATION** section of this document.

Docket: To read background documents or comments received, go to *http://dms.dot.gov* at any time or to Room PL–401 on the plaza level of the Nassif Building, 400 Seventh Street, SW., Washington, DC between 9 a.m. and 5 p.m., Monday through Friday, except Federal holidays.

FOR FURTHER INFORMATION CONTACT: Michael E. Dostert, FAA, Propulsion/Mechanical Systems Branch (ANM–112), Transport Airplane Directorate, Aircraft Certification Service, 1601 Lind Avenue, SW., Renton, Washington 98055–4056; telephone (425) 227–2132, facsimile (425) 227–1320; e-mail: *mike.dostert@faa.gov.*

SUPPLEMENTARY INFORMATION:

Comments Invited

The FAA invites interested persons to participate in this rulemaking by submitting written comments, data, or views. We also invite comments relating to the economic, environmental, energy, or federalism impacts that might result from adopting the proposals in this document. The most helpful comments reference a specific portion of the proposal, explain the reason for any recommended change, and include supporting data. We ask that you send us two copies of written comments.

We will file in the docket all comments we receive, as well as a report summarizing each substantive public contact with FAA personnel concerning this proposed rulemaking. The docket is available for public inspection before and after the comment closing date. If you wish to review the docket in person, go to the address in the **ADDRESSES** section of this preamble between 9 a.m. and 5 p.m., Monday through Friday, except Federal holidays. You may also review the docket using the Internet at the web address in the **ADDRESSES** section. Comments that you may consider to be of a sensitive security nature should not be sent to the docket management system. Send those comments to the FAA, Office of Rulemaking, ARM–1, 800 Independence Avenue, SW., Washington, DC 20591.

Privacy Act: Using the search function of our docket Web site, anyone can find and read the comments received into any of our dockets, including the name of the individual sending the comment (or signing the comment on behalf of an association, business, labor union, etc.). You may review DOT's complete Privacy Act Statement in the **Federal Register** published on April 11, 2000 (65 FR 19477–78) or you may visit *http://dms.dot.gov.* Before acting on this proposal, we will consider all comments we receive on or before the closing date for comments. We will consider comments filed late if it is possible to do so without incurring expense or delay. We may change this proposal in light of the comments we receive.

If you want the FAA to acknowledge receipt of your comments on this proposal, include with your comments a pre-addressed, stamped postcard on which the docket number appears. We will stamp the date on the postcard and mail it to you.

Availability of Rulemaking Documents

You can get an electronic copy using the Internet by:

(1) Searching the Department of Transportation's electronic Docket Management System (DMS) web page (*http://dms.dot.gov/search*);

(2) Visiting the Office of Rulemaking's web page at *http://www.faa.gov/avr/arm/index.cfm*; or

(3) Accessing the Government Printing Office's web page at *http://www.access.gpo.gov/su_docs/aces/aces140.html.*

You can also get a copy by submitting a request to the Federal Aviation Administration, Office of Rulemaking, ARM–1, 800 Independence Avenue, SW., Washington, DC 20591, or by calling (202) 267–9680. Make sure to identify the docket number, notice number, or amendment number of this rulemaking.

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I. Executive Summary

Fuel tank explosions have been a constant threat with serious aviation safety implications for many years. Since 1960, some 17 airplanes have been destroyed as the result of a fuel tank explosion.[1] Four fatal airplane accidents have been caused by fuel tank explosions just since 1989. Two of the more recent accidents—one involving a Boeing Model 747 (TWA Flight 800) off Long Island, New York in 1996 and the other, a Boeing Model 727 accident (Avianca Flight 203) in Bogotá, Columbia in 1989—occurred during flight and led to catastrophic losses, including the deaths of 337 individuals. The two other recent explosions occurred on the ground but led to nine fatalities.[2] Although it was determined that a terrorist's bomb had caused the explosion of the center tank in the Bogotá accident, the NTSB determined the ''bomb explosion did not compromise the structural integrity of the airplane; however, the explosion punctured the [center wing tank] and ignited the fuel-air vapors in the ullage, resulting in destruction of the airplane.'' Investigations of the other three accidents failed to identify the ignition source that caused the explosion. But in each instance the weather was warm, with an outside air temperature over 80 °F, the incident occurred during the initial (ground, takeoff or climb) phases of flight, and the explosion involved empty or nearly empty tanks that had been previously fueled. Additionally, investigators were able to conclude that the center wing fuel tank in all four airplanes contained flammable vapors in the ullage (that portion of the fuel tank not occupied by liquid fuel) when the fuel tanks exploded. While the proposed requirements are not intended to address terrorist initiated fuel tank explosions, a system designed to reduce the likelihood of a fuel tank fire, or mitigate the effects of a fire should one occur, would have prevented these four fuel tank explosions.

A statistical evaluation of these accidents has led the FAA to project that nine more transport category airplanes will likely be destroyed by a fuel tank explosion in the next 50 years, unless remedial measures are taken. Although we cannot forecast precisely when these accidents would occur, computer modeling that has been an accurate predictor in the past indicates these events are virtually certain to occur. We believe at least eight of these explosions are preventable if we adopt a comprehensive safety regime to reduce both the incidence of ignition and the likelihood of an explosion following ignition. We have already taken steps through other regulatory actions to reduce the chances of ignition. Today's proposal attempts to address the risk of an explosion by reducing the likelihood that fuel tank vapors cause an explosion when an ignition source is introduced into the tank.

Since the introduction of turbine powered airplanes, the FAA has premised its fuel tank rules on the assumption that fuel tanks will always contain flammable vapors and thus the best way to prevent explosions is to eliminate ignition sources. Since 2001, we have imposed airworthiness requirements (including airworthiness directives or ''ADs'') directed at the elimination of fuel tank ignition sources. Although these measures—particularly Special Federal Aviation Regulation 88 of 14 CFR part 21 (SFAR 88), which requires the detection and correction of potential system failures that can cause ignition—should prevent some of the nine forecast explosions, review of the current designs of airplanes in the transport category of all major manufacturers has shown that unanticipated failures and maintenance errors will continue to generate unexpected ignition sources. We have concluded we are unlikely ever to identify and eradicate all possible sources of ignition.

To ensure safety, therefore, we must also focus on the environment that permits combustion to occur in the first place. Technology now exists that can prevent ignition of flammable fuel vapors by reducing their oxygen concentration below the level that will support combustion. By thus making the vapors ''inert,'' we can significantly reduce the likelihood of an explosion when a fire source is introduced to the fuel tank. Prototype onboard fuel tank inerting systems have been successfully flight tested on Airbus A320, Boeing Model 747, and Model 737 airplanes. Boeing applied in 2002 for type certification of an inerting system for the Model 747 that it plans to install on all new production 747 aircraft.

Because the chances of a fuel tank explosion naturally correlate with the exposure of the tank to flammable vapors, the proposed requirements would mitigate the effects of such exposure or limit such exposure to acceptable levels by mandating the installation of either a Flammability Reduction Means (FRM) or an Ignition Mitigation Means (IMM). In either case, the technology would have to adhere to performance and reliability standards that would be set by the FAA and contained in Appendices K and L to Title 14 Code of Federal Regulations (CFR) part 25.

If adopted, this rulemaking would amend the existing airworthiness

[1] None of the 17 explosions occurred on an airplane manufactured by Airbus, who, along with Boeing, would be most affected by this rulemaking. Although Airbus currently delivers more airplanes worldwide than Boeing, their cumulative fleet hours are still relatively small, at approximately 65 million (approximately 9% of total fleet hours for all transport category airplanes). Based on the FAA's projection of the likelihood of an explosion based on one accident every 60 million hours, there is a 40% chance that no Airbus accidents would have occurred to date.

[2] Philippine Airlines 737 accident in 1990 and the Thai Airlines accident in 2001.

standards contained in 14 CFR 25.981 so as to require all type certificate (TC) holders and their licensees to develop FRM or IMM for many large turbine powered transport category airplanes with high risk fuel tanks. We would also amend 14 CFR parts 91, 121, 125 and 129 so as to require operators of these airplanes to incorporate the approved FRM or IMM and to keep them operational. We estimate that approximately 3,800 Airbus and Boeing airplanes operated in the United States would be affected. Fuel tank system designs in several pending type-certification applications, including the Airbus A380 and the Boeing Model 7E7, would also have to meet the proposed requirements.

We acknowledge that the proposed requirements are costly and propose these steps only after spending several years, in cooperation with scientists and other experts from the affected industry, researching the most cost-effective ways to prevent fuel tank explosions. Those efforts have resulted in the development of fuel-inerting technology that is vastly cheaper than originally thought.

The loss of a single, fully loaded large passenger aircraft in flight, such as a Boeing Model 747 or Airbus A380, moreover, would result in death and destruction causing societal loss of at least $1.2 billion based on prior calamities, and we project that the new rule would prevent four accidents of some type (for analytical purposes we assume the accidents would involve ''average'' aircraft with ''average'' passenger loads) over 50 years. Such estimates of harm do not account for the intangible costs of a series of in-flight explosions (such as a loss of confidence in aviation) or the indirect costs (such as trip cancellations following these incidents).

Our philosophy is to address aviation safety threats whenever practicable solutions are found, especially when dealing with intractable and catastrophic risks like fuel tank explosions that are virtually certain to occur. Thus, now that solutions are reasonably cost-effective, the Administrator has tentatively determined that it is necessary for safety and in the public's best interest to adopt the requirements proposed today. This action is in response to an NTSB recommendation.

II. Background

A. The Need for Safety Improvements in Fuel Tank Systems

Fuel tank explosions continue to occur despite many safety improvements over the last 40 years aimed at removing ignition sources from fuel tanks. Experience tells us that even with the latest and most comprehensive initiative, SFAR 88, we cannot adequately protect the public from fuel tank explosions absent measures designed to lessen the exposure of vulnerable tanks to highly flammable jet fuel vapors. Fortunately, by taking such steps now to complement ignition-source reduction measures already taken, we are confident that fuel tank explosions in affected aircraft will be nearly eliminated.

For a variety of reasons, SFAR 88, though a significant advancement in safety, will never provide a complete safeguard against fuel tank explosions; thus our analysis has assumed that SFAR 88 will not reduce the possibility of a fuel explosion occurring by more than 50 percent. To be sure, SFAR 88 has resulted in several significant changes in fuel tank system design and maintenance, including (1) new features to prevent dry running of fuel pumps within the fuel tanks; (2) use of ground fault protection of fuel pump power supplies for pumps or wires exposed to the fuel tank ullage; (3) addition of electrical bonds on some components; (4) use of electrical energy limiters on wiring entering fuel tanks that are ''normally emptied'' [3] and located within the fuselage contour; (5) electrical bond integrity checks; and (6) improved maintenance programs. These design improvements, however, do not and cannot address all sources of ignition (such as external ignition sources resulting from fire).

Past experience, moreover, shows that it is not possible to pinpoint and remove every ignition source from a large, complex transport aircraft. For example, the FAA is aware of one case where a manufacturer had conducted an exhaustive design review to identify possible sources of arcing within the fuel tank after a fuel tank exploded due to lightning. The manufacturer identified several possible sources of the arcing, and the FAA issued ADs to correct these deficiencies. The same airplane design was then evaluated as a result of SFAR 88, and additional sources of lightning-induced ignition were identified. In another instance, a TC holder submitted a safety analysis to the FAA claiming that certain airplane models met existing system safety requirements of § 25.1309 and thus that the likelihood of an ignition source developing was extremely improbable (one in a billion flight hours). When the requirements of the SFAR 88 safety review and unsafe condition criteria were applied, however, approximately 80 new unsafe conditions were found. These conditions will now be addressed by AD for those airplane models but, in retrospect, it was clear that the manufacturer's claims were erroneous.

The safety reviews have also identified the potential for system failures (or ''failure modes'') that cannot be eliminated as possible ignition sources at reasonable cost. For example, use of ground fault protection for fuel pump power supplies will protect the fuel pumps from shorts to ground (such as one might find from lightning), but will not protect the fuel pumps from shorts between the three power wires to the pump, commonly referred to as ''phase-to-phase shorts.'' Currently there is no proven component available to address this failure mode. Combinations of failure modes are even more problematic. We could require installation of redundant bond paths to prevent the latent failure of a critical electrical bond, but doing so would be cost-prohibitive.

Finally, human error creates continuing risk. Each attempt to fix an electrical system presents the possibility of an inadvertent introduction of a new ignition source. Maintenance oversights, such as the failure to properly install electrical bonds or improper installation or overhaul of components, compound the possibility of an ignition source developing.

Carrier fuel carrying practices could impact the possibility of an explosion as well. If a carrier decides to carry only that fuel necessary to meet the FAA's fuel reserve requirements, the likelihood of an explosion is greater than if it carries excess fuel. This potential exists because more ignition sources within the fuel tank are exposed to the ullage and because the fuel has insulating properties which keeps the fuel tank cooler. Thus, ''tankering'', or carrying excess fuel, could theoretically lower the risk of an explosion. Current fuel management practices, where excess fuel is carried only when cost beneficial to the carrier, are largely market driven because airlines try to minimize their fuel costs to the maximum extent possible. Both the FAA and industry explored mandatory refueling of center wing tanks after the NTSB suggested the FAA adopt an interim flammability reduction measure in 1996. We determined that the reduction in

[3] The phrase ''normally emptied'' refers to fuel tanks that contain a substantial vapor space during a significant portion of the airplane operating time. Tanks that are designed to be normally emptied have been installed in various locations including the center wing structure, horizontal stabilizers, wings and cargo compartments. Fuel loading and usage management practices on certain airplane models use the auxiliary fuel tanks for controlling the center of gravity.

flammability exposure would not be significant and would not address the warm day flammability risk. Thus, while either reducing or increasing the amount of fuel carried in the center wing tank could theoretically have some impact on the risk of an explosion, the FAA does not believe that current fuel carrying practices are likely either to change significantly or to have a measurable impact on the overall risk of an explosion. We seek comment on this position.

B. Fuel Properties

Three conditions must be present in a fuel tank to support combustion and a fuel-tank explosion: Fuel vapor in the right amount, enough oxygen, and an ignition source. As discussed earlier, our regulatory efforts since piston-powered aircraft evolved into the jet age have been focused almost exclusively on the last item, ignition sources. A basic assumption in this approach has been that the fuel tank would contain flammable vapors under a wide range of airplane operating conditions. The question is, what level of exposure is safe?

Jet fuel vapors are flammable only in certain temperature and pressure ranges. The flammability temperature range of such vapors varies with the type and properties of the fuel, the ambient pressure in the tank, and the amount of dissolved oxygen released from the fuel into the tank. The amount of dissolved oxygen in a tank will also vary depending on the amount of vibration and sloshing of the fuel that occurs within the tank. The temperature range in which a flammable fuel vapor will form can vary with different batches of fuel even for a specific fuel type, but the threshold temperature for flammability decreases as the airplane gains altitude because of the corresponding decrease of internal tank air pressure. Thus, the higher the airplane is flying, the lower the ambient temperature required for a fuel tank to explode when an ignition source introduced.

Jet A fuel is the most commonly used commercial jet fuel in the United States and is widely used in other parts of the world. At sea level and with no sloshing or vibration present, these fuels have flammability characteristics that make it unlikely that the fuel molecules present in the fuel vapor-air mixture will ignite when the temperature in the fuel tank is below approximately 100 °F. The vapor will ignite, however, once the fuel temperature reaches approximately 175 °F, because of the increased concentration of fuel molecules at higher temperatures. At an altitude of 30,000 feet, the flammability temperature range drops to approximately 60 to 120 °F.[4] Use of Jet A or Jet A–1 fuel thus tends to limit the risk of high flammability to warmer days.

Jet B (JP–4) is another fuel approved for use on most commercial transport category airplanes, although it is no longer used as a primary fuel for commercial transports. The flammability range of Jet B (JP–4) is about 15 to 75 °F at sea level and 20 to 35 °F at 30,000 feet. Because the flammable temperature range of Jet B fuel is more within the range of typical air temperatures at those altitudes where the airplane is likely to be operated, airplane fuel tanks with Jet B fuel are flammable for a much larger portion of the flight.

C. National Transportation Safety Board (NTSB) Recommendations

The NTSB determined that the probable cause of the in-flight explosion on TWA Flight 800 was the ignition of the flammable fuel/air mixture in the center wing fuel tank. However, the source of ignition energy for the explosion could not be determined with certainty. The Board also faulted, as contributing to the accident, the FAA's design and certification approach to transport-category airplanes, as it (1) concentrated solely on precluding all ignition sources, and (2) allowed heat sources to be located beneath the center wing fuel tank.

In 1996, the NTSB issued recommendations to improve fuel tank safety. The NTSB recommended both eradicating ignition sources and reducing fuel tank flammability.[5] In their accident report, the Board concluded that ''a fuel tank design and certification philosophy that relies solely on the elimination of all ignition sources, while accepting the existence of fuel tank flammability, is fundamentally flawed because experience has demonstrated that all possible ignition sources cannot be determined and reliably eliminated.''

D. FAA Response

The FAA conducted ignition-prevention safety reviews following the 1996 accident, which revealed many new single-component failure modes that could ignite fuel tanks. We continue to issue ADs that require design or maintenance actions to address these deficiencies. These safety reviews also identified combinations of failures that could result in an ignition source, but as these combinations were less likely to occur than single failures, we determined that it was not practical to address them in existing airplanes. The safety reviews also confirmed that unforeseen design and maintenance errors could create ignition sources.

Recognizing the need to focus on flammability rather than just ignition, on April 3, 1997, the FAA published a notice in the **Federal Register** seeking comments on the 1996 NTSB recommendations on flammability exposure (62 FR 16014). That notice reviewed the service history of transport category airplane fuel tanks and the challenges underlying fuel-tank flammability reduction. Public comment indicated that more information was needed before we could begin a rulemaking on this safety issue.

Given that control of flammable vapors was a new concept, we assigned two Aviation Rulemaking Advisory Committee (ARAC) working groups to study the issues and provide recommendations. (The ARAC consists of interested parties, including the public, and provides a process to advise us on the development of new regulations.) The first working group reviewed the practicality of requiring flammability reduction, evaluating many different flammability reduction methods. Upon the recommendation of the first working group, the second working group then focused exclusively on fuel tank inerting.

On January 23, 1998, we published a notice in the **Federal Register** that established the Fuel Tank Harmonization Working Group as part of ARAC (63 FR 3614). This group was asked to recommend regulations on fuel tank flammability for both newly certificated and existing airplanes. The working group looked at fuel tank explosions that occurred after Jet A fuel had replaced Jet B fuel as the predominant type used on transport airplanes. The group examined the performance of two types of fuel tanks: the center wing fuel tanks located within the fuselage contour, and wing fuel tanks. Fuel tanks located in an aluminum wing are typically unheated and cool quickly when the wing surfaces are exposed to colder air during flight. Conversely, the center wing fuel tanks in certain airplanes have equipment underneath the tank radiating heat; in addition, with no surfaces exposed to outside air, the tank

[4] Most transport category airplanes used in air carrier service are approved for operation at altitudes from sea level to 45,000 feet.

[5] NTSB recommendations provided on page 309 of NTSB Accident Report, ''In-flight Breakup Over the Atlantic Ocean, TransWorld Airlines Flight 800 Boeing 747–131, N93119 Near East Moriches, New York, July 17, 1996, Report number NTSB/AAR–00/03, DCA96MA070, Adopted August 23, 2000.

cools much more slowly than a wing fuel tank.

The working group concluded that the safety records of fuel tanks located in aluminum wings of airplanes fueled with Jet A type fuel were satisfactory. These tanks had an average flammability exposure (as calculated under a methodology contained in proposed Part 25, Appendix L) of approximately 2 to 6 percent. However, the group found that on some airplane fleets the center wing fuel tanks had an average flammability exposure ranging from 7 percent to a high of 30 percent, a dangerous level.

The working group then evaluated many possible means of reducing or removing the hazards associated with explosive vapors in fuel tanks, such as fuel tank inerting, fuel tank cooling, fuel property alteration, fire suppression systems and polyurethane foam treatments. The ARAC sent the working group's report to the FAA on July 23, 1998 (Docket No. FAA–1998–4183, viewable on the U.S. Department of Transportation electronic Document Management System at *http://dms.dot.gov*).

The working group report concluded that flammability reduction was practical for new airplane designs, but impractical for current production designs or retrofit in the current fleet of transport category airplanes. The report recommended that the FAA begin rulemaking to add a requirement to § 25.981, so that fuel tanks in new airplane designs would have an average flammability exposure of less than 7 percent. The report also recommended requiring by regulation that each newly designed airplane incorporate means to mitigate the effects of an ignition of fuel vapors, such that any damage caused would not prevent continued safe flight and landing. The report reviewed various technical solutions, including control of heat transmission into fuel tanks, use of inerting systems, or ignition mitigation means like polyurethane foam. The report concluded that the best solution was likely to be control of heat transmission and suggested that the most practical means of control were (1) relocation of the air-conditioning equipment away from the fuel tanks; (2) ventilation of the air-conditioning bay to limit heating and cool fuel tanks; or (3) insulation of the tanks from heat. Nevertheless, the ARAC also recommended that we continue to evaluate the cost-effectiveness of other means for reducing flammable vapors in the fuel tanks, such as ground-based inerting of fuel tanks.

Based in part on the ARAC recommendations, we issued a rule entitled ''Transport Airplane Fuel Tank System Design, and Maintenance and Inspection Requirements'' in the **Federal Register** on May 7, 2001 (66 FR 23085). The rule added current § 25.981(c) which requires minimization of fuel tank flammability exposure in new type designs without setting a specific safety standard. Section 25.981(c) thus states:

(c) The fuel tank installation must include either—

(1) Means to minimize the development of flammable vapors in the fuel tanks (in the context of this rule, ''minimize'' means to incorporate practicable design methods to reduce the likelihood of flammable vapors); or

(2) Means to mitigate the effects of an ignition of fuel vapors within fuel tanks such that no damage caused by an ignition will prevent continued safe flight and landing.

Higher flammability tanks are typically located in the center wing box, in the horizontal stabilizer where little surface area is exposed to outside air, or in the cargo compartment. Our intent, as discussed in that rule's preamble was to ''require that [such] fuel tanks are not heated, and cool at a rate equivalent to that of a wing tank in the transport airplane being evaluated.'' We noted that, ''This may require incorporating design features to reduce flammability, for example cooling and ventilation means, or inerting for fuel tanks located in the center wing box, horizontal stabilizer, or auxiliary fuel tanks located in the cargo compartment.'' (Our reference to a wing tank was to a conventional subsonic airplane with aluminum wing tanks.) We also stated, ''At such time as the FAA has completed the necessary research and identified an appropriate definitive standard to address this issue, new rulemaking would be considered to revise the standard proposed in this rulemaking.''

We then issued two Advisory Circulars, AC 25.981–1B, ''Fuel Tank Ignition Source Prevention Guidelines,'' and AC 25.981–2, ''Fuel Tank Flammability Minimization.'' These ACs described acceptable means of showing compliance with § 25.981(c). AC 25.981–2 specifically discussed the use of fuel tank inerting as a method of compliance with the flammability exposure requirements. To ''inert'' a fuel tank, as defined in AC 25.981–2, the percentage of oxygen in a fuel tank's air should not exceed 10 percent. (Later research, discussed below, showed that containing oxygen concentrations to 12 percent or less would inert a fuel tank.)

After revising § 25.981, we began scientific research, hoping to gain a better understanding of the ignition properties of commercial aviation jet fuel vapors. We also explored new ideas for removing flammable fuel air mixtures from fuel tanks, as well as other methods for improving fuel tank safety. Initially, efforts to develop commercially viable ways to remove flammable fuel vapors from tanks failed. For example, to lower the danger of fuel tank explosions after post-crash ground fires, systems were considered that would ''scrub'' the vapor in the ullage—ventilating the tank with air so as to prevent the build-up of flammable concentrations of fuel vapor. At the time, we found these systems to be impractical because of their weight, complexity, unreliability, and undesirable secondary effects on the environment.

On the recommendation of the ARAC, we refocused our efforts on reducing fuel tank flammability through nitrogen inerting. Public comment on the 1997 notice had suggested inerting was possible through adoption of a hollow fiber membrane technology, which separates oxygen from nitrogen in the atmosphere. (Air is made up of about 78 percent nitrogen and 21 percent oxygen.) The hollow fiber membrane material uses the absorption difference between the nitrogen and oxygen molecules to separate nitrogen-enriched air from oxygen. The technology had been used for many years in non-aerospace applications, such as obtaining oxygen-enriched air for medical purposes and generating nitrogen-enriched air to preserve produce in transport. In airplane applications, nitrogen-enriched air could be produced when pressurized air is forced through a canister that contains the hollow fibers. The created nitrogen-enriched air is then directed, at appropriate concentrations, into the ullage of fuel tanks and displaces the normal fuel vapor/air mixture in the tank. Use of this technology allows nitrogen to be separated from the available pressurized air onboard the airplane, which eliminates the need to carry and store nitrogen in the airplane.

Initially, we found that airplanes in the current transport category fleet were not designed with optimized air sources for creating nitrogen-enriched air. As a result, early designs required installation of an air compressor, adding significant weight and cost. Aware of the earlier system's disadvantages, our researchers worked to address those issues. Earlier fuel tank inerting designs, primarily produced for military applications to prevent fuel tank explosions from battle damage, assumed a fuel tank was ''inert'' with a maximum of 9 percent oxygen content in the ullage. Achieving this level of concentration was not needed for transport category airplanes, as our research determined that a maximum oxygen content of 12 percent would be sufficient to protect airplanes from less powerful ignition sources typical of airplane system failures and malfunctions at sea level. Thus, our testing excluded turbulent flow flame propagation, or external fuel tank events, such as explosives and hostile fire. (The FAA test results are available in an FAA Technical Note: ''Limiting Oxygen Concentrations Required to Inert Jet Fuel Vapors Existing at Reduced Fuel Tank Pressures'' (DOT/FAA/AR–TN02/79). See: *http://www.fire.tc.faa.gov/pdf/TN02-79.pdf*.)

Terrorist initiated accidents were also excluded from consideration in the earlier ARAC reports and the possible benefits in the regulatory evaluation within this notice. While the proposed FRM requirements are not intended to address terrorist initiated explosions, such as the Bogata 727 accident discussed earlier, inerting fuel tanks may provide other significant secondary safety benefits by addressing flammability exposure. Testing conducted by China Lake Naval Weapons Center [6] showed that inerting a fuel tank to 12 percent oxygen offers a high degree of protection from a fuel tank explosion when 30-millimeter high explosive incendiary projectiles shot into fuel tanks. The FAA invites comments related to the potential additional security benefits that may be achieved by imposing FRM.

Based on our research, we identified a simplified inerting system that, using existing airplane pressurized air sources, could limit a fuel tank to the 12 percent oxygen content level. This concept eliminated the need for an air compressor, thus reducing the size and complexity of the system. Our research determined that the method of distributing the nitrogen-enriched air to the fuel tank could also be simplified, which further reduced the system's weight and installation cost. We now estimate that a simplified inerting system adequate to protect the center wing tank on airplanes in the existing fleet should weigh from 100 to 250 pounds and cost from $140,000 to $225,000 to procure and install in existing airplanes, depending on fuel tank capacity. (More information on the costs of these systems is provided in the Preliminary Regulatory Evaluation.)

The FAA has openly shared with industry information on the simplified inerting system design ever since it was first developed in May 2002. This design concept was adopted by Boeing when applying for a series of type certification and production approvals to incorporate a fuel inerting system using nitrogen air enrichment in all currently produced Boeing model airplanes. Thus, on November 15, 2002, Boeing applied for a change to TC No. A20WE to modify Boeing Model 747 series airplanes to incorporate the system into its center wing fuel tanks. It has since applied for similar approvals for the Boeing Model 737 series, Boeing Model 757 series, Boeing Model 767 series, and Boeing Model 777 series airplanes. We published a request for and received public comments on a Notice of Proposed Special Conditions for flammability reduction on the Boeing Model 747 on December 9, 2003 (68 FR 68563). Final Special Conditions No. 25–285–SC was issued on January 24, 2005 (70 FR 7800; February 15, 2005).

III. Proposed Requirements Relating to Fuel Tank Flammability

We are proposing today a performance-based set of requirements that do not specifically direct the use of fuel inerting, but rather set acceptable levels of flammability exposure in tanks most prone to explosion or require the installation of an ignition mitigation means in an affected fuel tank. We also by separate notice propose to revise Advisory Circular 25.981–2 so as to describe several means of compliance with these requirements, including both flammability-reduction means, such as cooling, inerting using nitrogen or carbon dioxide, and ignition-mitigation means, such as use of polyurethane foam or explosion suppression systems. The revised AC sets out detailed parameters for such systems if used as a means of achieving the targeted safety standards.

The rule, if adopted, would require a retrofit of much of the existing fleet of large airplanes but would not necessarily affect all transport aircraft. We will require retrofit based on safety needs, using a fleet average flammability exposure limit of seven (7) percent, the level recommended by ARAC. We know that this level is routinely exceeded in tanks that are incidentally heated by nearby air conditioning equipment and in unpressurized auxiliary fuel tanks that are located in the cargo compartment and that do not significantly cool. The vast majority of large transport category airplanes operating in the U.S., including all Airbus models and most Boeing models, have center wing tanks that are above this level. We estimate that 3,800 airplanes with flammability exposure level above 7 percent would be retrofitted if this rule is adopted.

As is the case for new production airplanes, all airplanes currently equipped with a normally emptied or auxiliary fuel tanks that have a flammability level above 7 percent could not have center wing tanks that are flammable more than 3 percent on average and 3 percent on hot days. Lowering the flammability levels of these fuel tanks in the existing fleet and limiting the permissible level of flammability on new production airplanes would result in an overall reduction in the flammability potential of these airplanes of approximately 95 percent.

Some airplane models have center tanks with a fleet average flammability exposure level that does not exceed 7 percent, including to the best of our information the Lockheed L–1011, and Boeing MD–11, DC10, MD80, and Boeing Model 727, and Fokker F28 MK100. At this time we do not believe that these airplanes would need FRM or IMM for their center tanks, unless the certificate holder has also installed an auxiliary fuel tank that is found to be affected.[7]

A. Overview of the Proposal

Our proposal would require manufacturers and operators of most large transport category airplanes to reduce the average flammability exposure in affected fleets to tolerable levels of risk. Fleet average flammability exposure represents the percent of flight time that fuel vapors in the ullage are flammable, calculated across a fleet of an airplane type operating over the range of actual or expected flights and based on a wide range of environmental conditions and fuel properties.[8] This

[6] The Effectiveness of Ullage Nitrogen-Inerting Systems Against 30-mm High-Explosive Incendiary Projectiles, China Lake Naval Weapons Center, J. Hardy Tyson and John F Barnes, May 1991.

[7] Auxiliary fuel tanks are installed subject to amended supplemental type certificates or field approvals. As such they are ''aftermarket'' installations not contemplated by the original manufacturer of the airplane. Auxiliary fuel tanks are installed to permit airplanes to fly for longer periods of time by increasing the amount of available fuel. While all auxiliary fuel tanks are normally emptied, some ''normally emptied'' tanks are included in the original type design, such as the center wing tank on the Boeing 747.

[8] The airplane flammability exposure evaluation time begins when the airplane is prepared for flight (which commences upon the start of preparing the airplane for flight by turning on the auxiliary power unit/ground power, starting the environmental control systems, or taking other steps that begin the

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rulemaking is premised on our finding that fuel tanks whose fleet-wide average flammability exposure is more than 7 percent have a ''high flammability exposure,'' which we consider unduly dangerous. This finding, in turn, is based on the reports and findings of the ARAC and our own risk assessment of the current transport category airplane fleet.

Our proposal would modify current regulations in several important respects, affecting both manufacturers (TC holders and STC holders) and operators (air carriers). We would significantly expand the coverage of part 25 by making manufacturers generally responsible for the development of service information and safety improvements (including design changes) where needed to ensure the continued airworthiness of previously certificated airplanes. This proposal would apply to holders of existing TCs, holders of STCs, applicants for changes to existing TCs, and certain other airplane manufacturers. We are proposing to specify the new requirements for these entities in a new subpart I to part 25, although we may decide to relocate these requirements at the time the final rule is issued to simplify harmonization efforts.

As to fuel tank flammability specifically, manufacturers, including holders of listed airplane TCs and of auxiliary fuel tank STCs, would be required to conduct a flammability exposure analysis of their fuel tanks, unless they have already notified the FAA that they will utilize an ignition mitigation means instead. A new Appendix L to part 25 will regulate the conduct of these analyses.[9] As discussed later in this document, the Appendix contains the method for calculating overall and warm day fuel tank flammability exposure values needed to show that the affected aircraft tanks comply with proposed limitations on flammability exposure levels, described below.

Where the required analyses indicate that the fuel tank has an average flammability exposure level below 7 percent, no changes would be required. However, for the other fuel tanks, manufacturers would be required to develop design modifications to support a retrofit of the airplane. Under today's proposal, the average flammability exposure level of any affected wing tank would have to be reduced to no more than 7 percent. In addition, for any normally emptied fuel tank (including auxiliary fuel tanks) located in whole or in part in the fuselage, flammability exposure would have to be reduced to 3 percent, both for the overall fleet average and for operations on warm days.

For long-pending certification projects that have not received a type certificate from the FAA prior to the date of the final rule (where application was received by the FAA before June 6, 2001, the effective date of 14 CFR 25.981(c), applicants would be required to limit the flammability exposure of any wing tank to no more than 7 percent. Any of those applicants whose proposals include any normally emptied or auxiliary fuel tank with a flammability exposure level that exceeds 7 percent would also have to meet the same flammability exposure requirements proposed for retrofit (i.e., 3 percent), if any portion of the tank is located within the fuselage contour. Applicants for more recent certification projects (where application was received after June 6, 2001), and all applicants for a TC or STC submitted after the effective date of the final rule would need to meet the new requirements of that section set forth in today's proposal.

We would set more stringent safety levels for certain critically located fuel tanks in most new type designs, while maintaining the current, general standard under § 25.981 for all other fuel tanks. We expect that as a result of this rule the design of most normally emptied and auxiliary tanks located, in whole or in part, in the fuselage of transport-category airplanes would need to incorporate some form of FRM or IMM. Regulations in a new proposed Appendix K to Part 25 contain detailed specifications for all FRM, if they are used to meet the flammability exposure limitations. These additional requirements are designed to ensure the reliability of flammability-reduction means, reporting of performance metrics and warnings of possible hazards in and around fuel tanks. Specifications for IMM are detailed in the current AC–25.981–2 and are not generally discussed in this document.

Type certificate holders for specific airplane models with high flammability exposure fuel tanks would be required to develop design changes and service instructions to facilitate the adoption of IMM or FRM. Manufacturers of these airplanes would have to incorporate these design changes in airplanes produced in the future. In addition, these sections would require design approval holders (TC and STC holders) and applicants to develop airworthiness limitations to ensure that maintenance actions and future modifications do not increase flammability exposure above the limits in this proposal. These design approval holders would have to submit binding certification plans by a specified date, and these plans would be closely monitored by the holders' FAA oversight offices to ensure timely progress.

Lastly, the proposal requires affected operators to incorporate FRM or IMM where required for high-risk fuel tanks in their existing fleet of affected airplane models. Air carriers would also have to revise their maintenance and inspection programs to incorporate the airworthiness limitations developed under the other proposals. We also intend to establish strict retrofit deadlines, which are premised on prompt compliance by manufacturers with their certification plans.

Table 1 summarizes the proposed regulatory changes that relate to fuel tank flammability safety. This table does not summarize the proposed regulatory changes that are common between this proposal and other aging airplane initiatives. Those changes are discussed in detail later.

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initial preparation of the airplane), continues through the actual flight and landing, and ends when all payload has been unloaded and all passengers and crew have disembarked.

[9] Rather than relying on the analysis already conducted pursuant to SFAR 88 and then simply regulating those airplanes with a demonstrated exposure level of 7 percent or greater, today's proposal contemplates requiring a new exposure analysis. The existing analyses, while helpful in positing which airplanes are likely to be affected by a final rule, were derived from incomplete, and sometimes differing, assumptions. Appendix L would correct such inconsistencies by establishing a single methodology for calculating average flammability exposure.

TABLE 1.—SUMMARY OF PROPOSED RULES

14 CFR	Description of proposal	Applies to
25.1, 25.2	Expand applicability to current holders of TCs, STCs, and certain manufacturers. Amend § 25.2 to make reference to the proposed subpart I.	Applicants for TCs, and changes to those TCs for transport category airplanes. Manufacturers of certain airplane models.
25.981	Revise paragraph (b) to specify limits on fuel tank flammability. Add paragraph (c) to restate current option of providing ignition mitigation means (IMM). Add paragraph (d) to include airworthiness limitation items (ALI) for IMM or Flammability Reduction Means (FRM), and move the existing ignition prevention ALI requirements into this paragraph.	Applicants for future TCs and design changes to those certificates.
Subpart I 25.1801	Defines the intent of the subpart	TCs, and design changes to those TCs for transport category airplanes. Manufacturers of certain airplane models.
25.1815	Require flammability exposure analysis of all fuel tanks within 150 days after effective date. If below 7 percent no flammability reduction required. Compliance with § 25.981(d) to define ALI required.	TC holders.
	If above 7 percent and in fuselage and normally emptied, must develop service instructions to meet § 25.981(b), (c) and (d). If above 7 percent and other tank type, must develop service instructions to incorporate IMM (meet § 25.981(c), or reduce flammability to 7 percent). Specific compliance dates for each Boeing and Airbus airplane model. Other models within 24 months.	Large transport category passenger airplanes, with passenger capacity of 30 or more or a payload of 7500 lbs or more (original TC or later increase).
25.1817	Require flammability exposure analysis of all fuel tanks installed under STC within 12 months after effective date. Require impact assessment of fuel tanks installed by STCs, and (for pending and future applicants) other STCs affecting fuel tank flammability, on IMM or FRM developed by TC holder under § 25.1815 to determine if any ALI has been violated 6 months after FAA approval of ALI submitted by TC holders under § 25.1815 or before certification, whichever is later.	Auxiliary tank STC holders for large transport category passenger airplanes, with passenger capacity of 30 or more or a payload of 7500 lbs. or more (original TC or later increase).
	Require development of service instructions to correct designs that compromise ALI defined by TC holder under § 25.1815 within 24 months. Require within 24 months after TC holder compliance with 25.1815 development of service instructions for a IMM or FRM for any tank with flammability above 7 percent, if located within the fuselage and normally emptied.	Applicants for future STCs or amendments to TCs that affect fuel tank system or IMM/FRM.
25.1819	Requires IMM or FRM for any fuel tank on a passenger airplane with a flammability level that exceeds 7 percent. Fuel tanks located in the fuselage and normally emptied must meet § 25.981(b) level. Other fuel tanks must not exceed 7 percent.	Pending certification projects. Pre Amendment 102.
	Requires compliance with § 25.981(c)	Post Amendment 102.
25.1821	Requires any affected airplanes produced after a certain date to incorporate IMM or FRM.	Manufacturers of certain airplane models.
Appendix 25 K	Establishes performance, reliability and reporting requirements for flammability reduction means.	Applicants for approval of flammability reduction means.
Appendix 25 L	Defines flammability analysis method and input parameters that must be used in the analysis.	Any person required to perform flammability analysis.
91.1509, 121.917, 125.509, 129.117.	Require retrofit of IMM or FRM into large airplanes with high flammability fuel tanks. Require large transport category airplanes manufactured after specific dates to have IMM or FRM in high flammability fuel tanks. Require incorporation of ALI into the maintenance program.	U.S. certificate holders and foreign persons operating U.S.-registered large transport category passenger airplanes.

B. Ongoing Responsibility of Type Certificate Holders for Continued Airworthiness

Several recent safety regulations necessitated action by air carriers and other operators but did not require design approval holders to develop and provide the necessary data and documents to facilitate the operators' compliance. Operators are often dependent on action by a design approval holder before they can implement new safety rules. Ongoing difficulty reported by operators in attempting to meet these rules has convinced us that the corresponding design approval holder responsibilities may be warranted under certain circumstances to enable operators to meet regulatory deadlines.

We intend to require type-certificate holders, manufacturers and others to take actions necessary to support the continued airworthiness of and to improve the safety of transport-category airplanes. Such actions include performing assessments, developing design changes, revising instructions for continued airworthiness (ICA), and making available necessary documentation to affected persons. We believe this requirement is necessary to facilitate compliance by air carriers with operating rules that in effect demand the use of new safety features.

To address this problem, we propose to amend subpart A of part 25 to expand its coverage and to add a new subpart I to establish requirements for current holders. As discussed in our final rule, ''Fuel Tank Safety Compliance Extension and Aging Airplane Program Update'' (69 FR 45936, July 30, 2004), this and related proposals would add provisions to a new subpart I requiring actions by design approval holders that will allow operators to comply with our rules.

Part 25 currently sets airworthiness standards for the issuance of TCs, and changes to those certificates, for transport category airplanes. It does not list the specific responsibilities of manufacturers to ensure continued airworthiness of these airplanes once the certificate is issued. Therefore, we propose to revise § 25.1 by adding paragraph (c) to make clear that part 25 creates such responsibilities for holders of existing and supplemental type certificates for transport category airplanes, and applicants for approval of design changes to those certificates; we are also adding paragraph (d) to require design changes and other service activities by manufacturers when needed. In order to ensure the effectiveness of these changes, we would also amend § 25.2 (''Special retroactive requirements'') so as to require adherence to a new Subpart I which may require design changes and other activities by type certificate holders.

This proposal would establish a new subpart I, Continued Airworthiness and Safety Improvements, where we would locate rules imposing ongoing responsibilities on design approval holders. In the past, this type of requirement took the form of a Special Federal Aviation Regulations (SFAR). SFARs are difficult to locate, because they are scattered throughout Title 14. Placing all these types of requirements in a single subpart of part 25, which contains the airworthiness standards for transport category airplanes, would provide ready access to critical rules.

In preliminary discussions with foreign aviation authorities, with whom we try to harmonize our safety rules, they have expressed concern about consolidating parallel requirements in their counterparts to part 25. They have suggested that it may be more appropriate to place them in part 21 or elsewhere. Therefore, we specifically request comments from the public, including foreign authorities, on the appropriate place for these airworthiness requirements for type certificate holders.

We reserve additional sections in this proposal to include other subparts we would expect to create with future aging airplane rules, several of which are under development. Some of these proposals include similar language establishing the general airworthiness responsibilities of manufacturers and thus include some overlapping provisions. Once any proposal establishing these broad responsibilities becomes a final rule, we will delete the duplicative requirements from the other proposals and retain only that language pertinent to any specific new safety regulations (such as fuel-tank flammability reduction).

Except in one respect (discussed below), however, the ongoing-airworthiness requirements in Subpart I would not by their terms reach applicants for TCs with respect to new projects for which application is made after the effective date of the proposed rule. This is unnecessary because, when we adopt a new requirement for TC holders, there will be a corresponding amendment to part 25 expressly making compliance with the new, or a similar safety standard a condition for receiving a TC in the future. For example, in this proposal, the new requirements of § 25.981(b), (c) and (d) regarding FRM and IMM will govern future applications.

For safety reasons, however, we are requiring that any application for a type design change, whenever filed, not degrade the level of safety already created by the TC holder's presumed compliance with the subpart I rule. Currently, when reviewing an application for such a change, we employ the governing standards stated in part 21, specifically § 21.101. That section generally requires compliance with standards in effect on the date of application but contains exceptions that may allow applicants to show compliance with earlier standards. For example, if a change is not considered ''significant,'' the applicant may be allowed to show compliance by pointing to standards that applied to the original TC. (*See* AC 21.101–1, ''Establishing the Certification Basis of Changed Aeronautical Products,'' a copy of which can be downloaded from *http://www.airweb.faa.gov/rgl*).

With the adoption of subpart I rules, we must ensure that safety improvements that result from TC holder compliance with these requirements are not undone by later modifications. Therefore, even when we determine under § 21.101 that an applicant need not comply with the latest airworthiness standards, it will be required to demonstrate that the change would not degrade the level of safety provided by the TC holder's compliance with the subpart I rule. In the context of today's proposal, for example, this will mean that an applicant for approval of a design change would have to show that it would not increase the fuel tank flammability above the limits defined in this proposal or adversely affect the FRM or IMM established by the TC holder.

C. Applicability

1. Manufacturers and Holders of Type Certificates, Supplemental Type Certificates and Field Approvals

Today's proposal, if adopted, will impose requirements on TC holders for all affected transport category airplanes as well as STC holders and operators who have field approvals for auxiliary fuel tank designs. Not all airplanes would require the installation of an FRM or IMM. Those requirements would be based on the initial average flammability exposure analysis discussed in detail later in this document. However, the TC, STC or field approval holder would be required to develop and provide limitations on the types of alterations and operations permitted for the airplane in order to retain the validity of that initial analysis.

Today's proposal, if adopted, would apply not only to domestic TC holders, but also to foreign TC holders. This rule would be different from most type certification programs for new TCs, where foreign applicants typically work with their responsible certification authority, and the FAA relies, to some degree, upon that authority's findings of compliance under bilateral airworthiness agreements. No other certification authority has yet adopted requirements addressing fuel tank flammability for existing TCs. While some authorities have indicated an interest in adopting some type of requirements for new airplane designs, they may not adopt requirements applicable to existing TCs. Accordingly, the FAA will retain the authority to make all the necessary compliance determinations, and where appropriate may request certain compliance determinations by the appropriate foreign authorities using procedures developed under the bilateral agreements. The compliance planning provisions of this proposed rule are equally important for domestic and foreign TC holders and applicants, and we will work with the foreign authorities to ensure that their TC holders and applicants perform the planning necessary to comply with those requirements.

As discussed briefly above, the proposed rule would require holders of existing type certificates to incorporate FRM or IMM into all new production airplanes if the fleet average flammability exposure level exceeds permissible levels. In past rulemakings where the FAA has required production cut-in of safety improvements, we have adopted rules prohibiting operators of airplanes produced after a specified date from operating those airplanes unless they are equipped with the improvements. This approach is effective in ensuring that U.S. operators receive the benefits of these safety improvements. But these rules do not apply to foreign operators, unless they operate U.S.-registered airplanes.

By requiring FRM or IMM separately from the operational rules proposed in this notice, the proposed rule would improve the safety of the overall fleet of larger transport category airplanes. This requirement would also facilitate the secondary market for these airplanes. Even if a manufacturer initially sells an airplane to a foreign operator who may not be required to have the system, the operator may later sell or lease it to a U.S. operator. The U.S. operator would be able to simply place it into service, rather than having to install a system. Given the frequency of airplane transfers in today's global economy, we think having these systems installed during production will provide significant long-term efficiencies since no retrofit would be required, as well as providing immediate safety benefits.

2. Airplanes

If adopted, this rule would apply, with some exceptions discussed below, to transport category turbine-powered airplanes with a maximum type-certificated capacity of 30 or more passengers, or a maximum payload capacity of 7500 pounds or more resulting from the original certification of the airplane or later increase in capacity. This would result in the coverage of airplanes where the safety benefits and the public interest are the greatest.

We are proposing to apply this rule to airplanes for which a passenger capacity of 30 or more has been approved at any time. In the past, some designers and operators have obtained design change approval to slightly lower existing capacity to avoid applying requirements mandated only for airplanes over specified capacities. Today's proposal would remove this possible means of avoiding compliance. It is also possible that an airplane design could be originally certificated with a capacity slightly lower than the minimum specified in this section, but through later design changes, the capacity could be increased above this minimum. Today's proposal addresses both of these situations by proposing to regulate all airplanes that have been approved for carriage of 30 or more passengers, or 7500-pound or more payload, at any time.

We considered applying this proposal to all part 25 airplanes. This would have resulted in modifications to all fuel tanks located in the fuselage that are normally emptied. However, smaller airplanes generally do not have a significant number of high flammability exposure fuel tanks. Few of the smaller transport category airplanes in the current fleet have center wing tanks that are normally emptied. While some of the smaller airplanes have auxiliary or normally emptied fuel tanks located within the fuselage contour, many of these airplane types use differential fuel pressure to transfer the fuel from the fuel tanks. The increased pressure results in a reduction in the fuel tank flammability by keeping the fuel vapors at a level where ignition is unlikely. We have determined that the benefits of including these airplane types in this proposal are not sufficient to warrant the cost.

Certain vintage airplanes type certificated before 1958, the beginning of the jet age, would be excluded from the requirements of this proposal. They are listed in § 25.1815(j). There are no known reciprocating-powered transport category airplanes currently in scheduled passenger service. Compliance would not be required for these specific older airplanes, because their advanced age and small numbers would likely make compliance economically impractical. If the public knows of other airplanes that may present unique compliance challenges, the FAA is interested in receiving comments. These comments may result in additional airplane models being excluded from the requirements of this proposed rule.

The proposal does not extend to airplanes used in all-cargo operations. Our analysis of the costs of extending the proposal to include these airplanes does not appear to be justified by the associated benefits. The potential loss of life in a single accident is much smaller on all-cargo planes of the size contemplated by today's proposal than on comparably sized passenger planes. The undiscounted cargo airplane costs would be about $261 million, with a present value of $110 million, while the benefits would be less than $1 million. However, the FAA does believe there is a risk to all-cargo airplanes because they share the same design features as at-risk passenger airplanes. We typically do not base our certification standards for transport category airplanes on use. Rather, our general philosophy is to address the performance characteristics of these airplanes because we believe all occupants should be protected against those designs that present a risk of serious injury or death.

We have not evaluated the risk to all-cargo airplanes because they are derivatives of passenger airplanes. The risk may be lower for all-cargo operations than for passenger operations. For example, if the risk of a fuel tank explosion per operating hour is the same for all-cargo planes as for passenger airplanes, the projected number of accidents for these planes is significantly less than one (0.15) in the next 50 years. This is because the projected number of miles flown by a cargo plane over the next 50 years is only 23 million miles. The risk may also be lower for all cargo operations because many cargo operations are conducted at night when the flammability of the fuel tanks is lower because of lower ambient temperatures.

The 747 has both a passenger version and a freighter. The Monte Carlo analysis conducted for the 747 included both types of airplanes, and was weighted primarily toward the passenger airplane because they make up the majority of the 747 fleet. Thus, it should be possible to model the risk of a fuel tank explosion for cargo airplanes separate from passenger airplanes. We request flammability analyses on all-cargo airplanes and on the passenger versions of the same airplane model, as well as any underlying data.

We have provided a breakdown of the estimated costs and benefits associated with requiring all-cargo airplanes be equipped with a means of reducing flammability in the preliminary regulatory evaluation. We believe that the cost associated with providing a means of flammability reduction on newly designed cargo airplanes may be sufficiently low that it could make sense for all airplanes manufactured under a TC or amended TC applied for after the effective date of the final to have either an FRM or IMM. We believe there will be only a minimal cost associated with equipping newly designed all-cargo airplanes with a means of flammability reduction since the passenger version of the same model will be designed with such a system.

We request comment on whether, given the costs involved, the design rules, the production cut-in rules, or the operating rules, if adopted, should be applied to all-cargo airplanes.

Even with the categories of airplanes excluded that are discussed above, we recognize that this proposal is costly. To ensure that this rule is as cost effective as possible, we specifically request comments on whether there are other categories of airplanes or ways to distinguish among airplanes that would focus this rule on those where the benefits would be greatest. Any comments provided should include data to support the suggested exclusions or distinctions.

3. Fuel Tanks

The requirements proposed today would apply the proposed new FRM or IMM requirements to existing fuel tanks with a fleet average flammability exposure level that exceeds 7 percent. Main fuel tanks on existing airplanes, i.e., those that are designed both to feed fuel directly to one or more engines and to hold the required fuel reserves continually throughout each flight, are unlikely to be affected as they should have a fleet average flammability exposure level well below 7 percent.

For any fuel tank that is normally emptied and has a fleet average flammability exposure level that exceeds 7 percent average flammability exposure, if any portion of the tank is located in the fuselage contour, the proposal would require TC STC and field approval holders to develop IMM or FRM that reduces the flammability exposure to 3 percent average flammability exposure and that meets the 3 percent warm day requirements.

All other tanks with a fleet average flammability exposure level exceeding 7 percent would need to incorporate IMM, or FRM. If FRM is installed it would need to provide a fleet average flammability exposure at one of two levels: Tanks on airplanes manufactured pursuant to a type certificate applied for prior to June 6, 2001 would have to have an exposure level no greater than 7 percent; tanks on airplanes manufactured pursuant to a type certificate applied for after June 6, 2001 would have to have an exposure level either no greater than 3 percent or equivalent to that of a comparable conventional unheated aluminum tank (which could be either more or less than 3 percent).

The ARAC found fuel tanks that are normally emptied have higher flammability exposure times than main tanks. Because these tanks contain a high percentage of ullage during a significant portion of most flights, a larger number of potential ignition sources are exposed to fuel vapor space for an extended time. Additionally, when they are within the fuselage contour, they are not naturally cooled by external air, which causes the fuel vapor to be flammable for a significant portion of the airplane operating time.

Auxiliary fuel tanks are developed by TC holders, STC holders and, occasionally, by operators via field approvals, to increase the fuel capacity available on a type-certificated airplane. There are 74 different STCs for auxiliary fuel tanks in the airplanes potentially affected by the proposed rule. There are also field approvals for auxiliary tanks installed by airplane operators. Data submitted to the FAA as a result of SFAR 88 shows that fifteen of these auxiliary tanks have high flammability exposure fuel tanks. Some of these tanks have been installed in airplanes such as the DC–9 and DC–10 that do not have any other fuel tanks with high flammability exposure. Production of these airplane models ended long ago, so many of these airplanes will be at or near the end of their intended operational life at the end of the proposed compliance time given to the operators to incorporate FRM or IMM. Requiring the affected certificate holders to develop service instructions and the operators to incorporate FRM for these older fuel tanks increases the cost of the proposed rulemaking with fewer benefits than incorporation of FRM on newer airplane models. Therefore, the FAA specifically requests comments on including these auxiliary fuel tanks in the proposal. Information on the number of fuel tanks installed in the fleet and the remaining useful life of the affected airplanes should be provided.

Portions of fuel tanks that are located within the fuselage contour include those in either the pressurized or unpressurized section of the fuselage or those whose surfaces make up part of the pressurized compartment. Fuel tanks located within the cargo compartment and center wing tanks are considered to be located in the fuselage contour. Many center tanks have portions that extend from the center wing box to the wing. The compartments of the tank located within the wing would also be considered part of the tank located within the fuselage contour and the same flammability requirements would apply. Fuel tanks located in the horizontal stabilizer, which also include segments located inside the fuselage and portions that extend outside the fuselage contour, would be assessed in the same way. Fuel tanks have also been located within the vertical stabilizer. If no portion of these tanks is in the fuselage, these tanks would not be considered as located within the fuselage boundary.

4. Airplane Operators

The rule proposed today would also apply to operators of the affected aircraft other than those who operate pursuant to 14 CFR part 135, Operating Requirements: Commuter and On Demand Operations and Rules Governing Persons On Board Such Aircraft. We are excluding part 135 operators, because we have determined that only a few airplanes operated under part 135 would be subject to the rule. This is because part 135 is currently limited to a carrying of capacity of 10 or fewer passengers and a payload of no more than 7,500 lb. We are in the process of revising part 135 and may consider increasing the payload capacity as part of that revision. If an increase in payload capacity is contemplated, we may also consider requiring FRM or IMM under part 135.

As discussed previously, in an effort to enhance the cost effectiveness of this rule, we specifically request comments on whether other categories of operations should be excluded. Any comments provided should include data to support the suggested exclusions or distinctions.

D. Proposed Requirements for Manufacturers and Holders of Type Certificates, Supplemental Type Certificates and Field Approvals

1. New Airplane Designs

Currently, § 25.981(c) establishes a requirement that fuel tank installation on all airplanes for which the type certificate was applied for after 2001 must have either a ''means to minimize the development of flammable vapors in the fuel tanks'' that would ''reduce the likelihood of flammable vapors, or a ''means to mitigate the effects of an ignition of fuel vapors * * *.'' We propose amending this section to address new airplane designs.

We propose to require those airplanes incorporating FRM to limit the fleet average flammability exposure to 3 percent, and to limit warm day exposure to 3 percent, for all normally emptied fuel tanks located, in whole or in part, in the fuselage. All other fuel tanks could either meet the 3 percent average flammability exposure limitation or have a level that is no higher than the exposure level in a conventional unheated aluminum wing tank that is cooled by exposure to ambient temperatures during flight. The advantage of the first option is that manufacturers using unconventional designs would not be required to conduct the modeling on an equivalent unheated aluminum wing tank that is a purely theoretical design. The advantage of the second option is that a manufacturer could increase the level of acceptable exposure based on the exposure characteristics of this theoretical wing design.

TC Applicants have proposed newer technology airplanes using composite wing skins or fuel tank designs with little exposed surface area. These designs may result in average fuel tank flammability exposure above the levels recommended by the ARAC. We expect future applicants will propose similar designs. For these airplane types, the applicant would have the option of demonstrating compliance by analyzing the fleet average flammability exposure of an equivalently designed wing made of aluminum for the model under evaluation. The thermal characteristics of the wing treated as a single fuel tank, as well as airplane specific parameters such as climb, cruise and descent profiles and flight length distribution, would be used as inputs to the flammability exposure analysis defined in Appendix L. This analysis would establish the maximum allowable flammability for the airplane model under evaluation.

The safety objective of an ''unheated aluminum wing tank'' that is proposed as the standard in this notice is consistent with the ARAC recommendation and 14 CFR 25.981(c). It does not provide a numerical standard to apply in future type certification programs and the demonstration of compliance requires the applicant to conduct an analysis of their design to establish the flammability of a conventional unheated aluminum wing tank. In certain cases the compliance demonstration would be simplified if a numerical standard were provided in the regulation. Therefore we are proposing to establish a numerical flammability exposure standard of 3 percent that can be used. This approach may have implementation advantages and should achieve the safety level intended by the ARAC recommendation and the current approach of § 25.981(c). We specifically request comments on which approach would be more workable and effective. If, based on comments received, we determine that a numerical standard alone is preferable, we may revise the final rule to adopt this approach.

In addition to designing normally emptied fuel tanks that meet the proposed requirements, the TC holder would be required to provide airworthiness limitations designed to prevent exceeding the exposure limits of this rule or degrading the performance and reliability of FRM or IMM provided by the TC holder. For example, the manufacturer may state that any changes to the fuel system may invalidate its exposure analysis. In such an instance, the party making subsequent changes would need to conduct its own exposure analysis to ensure that the affected fuel tanks remain within the applicable limits. Likewise, a manufacturer may limit the type of jet fuel acceptable for its systems, as a jet fuel with a lower flash point may invalidate the initial exposure analysis.

As discussed earlier, today's proposal would not apply to airplanes designed solely for all-cargo operations. This exclusion applies to airplanes that, either as a result of initial type certification or through later design changes, have no passenger carrying capability, except for carriage of supernumeraries.[10] Airplanes designed for all-cargo operations would continue to be subject to the existing requirements of § 25.981(c), which requires either means to minimize the development of flammable vapors in the fuel tanks or IMM. On the other hand, if an airplane that is designed for all-cargo operations is converted to an airplane equipped to carry passengers, including a ''combi'' airplane (part cargo, part passenger), this design change would make the airplane subject to these proposed requirements.

2. Existing Airplane Designs

Holders of existing TCs would be required to first conduct a fleet average flammability exposure to determine whether the rule proposed today would apply to their fuel tanks. If the exposure level for normally emptied fuel tanks within the fuselage exceeds 7 percent, design changes and instructions for IMM or FRM that limit both overall and warm day fleet flammability exposure levels (discussed later) to no more than 3 percent would need to be developed. All other normally emptied fuel tanks exceeding a 7 percent exposure limit would require design changes limiting exposure to 7 percent unless manufactured pursuant to a type certificate applied for after June 6, 2001, in which case the potentially more stringent requirements of existing § 25.981(c) would continue to apply.[11] Once design changes are developed, a second exposure analysis would need to be conducted to validate the design changes.

Even if no changes to existing fuel tanks are required based on the fleet average exposure analysis, the manufacturer would be required to develop the same type of airworthiness limitations as those required for new airplane designs.

The affected TC holders would also be required to submit compliance plans for the flammability analysis and the development of service instructions for an FRM or IMM. The contemplated compliance schedules and submissions are discussed later in this document.

Finally, today's proposal would require production cut-in for all airplanes manufactured after the required design changes are available. This section would apply only if the FAA has jurisdiction over the organization responsible for final assembly of the airplane. Section 25.1821(a) uses the same terminology as Annex 8 to the Convention on International Civil Aviation, which defines the limits of the FAA's authority under international law. In most cases, this refers to final assembly within the United States; there are limited circumstances where final assembly may occur in United States, but the responsible organization is under the jurisdiction of a foreign authority. It is also possible that final assembly could be done in another country by an organization over which the FAA has jurisdiction, such as a production certificate holder.

3. Auxiliary Fuel Tanks

Manufacturers and installers of auxiliary fuel tanks, whether manufactured under an amended TC, an STC or a field approval, would be required to conduct both an initial fleet

[10] These are cargo handlers and other persons who are typically carried on cargo-only airplanes to assist in the cargo operations.

[11] If this proposed amendment is not issued until after affected pending certification projects are completed, the final rule may revise the retrofit requirements proposed in § 25.1815 to reference Amendment 25–102 as the appropriate standard for fuel tanks on these airplanes other than those located in the fuselage.

average exposure analysis and an impact assessment. The first analysis would determine the exposure of the tanks for which they are responsible, while the second would determine whether those tanks negatively impact the flammability exposure of the tanks originally installed on the airplane.

Changes to TCs, including installation of auxiliary fuel tanks or changes in the capacity of fuel tanks, may result in increased fuel tank flammability exposure or adversely affect FRM or IMM.[12] Accordingly, the proposed rule would require a flammability exposure analysis of the auxiliary fuel tank design, an impact assessment to determine any adverse impact its design may have on the original or modified type design, and development of a flammability impact mitigation means (FIMM) to address adverse changes in flammability exposure.

STC holders or applicants for an amended TC affected by the proposed rule would need to conduct a flammability analysis using the ''Monte Carlo'' method defined in proposed Appendix L and discussed later in this document. A number of inputs are required to conduct this analysis. Airplane specific data, such as fuel management, fuel tank thermal characteristics, or airplane climb rate may not be readily available from the original TC holder. We intend the STC holders to obtain the information by working with the TC holder and operators of airplanes that have their tanks installed. Applicants would need to work with prospective customers. Operators have business agreements with the original TC holders and in many cases access to TC holder information they obtained when they purchased the airplane. Conservative assumptions or business agreements with the original TC holders are other possible methods of gathering airplane type specific data needed for the analysis.

If an increase in exposure above the allowable limits is identified, the holder of the STC or field approval would have to develop a FIMM and demonstrate how it will mitigate the impact of the increased exposure. One of the easiest methods may be simply deactivating the auxiliary tank or sealing off the venting to the affected tank. As another example, if an auxiliary fuel tank vents into a TC holder's tank for which FRM is provided, the venting may have to be modified to prevent adversely affecting the FRM's performance.

Finally, a validation analysis would be required for the auxiliary tanks that demonstrates that the auxiliary tank flammability exposure levels, as modified with the addition of FRM or IMM, do not exceed the acceptable limits. Likewise, a validation analysis would be required to demonstrate that the FIMM is effective in maintaining the level of exposure in other tanks determined by the manufacturer of the other tank. As is the case for TC holders of existing airplanes, holders of STCs and field approvals would need to develop future airworthiness limitations and meet all mandated compliance schedules should they decide not to deactivate the fuel tank.

For applicants for STCs and TC amendments, this proposal includes other design changes that could affect flammability exposure. Because this rule would require retrofit of airplanes to reduce flammability exposure, it would be counterproductive to allow future design changes that might negate the safety benefits of those retrofits.

Any design change to a TC subject to the requirements proposed in today's document that adds an auxiliary fuel tank, increases fuel tank capacity, or increases the flammability exposure of the existing fuel tank would have to meet the requirements of § 25.981 proposed today. This requirement is intended to apply primarily to future design changes, but it may also apply to design change projects that are pending when this rule is issued. For example, in addition to applying for a new TC for the Airbus Model A380, Airbus has also applied for an amendment to that TC for the Model A380–800F (freighter derivative). Among other design changes, this TC amendment would incorporate a new fuel tank in the fuselage contour that is normally emptied. Under this proposal, this fuel tank would have to be shown to meet the requirements of proposed § 25.981. Because of the increased technical complexity of auxiliary fuel tank installations resulting from this proposal once this final rule is adopted, field approvals will no longer be granted for these tanks on airplanes affected by this rule.

4. Methods of Mitigating the Likelihood of a Fuel Tank Explosion

As noted above, TC and STC holders may need to make design changes to their fuel tanks located, in whole or in part, within the fuselage to decrease their level of flammability exposure. The rule proposed today offers two options, IMM or FRM.

a. Flammability Analysis Using the Monte Carlo Method

For all fuel tanks, an analysis must be performed to determine whether the fuel tank, as originally designed, meets the fleet average flammability exposure limits discussed above. By ''average,'' we mean that the analysis of each fuel tank must be averaged over the entire flammability exposure evaluation time (FEET) (see footnote 8) of each airplane in the entire fleet. To determine the flammability exposure of fuel tanks, the ARAC used a specific methodology referred to as the Monte Carlo method.[13] We are proposing that any analysis of a fuel tank must be performed in accordance with this methodology, as detailed in proposed Appendix L and in the FAA document, Fuel Tank Flammability Assessment Method Users Manual.[14] We considered approving alternative methodologies in lieu of Appendix L, but we found that no other alternative considered all factors that influence fuel tank flammability exposure, which is the safety objective of this proposal.

The Monte Carlo method,[15] as commonly understood by scientists, is

[12] With the adoption of rules requiring the retrofit of fuel tanks in certain airplanes, we have to consider different issues in deciding what standards applicants for design change approvals must meet. Otherwise, the safety improvements that result from TC holder compliance with these requirements could be undone by later modifications. Therefore, even if we determine under § 21.101 that it is not necessary to require these applicants to comply with the latest airworthiness standards, it is still necessary for them to show that the change would not degrade the level of safety provided by the TC holder's compliance with the rule proposed today.

[13] This methodology determines the fuel tank flammability exposure for numerous simulated airplane flights during which various parameters such as ambient temperature, flight length, fuel flash point are randomly selected. The results of these simulations are averaged together to determine the fleet average fuel tank flammability exposure.

[14] As indicated in Appendix L, we intend to incorporate the users manual by reference into the final rule.

[15] *History of Monte Carlo method*

The method is called after the city in the Monaco principality, because of a roulette, a simple random number generator. The name and the systematic development of Monte Carlo methods dates from about 1944.

The real use of Monte Carlo methods as a research tool stems from work on the atomic bomb during the second world war. This work involved a direct simulation of the probabilistic problems concerned with random neutron diffusion in fissile material; but even at an early stage of these investigations, von Neumann and Ulam refined this particular '' Russian roulette'' and ''splitting'' methods. However, the systematic development of these ideas had to await the work of Harris and Herman Kahn in 1948. About 1948 Fermi, Metropolis, and Ulam obtained Monte Carlo estimates for the eigenvalues of Schrodinger equation.

In about 1970, the newly developing theory of computational complexity began to provide a more useful for obtaining numerical solutions to problems which are too complicated to solve analytically. The method provides approximate solutions to a variety of mathematical problems by performing statistical sampling experiments on a computer. The method applies to problems with no probabilistic content as well as to those with inherent probabilistic structure.

Our use of this method to analyze fuel tank flammability exposure and define acceptable limits is based on the recommendation of the ARAC, which compared the flammability exposure of conventional unheated aluminum wing fuel tanks to that of tanks that are located within the fuselage contour and heated by adjacent equipment. Use of the Monte Carlo method allows us to consider variables from within defined distributions that represent possible operating conditions for the flight. The results of a large number of flights can then be used to approximate average flammability exposure over a large fleet of airplanes.

Variables include those affecting all airplanes in the transport category airplane fleet, such as: (1) Ground, overnight, and cruise air temperatures likely to be experienced worldwide; (2) fuel properties; and (3) conditions when the tank in question will be considered flammable. In addition, the analysis factors in specific airplane models characteristics, such as climb and descent profiles, fuel management, heat transfer characteristics of fuel tanks, maximum airplane operating temperature limitations, maximum airplane range for the airplane model, and the effectiveness of FRM (if installed).

The flammability analysis must include any model variations and derivatives for which the TC holder has obtained approval that affect fuel tank flammability exposure. Model variations that may affect fuel tank flammability could include changes in the fuel tank volume or usable fuel capacity, changes in the fuel management procedures, and engine changes that might affect parameters such as airplane climb rate or bleed air available if needed by an FRM. Other examples of configuration differences that may affect fuel tank flammability exposure are provided in the discussion of § 25.1817. The flammability analysis would also include all modifications and changes mandated by ADs that affect fuel tank flammability exposure as of the effective date of the rule. These ADs would only be those issued against any configurations developed by TC holders. The analysis would not address any ADs issued against modifications defined by a third party STC installed on affected airplanes. The result would be a configuration that is clearly understood by both industry and the FAA.

Mass loading and changes in fuel vapor concentration caused by fuel condensation and vaporization have been excluded from the flammability exposure analysis. The method used by the ARAC to establish the flammability exposure value as the benchmark for fuel tank safety for wing fuel tanks did not include the effects of cooling of the wing tank surfaces and the associated condensation of vapors from the tank ullage. If this effect had been included in the wing tank flammability exposure calculation, it would have resulted in a significantly lower wing tank flammability exposure benchmark value. The ARAC analysis also did not consider the effects of the low fuel condition (or ''mass loading'') which would lower the calculated flammability exposure value for fuel tanks that are routinely emptied, such as center wing tanks. When the amount of fuel is reduced to very low quantities within a fuel tank, there may be insufficient fuel in the tank to allow vaporization of fuel to the concentration that would be predicted for any particular temperature and pressure.

The effect of condensation and vaporization in reducing the flammability exposure of wing tanks is comparable to the effect of the low fuel condition in reducing the flammability exposure of center tanks. Therefore, we consider these effects to be offsetting, so that by eliminating their consideration, the analysis will produce results for both types of tanks that are comparable. Accordingly, both factors have been excluded when establishing the flammability exposure limits in this proposal. During development of the harmonized special conditions for the Boeing 747, the FAA and the European Joint Aviation Authorities (JAA)/EASA agreed that using the ARAC methodology provides a suitable basis for determining the flammability of a fuel tank and consideration of these effects should not be permitted.

Using these variables, the Monte Carlo method would then be applied to a statistically significant number of flights (1,000,000), where each of the factors described above is randomly selected. The flights selected are representative of the fleet using the defined distributions of the variables. For example, flight one may be a short flight on a cold day with an average flash point fuel. Flight two may be a long flight on an average day with a low flash point fuel. This process is repeated until 1,000,000 flights have been defined in this manner.

For every one of the 1,000,000 flights, the Monte Carlo program calculates the amount of time the bulk average fuel temperature and ambient pressure in the fuel tank or compartment of interest would result in the fuel vapor being within the flammable range. This calculation is then used, in combination with the oxygen concentration in the fuel tank (if an FRM is installed), to establish whether the fuel tank is flammable. Averaging the results for all 1,000,000 flights provides an average flammability exposure for the fleet of airplanes of a particular model type.

The determination of whether the fuel tank ullage is flammable is based on the temperature of the fuel in the tank or the compartment of interest, determined by the tank thermal model, the atmospheric pressure in the fuel tank, and properties of the fuel loaded for a given flight, which is randomly selected from data provided in tables in this appendix.

The Monte Carlo methodology has previously been recommended by ARAC and has been used in previous analyses by the affected certificate holders in evaluating the flammability exposure of fuel tanks conducted as part of evaluating the findings of SFAR 88. Therefore we expect the affected type certificate holders already have a good understanding and can comply with this requirement within the proposed timeframe of 150 days.

b. Ignition Mitigation Means

The proposed rule maintains the option introduced by Amendment 25–102 for affected manufacturers to use ignition mitigation as a means of protecting the airplane from the hazards associated with fuel tank flammability. IMM is a passive system that requires little attention once installed. IMM does not prevent an ignition in the fuel tank; rather, material absorbs the heat created by the fire. While a small fire could occur, an IMM system eliminates the

precise and persuasive rationale for employing the Monte Carlo method. The theory identified a class of problems for which the time to evaluate the exact solution to a problem within the class grows at least exponentially with M. The question to be resolved was whether or not the Monte Carlo method could estimate the solution to a problem in this intractable class to within a specified statistical accuracy in time bounded above by a polynomial in M. Numerous examples now support this contention. Karp (1985) shows this property for estimating reliability in a planar multiterminal network with randomly failing edges. Dyer (1989) establish it for estimating the volume of a convex body in M-dimensional Euclidean space. Broder (1986) and Jerrum and Sinclair (1988) establish the property for estimating the permanent of a matrix or, equivalently, the number of perfect matchings in a bipartite graph. Discussion derived from *History of the Monte Carlo Method*, Sabri Pllana, *http://geocities.com/College Park/Quad/2435/index.html.*

possibility of a catastrophic fuel tank explosion.

We acknowledge that IMM presents maintenance challenges. The mitigation means (such as polyurethane foam, metal foil products and explosion suppression systems discussed within AC 25.981–2) must be reinstalled exactly as removed when the fuel tanks are opened up for maintenance actions. Replacement is particularly difficult because all voids must be removed. It also appears that the materials used for mitigation (particularly the polyurethane foams) may be prone to compression, thus reducing the usable life of the material.

Nevertheless, given the potential effectiveness of IMM, the FAA believes we should continue to allow installation of IMM as a means of compliance with the requirements proposed today. A detailed discussion of acceptable means of compliance for manufacturers choosing to comply with the IMM option is provided in AC–25.981–2.

c. Flammability Reduction Means

Alternatively, a TC or STC holder could decide to use an FRM that limits the exposure level of the tanks. For fuel tanks that are normally emptied and located within the fuselage contour, the exposure would have to be limited to 3 percent under two sets of conditions, overall fleet exposure and warm day fleet exposure. Both of these conditions would be evaluated using the Monte Carlo method described below. For all other fuel tanks, the 3 percent limit would apply only to the overall fleet exposure.

The proposed flammability exposure requirements are intended to provide an additional layer of protection to the existing certification standards that require designs to preclude fuel tank ignition sources. This balanced risk management approach of precluding ignition sources and reducing flammability exposure in certain fuel tanks provides two independent layers for preventing fuel tank explosions in those tanks. The proposed requirements could be met by a highly reliable ‘‘single-string’’ (non-redundant) inerting-based FRM, allowing for limited operation of airplanes with an inoperative FRM until repairs could be made. These requirements could also be met by a cooling-based FRM. Compliance with these requirements has been shown to be practical using existing technology.

i. Accounting for System Reliability and Performance Issues

As discussed in the background section of this document, previous studies of inerting-based FRM showed that, if inerting systems were required to be operational for all flights, the system would be required to have at least some redundant design features and would not be practical. That is, it would require most components to be duplicated to provide a back-up function in the event the primary component failed. A requirement for a redundant FRM that would continue to operate after component failure would increase the weight and complexity of an inerting system. This may result in a system that would not be practical for commercial airplanes at this time. The overall fleet flammability exposure analysis would assume some periods of inoperability. However, we would require that the contribution to average flammability exposure due to either reliability (during periods when the system is inoperative) or system performance (during periods when the system does not have the capacity to maintain a non flammable tank), be limited to 1.8 percent. This gives the designer freedom to engineer the system, and allows for some operation of airplanes with an inoperative FRM until repairs can be made at an appropriate maintenance facility.

ii. Warm Day Fleet Flammability Exposure

The warm day exposure analysis is intended to ensure minimum FRM system performance levels when there is the greatest risk to safe flight. Therefore, the 3 percent flammability exposure limit excludes system reliability related contributions that are included in the overall fleet flammability exposure assessment. Compliance with this proposal would require conducting an analysis in accordance with Appendix L for each of the specific phases of flight during warmer day conditions defined in the proposal. The flammability exposure of the tank in question would be determined for the ground, takeoff and climb phases as separate values, without including the times when the FRM is not available because of failures of the system or dispatch with the FRM inoperative. The fleet flammability exposure level of each fuel tank for ground, takeoff, and climb phases of flight during warm days must not exceed 3 percent of the flammability exposure evaluation time in each of the three phases.

iii. Reliability Reporting

Today's proposal, if adopted, would require that the applicant demonstrate effective means to ensure collection of FRM reliability data so that the effects of component failures can be assessed on an on-going basis. The proposed reporting requirement applies to applicants and holders of the affected TCs, STCs, and field approvals.

The rule would require the TC or STC holder to provide the FAA with summaries of the FRM reliability data and compliance with Appendix K on a quarterly basis for the first five years after the FRM is installed and operational. After that time, continued quarterly reporting requirements may be replaced with other reliability tracking methods approved by the FAA oversight office. The requirement for quarterly reports may be eliminated if the FAA determines that the reliability of the FRM meets, and will continue to meet, the requirements of the rule.

Operators would not be required to report FRM reliability information. We intend TC holders to gather the needed data from operators using existing reporting systems that are currently used for airplane maintenance, reliability and warranty claims. We anticipate the operators would provide this information through existing business arrangements between the TC holders and the airlines.

iv. Reliability Indication and Maintenance Access

The proposed rule would require that indicators be provided to identify failures of the FRM, so that appropriate actions can be taken to maintain the reliability of the FRM. The need to provide indication of the FRM status will depend on the particular FRM design. Various design methods may be used to make sure an FRM meets the reliability and performance requirements. These may include a combination of system integrity monitoring and indication, redundancy of components, and maintenance actions. A combination of maintenance indication or maintenance check procedures could be used to limit exposure to latent failures within the system, or high inherent reliability may be used to make sure the system will meet the fuel tank flammability exposure requirements.

The need for FRM indications and the frequency of checking system performance (maintenance intervals) must be determined as part of the FRM fuel tank flammability exposure analysis. The determination of a proper maintenance interval and procedure will follow completion of the certification testing and demonstration of the system's reliability and performance prior to certification or as part of the FAA review process for airplanes manufactured under existing

TCs or auxiliary fuel tanks under existing STCs.

The rule would also require that sufficient accessibility to FRM status indications be provided for maintenance personnel. We intend that maintenance personnel or the flightcrew have access to any indications that must be accessed at intervals established by the FRM design approval holder when demonstrating compliance with the reliability requirements for the FRM. Access doors and panels to the fuel tanks with FRMs and to any other enclosed areas that could contain hazardous atmosphere under either normal conditions or failure conditions would need to be permanently stenciled, marked, or placarded to warn maintenance personnel of the possible presence of a potentially hazardous atmosphere. The proposal for markings does not alter the existing requirements that must be addressed when entering airplane fuel tanks.

d. Service Instructions and Service Bulletins

If the flammability exposure analysis shows that the average exposure level for any fuel tank exceeds 7 percent, the TC holder would be required to develop design changes and service instructions for either FRM or IMM.

Modifications incorporated into existing airplanes, including safety related changes (design and/or maintenance) that are mandated by AD, are typically made by operators using service instructions developed by the TC holders, commonly referred to as service bulletins. In this proposal, service instructions must contain sufficient information for the operator to incorporate the design change and any associated procedures and airworthiness limitations. They may include specific step-by-step procedures and information needed by the operator, such as parts lists and drawings. Therefore, the proposed rule would require TC holders to develop and submit for approval by the FAA, not just data defining a proposed design change, but all of the information necessary to enable an operator to comply with the proposed operational rules, discussed later.

e. Critical Design Configuration Control Limitations (CDCCL)

If adopted, the rule would require defining airworthiness limitations, including Critical Design Configuration Control Limitations (CDCCL), inspections, and other procedures for fuel tanks to prevent exceeding the applicable flammability exposure limits. For this proposal, CDCCL include those features of the design that must be present or maintained for compliance with the requirements of § 25.981(b) and (c) for the operational life of the airplane. For example, certain fuel tanks may rely on natural cooling to meet the flammability exposure levels within this proposal. Changes to the airplane, such as installing a fuel re-circulation system, hydraulic heat exchanger in the fuel tank, or a heat source adjacent to the fuel tank, may affect fuel tank flammability. The CDCCL would be necessary in this example to prohibit the addition of heat to the fuel tank. Another example of CDCCL might include limits on operation with certain fuel types such as JP–4. We expect all fuel tanks, even those in airplanes that do not have high flammability fuel tanks, would need to have CDCCL defined so that future modifications do not increase the flammability above the mandatory limit. The proposal applies the same requirements already applied to fuel tank ignition source prevention in § 25.981(b) to the FRM or IMM.

The proposal also includes the requirement that visible means identifying CDCCL are present. Our intent here is to prevent alterations to critical features of the system. As the visible identifications are critical to the FRM or IMM system, they are also considered to be CDCCL. Any tampering or removal would be in violation of the CDCCL. These CDCCL, inspections, or other procedures would be documented as airworthiness limitations in the ICA.

Under the proposal, all fuel tanks, regardless of flammability exposure, must be subject to airworthiness limitations consisting of CDCCL, inspections, or other procedures. The purpose of these limitations is to prevent increasing the flammability exposure of the tanks above that permitted under this section and to prevent degradation of the performance of any means installed in accordance with this section. For example, certain fuel tanks may rely on natural cooling or use of certain fuel types to meet the flammability levels within this proposal. Therefore, CDCCL may be required that define the critical features, such as—

- Flammability exposure of the unheated aluminum wing tank,
- Cooling rate,
- Limits on heat input,
- Limits on use of high volatility fuels such as JP–4,
- Quantity of engine bleed air flow that is used for inerting,
- Limits on penetrations of the fuel tank,
- Limits on any changes to fuel management that may affect FRM,
- Limits on changes to any placards or means used to visibly identify critical design features of the fuel tank system that must not be compromised for the operational life of the airplane.

As discussed above, airworthiness limitations, such as those proposed today, are part of the ICA. TC holders would need to make available to affected parties pertinent changes to the ICAs. (The term ''make available'' is used in the same sense that it is used in § 21.50.) We do not intend by this proposal to alter or interfere with the existing commercial relationships between TC holders and these other persons. We anticipate that TC holders would be able to be reasonably compensated for developing these documents, as they are under current practice.

The proposed rule would require creation of an Airworthiness Limitations Section (ALS), unless previously established. The ALS is required by current part 25 and includes those items that have mandatory inspection or replacement times related to fuel systems and structure. The ALS is included in the ICA, approved as part of certification, and distributed with an airplane on delivery. In this way the ALS is visible to all who need it and who would be required to comply with it under §§ 91.1509, 121.917, 125.509 and 129.117 of this proposal. The current part 25 ALS and ICA requirements apply only to airplane types for which the TC application was made after Amendment 25–54 (adopted in 1981) and were developed for structural considerations. As a result, they are not applicable to many current airplanes and do not currently contain information for other systems.

For those TC holders of airplanes that currently do not have an ALS, the intent of this proposal is to require an ALS only for fuel tank safety related limits. This proposal would not require that the ALS for these airplanes include the other requirements for an ALS established under Amendment 25–54 to part 25, or a later amendment. For those TC holders or applicants with airplanes certified to Amendment 25–54 or later, the existing ALS would be revised to include the fuel tank system airworthiness limitation items (ALI).

f. Compliance Planning

Historically, the FAA has worked together with the TC holders when safety issues arise, in order to identify solutions and actions that need to be taken. Some of the safety issues that have been addressed by this process include those involving aging aircraft structure, thrust reversers, cargo doors, and wing icing protection. While some manufacturers have promptly addressed these safety issues and developed service instructions, others have not applied the resources necessary to develop service instructions in a timely manner. This has caused delay in the adoption of corrective action(s). A more uniform and expeditious response is necessary to address fuel tank safety issues. Because this proposal sets a precedent in introducing part 25 requirements for holders of existing TCs, changes to existing TCs, and manufacturers, it is the FAA's expectation that they will work closely with the FAA oversight office in putting together a compliance plan for developing the required FRM or IMM.

In order to provide TC holders and the FAA with assurance that the TC holders understand what means of compliance is acceptable and have taken necessary actions (including assigning sufficient resources) to achieve compliance with the proposed rule, we are proposing a compliance planning requirement. This requirement is based substantially on ''The FAA and Industry Guide to Product Certification,'' which describes a process for developing project-specific certification plans for type certification programs. This Guide may be found in the docket. This planning requirement would not apply to future applicants for TCs. Since this type of planning routinely occurs at the beginning of the certification process, no additional compliance planning is required for future applicants.

The Guide recognizes the importance of ongoing communication and cooperation between applicants and the FAA. The proposed planning schedule, while regulatory in nature, is intended to encourage establishment of the same type of relationship in the process of complying with this rule, if adopted.

One of the items required in the plan is, ''If the proposed means of compliance differs from that described in FAA advisory material, a detailed explanation of how the proposed means will comply with this section.'' FAA advisory material is never mandatory, because it describes one means, but not the only means of compliance. In the area of type certification, applicants frequently propose acceptable alternatives to the means described in advisory circulars. But when an applicant chooses to comply by an alternative means, it is important to identify this as early as possible in the certification process to provide an opportunity to resolve any issues that may arise that could lead to delays in the certification schedule.

The same is true for the fuel tank flammability reduction requirement. As discussed earlier, timely compliance with this section is necessary to enable operators to comply with the operational requirements of this proposal. Therefore, this item in the plan would enable the FAA oversight office to identify and resolve any issues that may arise with the compliance plan without jeopardizing the TC holders ability to comply with this section by the compliance time.

i. Compliance Plan for Flammability Exposure Analysis

The proposed rule would require submission of a compliance plan within 60 days of the effective date of the final rule for the flammability exposure analysis required by the proposed rule. The intent of the proposal is to promote early planning and communication between the certificate holders and the FAA. The exposure analysis would need to be completed within 150 days of the rule's effective date. Thus, the 60 day planning submission should provide sufficient time for the FAA to discuss any concerns that it may have over how the affected party intends to analyze fleet average flammability exposure.

ii. Compliance Plan for Design Changes and Service Instructions

Under today's proposal, each holder of an existing TC would need to submit to the FAA oversight office a compliance plan for developing design changes and service instructions within 210 days of the rule's effective date.

TC holders and applicants would have to correct a deficient plan, or deficiencies in implementing those plans, in a manner identified by the FAA oversight office. Deficiencies in the compliance plan would need to be corrected within 30 days of notification by the FAA. This approach differs from the original type approval process. Applicants for type certificates face commercial pressures, not regulatory deadlines, so the FAA can permit them to resolve identified deficiencies on their own schedule. Such leeway is not appropriate here because operators who are subject to regulatory deadlines are dependent on TC holders' timely compliance with these requirements. However, before the FAA formally notifies a TC holder or applicant of deficiencies, we will contact it to try to understand the deficiencies and develop a means of correcting them. Therefore, the notification referred to in this paragraph should document the agreed corrections.

The ability of an operator to comply with the proposed operating rules will be dependent on TC holders complying with the requirement to develop design changes and service instructions. The FAA intends to carefully monitor compliance and take appropriate action if necessary. Failure to comply by the dates specified in the final rule would constitute a violation of the requirements and could subject the violator to certificate action to amend, suspend, or revoke the affected certificate (49 U.S.C. 44709). It could also subject the violator to a civil penalty of not more than $25,000 per day per certificate until § 25.1815 is complied with (49 U.S.C. 46301).

iii. Compliance Plan for Auxiliary Fuel Tanks

The proposed rule would also establish a timeframe in which affected STC holders, applicants for an amended TC, and operators using fuel tanks pursuant to a field approval must submit for approval (to the FAA oversight office) a flammability exposure analysis for their design changes. The proposal includes a 12-month timeframe to complete the analysis. Any applicant whose STC or TC amendment is not approved within the 12-month compliance period would have to complete the analysis before approval.

The proposed rule would also require submission for approval of an impact assessment of the fuel tank system, as modified by the STC holder's design change. The purpose of this proposal is to identify any features of the modification to the original type design that may violate the critical design configuration control limitations developed by the original TC holder. For example, if an FRM that utilized inerting is incorporated into an airplane, a CDCCL would likely be developed that would limit venting of air into the fuel tank, because it could introduce oxygen into the tank, resulting in a flammable vapor space. In this case the STC holder would need to assess its design and identify any violation of the CDCCL identified for the FRM. Results from the analysis would be provided to the FAA in the form of a report or summary letter.

Supplemental type certificate holders would have to submit the impact assessment within six months after we approve the TC holder's CDCCL. Applicants whose design changes are not approved within that six-month period would have to submit the assessment before approval of the change. Once the CDCCL is approved, the TC holder would be required to make them available to other affected persons, including those subject to this section. We consider the six-month period more than enough to perform the required assessment. The resulting service instructions would be required to show compliance with the applicable flammability requirements and to address any adverse effects of the design change on any IMM or FRM developed by the TC holder.

g. Compliance Schedule

Table 2 contains compliance dates for the required submissions. This table provides specific dates for each Boeing and Airbus model airplane that has fuel tanks whose average flammability exposure exceeds 7 percent. A compliance time of 24 months from the effective date of the final rule is proposed for all other models subject to this proposal (if the flammability exposure analysis shows an average exposure level exceeding 7 percent). We established the compliance dates proposed in this table after consideration of the time needed by the TC holders to develop the means to address fuel tank flammability exposure. We anticipate development of an FRM or IMM would take the affected TC holder about 2 years. The dates in the proposal were based on the assumption that it would be adopted well before the end of 2005. However, the rulemaking process took longer than originally anticipated. Consequently, given the specific compliance dates I the proposed rulemaking and the likelihood that finalization of the rules will be later than expected, there may not be as much time allowed for compliance as originally planned. We recognize that compliance intervals may need to be adjusted and will consider your comments on this condition.

On February 17, 2004, the FAA Administrator announced that the agency is developing a proposal for new rules that would require reducing the flammability exposure of new production transport category airplanes and existing transport category airplanes with high-flammability fuel tanks. Since then, Boeing has announced plans to incorporate FRM in newly produced airplanes and to make service instructions available for the airplane models listed in this notice. Boeing has also submitted applications for type certification of flammability reduction systems. On February 15, 2005, we published a Special Conditions No. 25–285–SC for flammability reduction means on the Boeing Model 747 (70 FR 780068563). Airbus flew an A320 [16] in August 2003 with the prototype FAA inerting system, but has not committed to production incorporation or development of service instructions for any flammability reduction means on its airplane models.

[16] *Flight-Testing of the FAA Onboard Inert Gas Generation System on an Airbus A320*, DOT/FAA/AR–03/58, dated June 2004.

While Airbus and Boeing may have less than 2 years from the effective date of the final rule to develop an FRM or IMM for some of their models, we know that both companies have been considering these improvements well in advance of this rulemaking. The proposed compliance dates are thus staggered to allow the engineering resources of the TC holders to develop design means for all of their models. The proposed dates are established based on both our assessment of when it is feasible for TC holders to comply and the risks associated with particular airplane models, due to the flammability of the fuel tanks and numbers of airplanes in the fleet. For example, the Boeing Model 747 is first, followed by the Boeing Model 737. The first Airbus model affected is the A320. The proposed dates will support the retrofit of airplanes at the earliest reasonable time to achieve the safety benefits intended by this rulemaking.

The compliance times proposed for airplane and fuel tank manufacturers are also used as the basis for the proposed compliance dates for introduction of these systems into the operators' fleets under parts 91, 121, 125, and 129. Extension of the compliance dates for development of the service instructions by the certificate holders would either reduce the amount of time available to operators or delay full deployment of these safety improvements. As discussed later in this proposal for the operational requirements, incorporation of FRM or IMM will likely require access inside the fuel tanks.

TABLE 2

Model	Service instruction submittal date
Boeing	
747 Series	December 31, 2005.
737 Series	March 31, 2006.
777 Series	March 31, 2006.
767 Series	September 30, 2006.
757 Series	March 31, 2007.
707/720 Series	December 31, 2007.
Airbus	
A319, A320, A321 Series.	December 31, 2006.
A300, A321 Series	June 30, 2007.
A330, A340 Series	December 31, 2007.
All other affected models.	Within 24 months of effective date of this amendment.

E. Proposed Requirements for Airplane Operators

The proposed operating rules would prohibit the operation of certain transport category airplanes operated under parts 91, 121, 125, and 129 beyond specified compliance dates, unless the operator of those airplanes has incorporated approved IMM, FRM or FIMM modifications and associated airworthiness limitations for the affected fuel tanks. The proposed rules would not apply to airplanes used only in all-cargo operations.

This rulemaking also includes a proposal to create new subparts that pertain to the support of continued airworthiness and safety improvements in the following parts of Title 14 Code of Federal Regulations:

- Part 91, General Operating and Flight Rules;
- Part 121, Operating Requirements: Domestic Flag and Supplemental Operation;
- Part 125, Certification and Operation: Airplanes Having a Seating Capacity of 20 or More Passengers or a Maximum Payload Capacity of 6,000 Pounds or More; and Rules Governing Persons On Board Such Aircraft; and
- Part 129, Operations: Foreign Air Carriers and Foreign Operators of U.S.-registered Aircraft Engaged in Common Carriage.

As discussed earlier, this proposal does not include part 135, since the number of airplanes in part 135 operation that would be affected by these proposals is relatively small. In the event changes to part 135 result in a greater number of affected airplanes operating under that part, the FAA will reassess the need to apply these proposed requirements to that part.

The FAA believes that inclusion of certain rules under the new subparts will enhance the reader's ability to readily identify rules pertinent to continued airworthiness. Unless stated otherwise, our purpose in moving requirements to the new subparts is to ensure easy visibility of those requirements applicable to the continued airworthiness of the airplane. We do not intend to change their legal effect in any other way. The new subparts are substantially the same and accordingly are not discussed separately here. Table 3 illustrates what proposed and existing requirements will be included in the new subparts. Each new subpart is titled ''Continued Airworthiness and Safety Improvements.'' The proposed new subparts consist of relocated, revised, and new regulations pertaining to continued airworthiness of the airplane.

TABLE 3.—NEW SUBPARTS FOR PARTS 91, 121, 125, AND 129

Part 91 new/relocated rules within proposed subpart K	Part 121 new/relocated rules within proposed subpart Y	Part 125 new/relocated rules within proposed subpart M	Part 129 new/relocated rules within proposed subpart B
§ 91.1501, Applicability (new)	§ 121.901, Applicability	§ 125.501, Applicability	§ 129.101, Applicability.
§ 91.1503, Reserved	§ 121.903, Reserved	§ 125.503, Reserved	§ 129.103, Reserved.
§ 91.1505, fuel tank system maintenance program.	§ 121.905, Electrical wiring interconnection systems (EWIS) maintenance program.	§ 125.505, Fuel tank system inspection program.	§ 129.105, Electrical wiring interconnection systems (EWIS) maintenance program.
§ 91.1507, Repairs assessment for pressurized fuselages (formerly § 91.401(a)).	§ 121.907, Fuel tank system maintenance program.	§ 125.507, Repairs assessment for pressurized fuselages (formerly § 125.248(a)).	§ 129.107, Fuel tank system maintenance program.
§ 91.1509, Reserved	§ 121.909, Reserved	§ 125.509, Reserved	§ 129.109, Reserved.
§ 91.1511, Reserved	§ 121.911, Reserved	§ 125.511, Reserved	§ 129.111, Reserved.
	§ 121.913, Aging airplane inspections and records reviews (formerly § 121.368).		§ 129.113, Supplemental inspections for U.S.-registered aircraft (formerly § 129.16).
	§ 121.915, Repairs assessment for pressurized fuselages (formerly § 121.370(a)).		§ 129.115, Repairs assessment for pressurized fuselages (formerly § 129.32(a)).
§ 91.1513, Reserved	§ 121.917, Supplemental inspections (formerly § 121.370(a).		§ 129.117, Aging airplane inspections and records reviews for U.S.-registered aircraft (formerly § 129.33).

1. Requirement to Install and Operate FRM, IMM or FIMM

The proposed rules would prohibit certificate holders from operating any affected airplane after dates specified, unless IMM, FRM or FIMM, as applicable, are installed and operational for any fuel tank for which they are required. The safety objective of these proposed rules is to have the required modifications installed and operational at the earliest opportunity.

The proposed rule would require that operators of the affected airplanes incorporate applicable maintenance program changes before returning an airplane to service after accomplishing any required modifications.

For some of the affected airplanes, manufacturer compliance with the proposed requirements may not result in any design changes, but would result in development of airworthiness limitations in the form of maintenance actions, operational procedures, or CDCCL, as previously discussed. In these cases the affected operators would be required to incorporate these limitations within one year after their approval by the FAA oversight office. The FAA will inform the affected operators and principal inspectors of the availability of the approved information.

Once an operator revises its maintenance or inspection program, it is important to make sure that later alterations to the airplane do not degrade the level of safety provided by these revisions. The proposed rules would require future applicants for approval of design changes to develop new airworthiness limitations for new auxiliary fuel tanks and other design changes affecting fuel tank flammability. To ensure that these airworthiness limitations are implemented, operators who incorporate these design changes into their airplanes would be required to revise their maintenance and inspection programs to incorporate the corresponding airworthiness limitations.

Today's proposal would require operators to submit the proposed maintenance and inspection program changes to their FAA Principal Inspector for review and approval.[17] This review would include the integration of the applicable airworthiness limitations for the TC and any STC and field approved auxiliary fuel tank to ensure their consistency and compatibility in the maintenance or inspection program. Guidance will be provided to operators and principal inspectors regarding how to address any deviations that may be proposed by the affected operators from the information approved by the FAA oversight office. As airworthiness limitations, these cannot be changed without FAA approval, nor are they subject to maintenance review board or other maintenance program development processes.

[17] A part 91 operator would send the relevant information to either their principal inspector or Flight Standards District Office, as applicable.

2. Authority To Operate With an Inoperative FRM, IMM or FIMM

Generally, the FAA does not require operators to use or maintain equipment installed on airplanes prior to a uniform compliance date. In this proposal, we take a different approach. The safety advantages associated with a fuel tank system equipped with an FRM or IMM design, as modified by any FIMM, are so compelling that we propose requiring that operators use these systems as soon as they are available. We have accommodated the difficulties faced by operators in making the required design changes by providing a phased-in compliance schedule that extends up to seven years after the manufacturer's compliance date for each model. Accordingly, an operator may not operate any airplane with fuel tanks equipped with FRM, IMM or FIMM, unless those systems are fully operational. The sole exception is when the systems are inoperative and the conditions and limitations specified in the operator's Minimum Equipment List (MEL) are met.

The method used to allow operation of an airplane when an FRM is inoperative would be to include the FRM dispatch relief in the FAA-approved MEL. The MEL contains a list of equipment that may be inoperative for a defined period of time. Under § 91.213 and similar regulations, the airplane may be dispatched with inoperative equipment in accordance with the Master Minimum Equipment List (MMEL).

The FAA Flight Operations Evaluation Board (FOEB) would establish the MMEL dispatch relief interval for an FRM based on data submitted by the applicant to the FAA. The expected MMEL dispatch relief interval is one of the contributing factors affecting the overall system reliability analyses that must be established early in the design of the FRM. The proposed requirements of Appendix K allow the designer to choose to design a highly reliable FRM and then request longer MMEL dispatch relief intervals when submitting their data to the FOEB.

This proposal does not recommend the adoption of a specific MMEL dispatch inoperative interval at this time. However, the comments received from the NTSB on to the proposed special conditions for the Boeing 747 indicate that the FRM should be treated like other non-redundant safety equipment, such as the flight data recorder. The recorders are allowed a 3-day MMEL inoperative interval. We specifically request public comment on the proposal to allow the current FOEB process to establish the MMEL interval rather than requiring a specific maximum interval.

3. Compliance Schedule

To achieve the safety benefits of this initiative, we believe it is necessary to have a mandatory schedule for phasing in the design changes rather than to rely solely on market forces to drive the production and availability of parts and normal maintenance scheduling for the installation of the FRM, IMM, or FIMM. Accordingly, this rule, if adopted, would require at least 50 percent of the affected airplanes be outfitted within four years after the relevant TC holder is required to comply with the proposed requirements. The remainder of the operator's fleet would have to comply with the final rule within seven years after the specified date. The affected fleet would include those airplanes that have field or STC approved auxiliary fuel tanks. Certificate holders that operate only one airplane of an affected model would have to modify that airplane within the seven-year compliance period.

The proposed compliance schedule of 7 years after TC holders to develop service instructions, while long, should allow for the approval of the service instructions for IMM, FRM, or FIMM, manufacture of modification parts for a large fleet of airplanes, and accomplishment of the modifications with minimum disruption of normal maintenance schedules. Typically, fuel tanks are only accessed during heavy maintenance checks that are done on a schedule that is established during development of the maintenance program. The compliance dates proposed for the operational rules were developed to allow for the majority of the modifications to be done during these heavy maintenance checks. Introduction of FRM, IMM or FIMM outside of normally scheduled maintenance would increase the cost to the operators, because extra tank entry and airplane down time would be needed.

Some airplane types or specific airplanes within an operator's fleet may not be scheduled for normally scheduled maintenance, where the fuel tanks would be opened, during the 7-year compliance time after service instructions become available. These airplanes would require incorporation of modifications outside of the normally scheduled maintenance. We have determined the number of airplanes that would be affected is small and that further lengthening the compliance period would not achieve the safety benefits of this proposal in a timely way. Also, we anticipate that some of the upcoming ADs to address ignition source issues will occur in this time period and in some cases will require fuel tank entry. Compliance with the AD may provide additional opportunities for incorporating approved FRM, IMM or FIMM if not occurring during normal scheduled maintenance. These issues are further discussed in the regulatory evaluation.

F. Additional Provisions

1. Relationship of This Proposal to Aging Airplane Regulatory Initiatives

As part of our broader review of several important initiatives comprising the Aging Airplane Program, we have revised certain compliance dates in existing rules and pending proposals so that operators can make required modifications during scheduled maintenance. Changing compliance dates affects our ability to expedite some aspects of this program but reduces the costs of the rules and proposals in place to deal with aging airplanes. Notice of these changes and a description of our Aging Airplane Program review appeared in the **Federal Register** on July 30, 2004 (69 FR 45936). In addition to this Fuel Tank Flammability Reduction proposal, the actions affected by these revisions include:

- Aging Aircraft Program (Widespread Fatigue Damage (proposal),
- Aging Airplane Safety (interim final rule), and
- Enhanced Airworthiness Program for Airplane Systems/Fuel Tank Safety (proposal).

Today's proposal, if adopted, would also affect compliance with SFAR 88 and potentially make it less costly. The safety reviews following the TWA 800 accident led us to require that the fuel quantity indication system wiring entering high flammability tanks incorporate either adequate separation or energy limiting devices, known as transient suppression devices, on the Boeing 737 and 747 to protect the tank from ignition sources. As part of the safety reviews of SFAR 88, we have identified other models that likewise would need a transient suppression device. We have determined that if FRM are incorporated in high flammability fuel tanks, ADs requiring installation of devices to protect the fuel quantity system wiring will no longer be needed. We have not yet estimated the potential savings and have not included these savings in the current regulatory evaluation. We specifically request comments regarding the savings that would be achieved if electrical energy limiting devices were not required on wiring entering high flammability fuel tanks affected by this proposal.

2. FAA Advisory Material

We are developing extensive guidance material to supplement the proposed rule, including a revised AC 25.981–2 to include guidelines on conducting a fuel tank flammability exposure assessment using the Monte Carlo methodology and developing IMM and FRM. It will also include guidance on development of the airworthiness limitations section, confined space hazards and markings, documentation required by the FAA, and reporting methods. We have incorporated some comments on these topics from a group of specialists at the Aerospace Industries Association, which included airplane manufacturers, airline operators and manufacturers of inert gas generating equipment.[18] The group provided advice on fuel tank inerting and use of the Monte Carlo methodology. We will invite public comments on the proposed ACs (which references the Monte Carlo User's Manual) by separate notice published in the issue of the **Federal Register**.

3. FAA Oversight Office

We are also requiring affected persons to submit various compliance materials to the FAA Oversight Office, defined in proposed § 25.1803(c). The FAA Oversight Office is the aircraft

[18] A copy of the AIA report is included in the docket for this rulemaking.

certification office or office within the Transport Airplane Directorate having oversight responsibility for the relevant TC or STC, as delegated by the Administrator. For example, with respect to fuel-tank flammability issues, TC and STC holders must obtain approvals from the responsible office in the FAA's Aircraft Certification Service. In other contexts, we have described the FAA office performing these functions as the ''cognizant FAA office.''

Table 4 lists the FAA offices that currently oversee issuance of TCs and amended TCs for manufacturers of large transport category airplanes.

TABLE 4.—FAA OFFICES THAT OVERSEE TYPE CERTIFICATES

Airplane manufacturer	FAA Oversight Office
Aerospatiale	Transport Airplane Directorate, International Branch.
Airbus	Transport Airplane Directorate, International Branch.
BAE	Transport Airplane Directorate, International Branch.
Boeing	Seattle Aircraft Certification Office.
Bombardier	New York Aircraft Certification Office.
Embraer	Transport Airplane Directorate, International Branch.
Fokker	Transport Airplane Directorate, International Branch.
Gulfstream	Atlanta Aircraft Certification Office.
Lockheed	Atlanta Aircraft Certification Office.
Boeing/McDonnell-Douglas Corp	Los Angeles Aircraft Certification Office.

4. Workplace Safety Issues

Because we would require that maintenance personnel be given access to FRM installations, the proposal could increase occupational safety risks for these personnel. A large percentage of the work involved in properly inspecting and modifying airplane fuel tanks and their associated systems must be done in the interior of the tanks. Performing the necessary tasks requires inspection and maintenance personnel to physically enter the tank, where environmental hazards exist. These hazards exist in any fuel tank (regardless of whether a nitrogen inerting system is installed) and include fire and explosion, toxic and irritating chemicals, oxygen deficiency, and the confinement to the fuel tank itself. To prevent related injuries, operator and repair station maintenance organizations have developed specific procedures for identifying, controlling, or eliminating the hazards of fuel-tank entry. In addition, government agencies have adopted safety requirements for use when entering fuel tanks and other confined spaces. These same procedures would be applied to the reduced oxygen environment likely to be present in an inerted fuel tank.

Introduction of nitrogen enriched air within the fuel tanks and the possibility of nitrogen enriched air in compartments adjacent to the fuel tanks if leakage occurs creates additional risk. Lack of oxygen in these areas could be hazardous to maintenance personnel, the passengers, or flight crew. Existing certification requirements address these hazards. This proposal requires markings to emphasize the potential hazards associated with confined spaces and areas where a hazardous atmosphere could be present as a result specifically of the addition of FRM. We would require that the access doors and panels to the fuel tanks with FRMs and to any other enclosed areas that could contain hazardous atmosphere under either normal conditions or failure conditions be permanently stenciled, marked, or placarded to warn of hazards.

Fuel tanks are confined spaces [19] and contain high concentrations of fuel vapors that must be exhausted from the fuel tank before entry. Other precautions such as measurement of oxygen concentrations before entering a fuel tank are already required. Addition of the FRM that utilizes inerting may result in reduced oxygen concentrations due to leakage of the system in locations in the airplane where service personnel would not expect it. These gases may be under pressure because of the FRM design, and any hazards associated with working in adjacent spaces near the opening should be identified in the marking of the opening to the confined space.

Designs currently under consideration locate the FRM in the fairing below the center wing fuel tank. Access to these areas is obtained by opening doors or removing panels, which could allow some ventilation of the spaces adjacent to the FRM. But this may not be enough to avoid creating a hazard. Therefore, unless the design eliminates this hazard, we intend that marking be provided to warn service personnel of possible hazards associated with the reduced oxygen concentrations in the areas adjacent to the FRM. Appropriate markings would be required for all inerted fuel tanks, tanks adjacent to inerted fuel tanks and all fuel tanks communicating with the inerted tanks via plumbing. The plumbing includes, but is not limited to, plumbing for the vent system, fuel feed system, refuel system, transfer system and cross-feed system. The markings should also be stenciled on the external upper and lower surfaces of the inerted tank adjacent to any openings, to ensure maintenance personnel understand the possible contents of the fuel tank.

Advisory Circular 25.981–2 will provide additional guidance regarding markings and placards.

IV. Rulemaking Analyses and Notices

Authority for This Rulemaking

The FAA's authority to issue rules regarding aviation safety is found in Title 49 of the United States Code. Subtitle I, Section 106, describes the authority of the FAA Administrator. Subtitle VII, Aviation Programs, describes in more detail the scope of the agency's authority. This rulemaking is promulgated under the authority described in Subtitle VII, Part A, Subpart III, Section 44701, ''General requirements.'' Under that section, the FAA is charged with promoting safe flight of civil aircraft in air commerce by prescribing.

- Minimum standards required in the interest of safety for the design and performance of aircraft;

[19] Our worker safety requirements apply to confined spaces, which are partly or fully enclosed areas big enough for a worker to enter and perform assigned work and with limited or restricted means of entry or exit. Such areas are not designed for someone to work in regularly but for tasks such as inspection, cleaning, maintenance, and repair. (Reference U.S. Department of Labor Occupational Safety & Health Administration (OSHA), 29 CFR § 1910.146(b).) This proposal would not significantly change the procedures used by maintenance personnel to enter fuel tanks and is not intended to conflict with existing government agency requirements (e.g., OSHA).

• Regulations and minimum standards in the interest of safety for inspecting, servicing, and overhauling aircraft; and

• Regulations for other practices, methods, and procedures the Administrator finds necessary for safety in air commerce.

This regulation is within the scope of that authority because it prescribes—

• New safety standards for the design of transport category airplanes, and

• New requirements necessary for safety for the design, production, operation, and maintenance of those airplanes, and for other practices, methods and procedures relating to those airplanes.

Paperwork Reduction Act

This proposal contains the following new information collection requirements. As required by the Paperwork Reduction Act of 1955 (44 U.S.C. 3507(d)), the Department of Transportation has sent the information requirements associated with this proposal to the Office of Management and Budget for its review.

Title: Transport Category Airplane Fuel Tank Flammability Reduction Safety Improvements.

Summary: This proposal would require certain certificate holders to develop means to reduce the flammability of high flammability exposure fuel tanks on certain large turbine-powered transport category airplanes. In addition, this proposal requires operators of the affected airplanes with high flammability exposure fuel tanks to incorporate FRM. The current requirements for fuel tank flammability exposure for new designs would be revised to add requirements for inerting systems if inerting is used to minimize flammability exposure. This proposal also proposes to expand the coverage of part 25 to include requirements that must be complied with by current holders of these certificates. Certificate holders would be required to provide a quarterly report to the FAA that contains reliability data for the FRM. There is no specific reporting requirement for operators. Data collected by the certificate holders from operators would be obtained through normal business agreements.

Proposed subpart I would also require that TC holders submit to the FAA a plan detailing how they intend to comply with its requirements. This information would be used by the FAA to assist the TC holder in complying with requirements. The compliance plan would be necessary to ensure that TC holders fully understand the requirements, correct any deficiencies in planning in a timely manner, and are able to provide the information needed by the operators for the operators' timely compliance with the rule.

Reporting: When scheduled or unscheduled maintenance and inspections are performed, including tasks that are not identified as ALI or Certification Maintenance Requirements, the operators are only required to report specific discrepancies and corrective actions in accordance with § 121.703. This proposal would not mandate any additional reporting above the current requirements for ALI by the operators. We do not intend that operators report to the FAA the results of routine inerting system operational checks, or discrepancies found .

The proposed reporting requirement applies to applicants and holders of the affected certificates. There is no proposed additional requirement within this rulemaking for operators to report FRM reliability information. We intend for certificate holders to gather the needed data from operators using existing reporting systems that are currently used for airplane maintenance, reliability and warranty claims. The operators would provide this information through existing or new business arrangements between the certificate holders and the airlines.

Use of: This proposal would support the information needs of the FAA in approving design approval holder and operator compliance with the proposed rule.

Respondents (including number of): The likely respondents to this proposed information requirement are the affected type certificate holders such as Boeing, Airbus and several auxiliary fuel tank manufacturers.

Frequency: The proposal would require the certificate holders to submit a report to the FAA once each quarter for a period up to 5 years.

Average Annual Burden Estimate: The burden would consist of the work necessary to:

• Develop the design and the data for STCs to install fuel tank inerting systems,

• Develop and incorporate a maintenance plan into the existing maintenance programs,

• Record the results of the installation and maintenance activities.

The largest paperwork burden would be a one-time effort (spread over 3 years) associated with the STC applications. This one-time total burden would be as follows:

Documents required to show compliance with the proposed rule	One-time pages	Present value discounted cost (in millions of $2005)
Specifications for Fuel Tank STC	8,000	2.7
Manuals (Flight Manuals, Operations, and Maintenance) for Fuel Tank STC	12,000	2.7
Production for Fuel Tank STC	500	0.4
Documentation for FAA/EASA Certification	1,000	13.4
Total	21,500	19.2

The yearly burden for each of the 3 years would have a present value of about $6.4 million and involve 7,167 pages.

This proposed rulemaking would result in a minimal annual recordkeeping and reporting burden. All records that would be generated to verify the installation, to record any fuel tank system inerting failures, and to record any maintenance would use forms currently required by the FAA.

The FAA computed the annual recordkeeping (Total Pages) burden by analyzing the necessary paperwork requirements needed to satisfy each process of the proposed rulemaking.

The agency is seeking comments to—

• Evaluate whether the proposed information requirement is necessary for the proper performance of the roles of the agency, including whether the information will have practical utility;

• Evaluate the accuracy of the agency's estimate of the burden;

• Improve the quality, utility, and clarity of the information to be collected; and

• Minimize the burden of the collection of information on those who are to respond using appropriate automated, electronic, mechanical, or other technological collection techniques or other forms of information technology.

Individuals and organizations may submit comments to the FAA on the information collection requirement by February 21, 2006. You should send your comments to the address listed in the **ADDRESSES** section of this document.

Under the Paperwork Reduction Act of 1995, (5 CFR 1320.8(b)(2)(vi)), an agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number. The OMB control number for this information collection will be published in the **Federal Register**, after the Office of Management and Budget approves it.

International Compatibility

In keeping with U.S. obligations under the Convention on International Civil Aviation, it is FAA policy to comply with International Civil Aviation Organization (ICAO) Standards and Recommended Practices to the maximum extent practicable. The FAA has determined that there are no ICAO Standards and Recommended Practices that correspond to these proposed regulations.

Regulatory Evaluation, Regulatory Flexibility Determination, International Trade Assessment, and Unfunded Mandates Assessment

Regulatory Evaluation

This portion of the preamble summarizes our analysis of the economic impacts of this NPRM. It also includes summaries of the initial regulatory flexibility determination. We suggest readers seeking greater detail read the full regulatory evaluation, a copy of which we have placed in the docket for this rulemaking.

Changes to Federal regulations must undergo several economic analyses. First, Executive Order 12866 directs that each Federal agency shall propose or adopt a regulation only upon a reasoned determination that the benefits of the intended regulation justify its costs. Second, the Regulatory Flexibility Act of 1980 requires agencies to analyze the economic impact of regulatory changes on small entities. Third, the Trade Agreements Act (19 U.S.C. 2531–2533) prohibits agencies from setting standards that create unnecessary obstacles to the foreign commerce of the United States. In developing U.S. standards, this Trade Act requires agencies to consider international standards and, where appropriate, to be the basis of U.S. standards. Fourth, the Unfunded Mandates Reform Act of 1995 (Pub. L. 104–4) requires agencies to prepare a written assessment of the costs, benefits, and other effects of proposed or final rules that include a Federal mandate likely to result in the expenditure by State, local, or tribal governments, in the aggregate, or by the private sector, of $100 million or more annually (adjusted for inflation).

In conducting these analyses, we determined this rule: (1) Is a ''significant regulatory action'' as defined in section 3(f) of Executive Order 12866, and is ''significant'' as defined in DOT's Regulatory Policies and Procedures; (2) would have a significant economic impact on a substantial number of small entities; (3) has a neutral international trade impact; and (4) does not impose an unfunded mandate on state, local, or tribal governments, or on the private sector. These analyses, available in the docket, are summarized as follows.

Total Benefits and Costs of This Rulemaking

We estimated that the proposed rule would prevent an expected 4 catastrophic passenger accidents over the analysis period. If all accidents happened in-flight, the present value total benefit would be of $490 million. The model of fuel tank flammability risk suggests an 8 percent probability that the explosion may occur on the ground. Assuming this rate of ground explosions, the present value of the total benefit would be about $460 million. This estimate is based on an average number of occupants per airplane. If the first of the prevented accidents would occur on a large passenger capacity airplane, like the Airbus A380 or TWA–800 Boeing Model 747, the quantified benefit of preventing one accident could exceed the present value costs. In addition, another fuel tank explosion would have a negative impact on public confidence in air travel safety, and, on the subsequent demand for air travel.

Table 1 displays the present value compliance costs by major element for the existing air carrier fleet and for airplanes manufactured over the next 25 years and operated over the next 50 years to be $919 million.

TABLE 1.—PRESENT VALUE COSTS OF COMPLIANCE (2006–2055)

[In millions 2005 $]

Source of cost	Present value of the compliance costs
Engineering Redesign	$64
Retrofitting Costs	377
Production Costs	133
Operational Costs	345
Total	919

Who is Potentially Affected By This Rulemaking

Boeing, Airbus, all operators flying U.S.-registered Boeing and Airbus airplanes, and holders of fuel tank supplemental type certificates (STCs).

Cost Assumptions and Sources of Information

Period of analysis is 2006–2055.

For 2008–2030, we evaluated the costs and benefits for all airplanes that would have fuel tank inerting systems. This includes airplanes that would be retrofitted between 2008 and 2015 and production airplanes manufactured between 2008 and 2030.

For 2031–2055, we evaluated the costs and benefits for all airplanes that had fuel tank inerting systems and are expected to be in service in 2030. No airplanes are added after that date. This time allows for all of the airplanes in this evaluation to complete their productive lives in U.S. aviation and be retired.

Based on Boeing's assertion that their production airplanes will have fuel tank inerting installed by 2008, we do not include Boeing production airplanes built during and after 2008 in either the cost or the benefits estimates.

- Final rule would be effective January 1, 2006.
- Discount rate is 7 percent.
- Fully burdened labor rate for an aviation engineer is $125 an hour.
- Fully burdened labor rate for an aviation mechanic is $85 an hour.
- 3,804 airplanes would be retrofitted between 2008 and 2016.
- No airplane scheduled to be retired before 2016 would be retrofitted.
- Cost of aviation fuel is $1.00 per gallon.[20]
- The type of accident that would be prevented is a catastrophic accident in

[20] The estimated cost for aviation fuel is based on both the FAA's 2005 forecast and the Department of Energy Information Administration's forecast ''Annual Energy Outlook with Projections to 2025'' (2005). Should these forecasts change prior to the publication of the final rule, if any, we will use the updated number. However, we do not expect changes in the forecast cost of aviation fuel to have a large impact on the overall cost of this rulemaking.

which all die and the airplane is destroyed.

- Special Federal Air Regulation (SFAR) 88 would prevent 50 percent of the future fuel tank explosions. (See ''History of Industry and Government Actions in Response to Fuel Tank Explosions'' in the full regulatory evaluation located within the docket file for this proposal)
- Boeing and Airbus airplanes have equal risk of an explosion.
- The explosion rate calculation does not include explosions caused by terrorist activity.
- An explosion is estimated to occur every 60 million hours of flight by heated center wing tank airplanes.
- The value of a statistical fatality averted is $3 million.
- An average of 140 passengers and crew are on a Boeing or Airbus airplane.
- The cost to investigate a catastrophic accident is $8 million.
- The average value of property loss and fatalities located on the ground is $500,000 to $1 million.

We obtained data from two Aviation Rulemaking Advisory Committee (ARAC) working groups, Boeing, and Airbus.

Finally, we request comments and information about all of our assumptions, values, and results. In particular, we request information concerning the potential cost savings from not requiring airplanes to install transient suppression devices. We also request that you provide documentation for the comments.

Estimated Benefits

We estimated the proposed rule would prevent four fuel tank explosions over the next 50 years, for a present value total benefit of $490 million.[21] The undiscounted benefits from preventing one average-sized airplane catastrophic accident are about $500 million, assuming $3 million for the value of a prevented fatality. If the value of prevented fatality is $5.5 million, the undiscounted benefits are about $890 million.

The model of fuel tank flammability risk suggests an 8 percent probability that an airplane would explode on the runway, with an average of four fatalities. Under this scenario, the average benefit would be about $60 million. Assuming an 8 percent chance on an accident while the airplane is still on the ground would reduce the total benefit, in present value, by $30 million to be about $460 million.

Costs of This Rulemaking

The undiscounted total costs for the analysis period 2006–2055 for all airplanes would be about $2.279 billion, with a present value of $919 million. The undiscounted passenger airplane costs would be about $2.018 billion with a present value of $809 million.

However, there is a potential cost reduction factor. If we enact a fuel tank flammability reduction rule, we would not require transient suppression devices and we would allow airlines that have installed them to remove them. We request information on potential cost savings from this action.

Analysis of the Proposed Rule and Alternatives, All Airplanes (2006–2055)

In all of the tables that follow, the results for the base case are found in the first row. As shown in Table 2, using a discount rate of 7 percent, $3 million for a prevented fatality, and an SFAR 88 effectiveness rate of 50 percent, the proposed rule benefits would be about $424 million less (54 percent) than the costs. Increasing the value of a prevented fatality to $5.5 million would make the benefits about 94 percent of the costs. At an SFAR effectiveness rate of 25 percent, the benefits would be 80 percent of the costs for a $3 million value of a prevented fatality, but would be 41 percent greater than the costs for a $5.5 million value of a prevented fatality.

For a 3 percent discount rate, the proposed rule benefits would be greater than the costs at an SFAR effectiveness rate of 25 percent. At 50 percent, the value of a fatality would need to be $5.5 million for the benefits to be greater than the costs—a $3 million value would result in the benefits being about three quarters of the costs.

At an SFAR 88 effectiveness rate of 75 percent, the proposed rule benefits would be less than the compliance costs under any combination of discount rate and value of a prevented fatality.

TABLE 2.—PRESENT VALUES OF THE ESTIMATED BENEFITS AND COSTS FOR ALL AIRPLANES BY DISCOUNT RATE, VALUE OF A PREVENTED FATALITY, AND SFAR 88 EFFECTIVENESS RATE

[Values in million of 2005 dollars]

Discount rate (percent)	Value of fatality	SFAR 88 effectiveness (percent)	Present values		Benefit/cost ratio (percent)
			Benefits	Costs	
7	$3	50	$495	$919	54
7	5.5	50	861	919	94
7	3	25	743	919	81
7	5.5	25	1,292	919	141
7	3	75	248	919	27
7	5.5	75	431	919	47
3	3	50	1,011	1,312	77
3	5.5	50	1,774	1,312	135
3	3	25	1,517	1,312	116
3	5.5	25	2,662	1,312	203
3	3	75	506	1,312	39
3	5.5	75	888	1,312	68

Passenger Airplanes (2006–2055)

As shown in Table 3, using a discount rate of 7 percent, a $3 million value for a prevented fatality, and an SFAR 88 effectiveness rate of 50 percent, we estimated that the proposed rule benefits for passenger airplanes would be about $313 million less than the costs. Increasing the value of a prevented fatality to $5.5 million indicates the proposed rule benefits would be greater than the costs by about 6 percent for passenger airplanes. At an SFAR effectiveness rate of 25 percent,

[21] These four accidents represent the expected average. Based on the Poisson distribution and a past average of one accident every 60 million flight hours for airplanes with a heated center wing fuel tank there is a 37 percent chance that there would be 5 or more such accidents.

the proposed rule benefits would be less than the costs for a $3 million value of a prevented fatality (benefits would be 92 percent of costs), but would be greater than the costs for a $5.5 million value of a prevented fatality (benefits would be 60 percent greater than the costs) for passenger airplanes.

For a 3 percent discount rate, the proposed rule benefits for passenger airplanes would be greater than their costs at an SFAR effectiveness rate of 25 percent. At 50 percent, the value of a fatality would need to be $5.5 million for the benefits to be greater than the costs—a $3 million value would result in the benefits would be about 87 percent of the costs.

At an SFAR 88 effectiveness rate of 75 percent, the proposed rule benefits would be less than the costs for passenger airplanes under any combination of discount rate and value of a prevented fatality.

TABLE 3.—PRESENT VALUES OF THE ESTIMATED BENEFITS AND COSTS FOR ALL PASSENGER AIRPLANES BY DISCOUNT RATE, VALUE OF A PREVENTED FATALITY, AND SFAR 88 EFFECTIVENESS RATE

[Values in million of 2005 dollars]

Discount rate (percent)	Value of fatality	SFAR 88 effectiveness (percent)	Present values		Benefit/cost ratio (percent)
			Benefits	Costs	
7	$3	50	$495	$808	61
7	5.5	50	861	808	106
7	3	25	743	808	92
7	5.5	25	1,292	808	160
7	3	75	248	808	31
7	5.5	75	431	808	53
3	3	50	1,011	1,157	87
3	5.5	50	1,774	1,157	153
3	3	25	1,517	1,157	131
3	5.5	25	2,662	1,157	230
3	3	75	506	1,157	44
3	5.5	75	888	1,157	77

Retrofitted Passenger Airplanes (2006–2037)

As shown in Table 4, if the SFAR 88 effectiveness rate is 75 percent, the proposed rule benefits would not be greater than the costs for retrofitted passenger airplanes under any combination of discount rate and value of a prevented fatality.

Using a discount rate of 7 percent, a $3 million value for a prevented fatality, and an SFAR 88 effectiveness rate of 50 percent, the proposed rule benefits for retrofitted passenger airplanes would be about $217 million less than the costs. Increasing the value of a prevented fatality to $5.5 million indicates the proposed rule benefits would be greater than the costs by about 4 percent for retrofitted passenger airplanes. At an SFAR effectiveness rate of 25 percent, the proposed rule benefits would be less than the costs for a $3 million value of a prevented fatality (benefits would be 88 percent of costs), but would be greater than the costs for a $5.5 million value of a prevented fatality (benefits would be 55 percent greater than the costs) for retrofitted passenger airplanes.

For a 3 percent discount rate, the proposed rule benefits for retrofitted passenger airplanes would be greater than their costs at an SFAR effectiveness rate of 25 percent.

At 50 percent, the value of a fatality would need to be $5.5 million for the benefits to be greater than the costs—a $3 million value would result in the benefits would be about three quarters percent of the costs.

At an SFAR 88 effectiveness rate of 75 percent, the proposed rule benefits would be less than the costs for retrofitted passenger airplanes under any combination of discount rate and value of a prevented fatality.

TABLE 4.—PRESENT VALUES OF THE ESTIMATED BENEFITS AND COSTS FOR ALL RETROFITTED PASSENGER AIRPLANES BY DISCOUNT RATE, VALUE OF A PREVENTED FATALITY, AND SFAR 88 EFFECTIVENESS RATE

[Values in million of 2005 dollars]

Discount rate (percent)	Value of fatality	SFAR 88 effectiveness (percent)	Present values		Benefit/cost ratio (percent)
			Benefits	Costs	
7	$3	50	$313	$530	59
7	5.5	50	549	530	104
7	3	25	469	530	88
7	5.5	25	824	530	155
7	3	75	156	530	29
7	5.5	75	275	530	52
3	3	50	557	750	74
3	5.5	50	992	750	132
3	3	25	836	750	111
3	5.5	25	1,488	750	198
3	3	75	279	750	37
3	5.5	75	496	750	66

Production Passenger Airplanes (2006–2055)

We determined that all of the retrofitted airplanes would have been retired from U.S. service by 2038. As shown in Table 5, using a discount rate of 7 percent, a $3 million value for a prevented fatality, and an SFAR 88 effectiveness rate of 50 percent, the proposed rule benefits for production passenger airplanes would be about $196 million less than the costs—about 65 percent of the costs. Increasing the value of a prevented fatality to $5.5 million indicates that the proposed rule benefits would be greater than the costs by about 12 percent for production passenger airplanes.

At an SFAR effectiveness rate of 25 percent, the proposed rule benefits for production airplanes would be greater than their costs for both combinations of discount rates and values of a prevented fatality.

At a 3 percent discount rate, the proposed rule benefits for production airplanes would be greater than their costs at an SFAR effectiveness rate of either 25 percent or 50 percent.

At an SFAR 88 effectiveness rate of 75 percent, the proposed rule benefits would be less than the costs for production passenger airplanes under any combination of discount rate and value of a prevented fatality—although they would be 96 percent of the costs if a 3 percent discount rate and a $5.5 million value of a prevented fatality were used.

TABLE 5.—PRESENT VALUES OF THE ESTIMATED BENEFITS AND COSTS FOR ALL PRODUCTION PASSENGER AIRPLANES BY DISCOUNT RATE, VALUE OF A PREVENTED FATALITY, AND SFAR 88 EFFECTIVENESS RATE

[Values in million of 2005 dollars]

Discount rate (percent)	Value of fatality	SFAR 88 effectiveness (percent)	Present values		
			Benefits	Costs	Benefit/cost ratio (percent)
7	$3	50	$182	$278	65
7	5.5	50	312	278	112
7	3	25	273	278	98
7	5.5	25	468	278	168
7	3	75	91	278	33
7	5.5	75	156	278	56
3	3	50	454	407	112
3	5.5	50	783	407	192
3	3	25	681	407	167
3	5.5	25	1,175	407	289
3	3	75	227	407	56
3	5.5	75	392	407	96

Alternative One: Apply the Proposed Rule Only to Production Airplanes—Exclude Retrofitting Requirements

As shown in Table 6, the benefit-cost ratios of the present values are lower for retrofitted airplanes than they are for production airplanes. However, at a 7 percent discount rate, the ratios are very close. Using the standard values, there is only a 6-percentage point difference (about 10 percent) between the 59 percent ratio for retrofitted passenger airplanes and the 65 percent ratio for production passenger airplanes. This same result is observed for all benefit/cost ratios calculated using a 7 percent discount rate. The difference becomes more pronounced (about 30 percent to 40 percent) when a 3 percent discount rate is used. This apparent conflict is resolved by noting that a far greater percentage of the total benefits for retrofitted airplanes would occur in the more immediate future than it would for production airplanes that have more of its benefits occurring farther out in time. Thus, a lower discount rate has a greater positive impact (relatively) on present value calculations for longer-term benefits than for shorter-term benefits. That is, retrofitted airplanes would incur the vast bulk of these airplanes flight hours and the relatively greater overall risk until about 2030.

TABLE 6.—BENEFIT-COST PRESENT VALUES RATIOS FOR PASSENGER AIRPLANES BY DISCOUNT RATE, VALUE OF A PREVENTED FATALITY, SFAR 88 EFFECTIVENESS RATE, AND TYPE OF FUEL TANK INERTING INSTALLATION

[Values in million of 2005 dollars]

Discount rate (percent)	Value of fatality	SFAR 88 effectiveness (percent)	Benefit/cost ratios		
			Retrofitted (percent)	Production (percent)	Production-retrofitted (percent)
7	$3	50	59	65	6
7	5.5	50	104	112	8
7	3	25	88	98	10
7	5.5	25	155	168	13
7	3	75	29	33	4
7	5.5	75	52	56	4
3	3	50	74	112	38
3	5.5	50	132	192	60
3	3	25	111	167	56
3	5.5	25	198	289	91
3	3	75	37	56	19

TABLE 6.—BENEFIT-COST PRESENT VALUES RATIOS FOR PASSENGER AIRPLANES BY DISCOUNT RATE, VALUE OF A PREVENTED FATALITY, SFAR 88 EFFECTIVENESS RATE, AND TYPE OF FUEL TANK INERTING INSTALLATION—Continued

[Values in million of 2005 dollars]

Discount rate (percent)	Value of fatality	SFAR 88 effectiveness (percent)	Benefit/cost ratios		
			Retrofitted (percent)	Production (percent)	Production-retrofitted (percent)
3	5.5	75	66	96	30

In light of these results, we determined that the benefit-cost analysis does not justify requiring production airplanes to have fuel tank inerting systems while not requiring these systems on retrofitted airplanes. Both airplanes need these systems.

Alternative Two: Include Cargo Airplanes in the Proposed Rule

As shown by Tables 2 and 3, including cargo airplanes in the proposed rule would have no affect on the present value of the proposed rule's quantified benefits and it would increase the cost by $111 million (a 12 percent increase). Using a discount rate of 7 percent, a $3 million value for a prevented fatality and an SFAR 88 effectiveness rate of 50 percent, the benefit-cost ratio would decrease from 61 percent to 53 percent.

Cost Benefit Summary

We believe the benefits of preventing four expected fuel tank explosions over fifty years justify the compliance cost. While our model predicts one accident every 60 million flight hours of fleet operation and a total of four prevented accidents within the analysis period, there is a nearly 40 percent probability of five or more accidents. In addition, these accidents could occur on airplanes with larger passenger capacity than the average assumed in this analysis, and they could occur sooner than we forecast. If this rule prevents two accidents comparable to the TWA accident with 230 fatalities, then preventing two of these accidents would produce estimated undiscounted benefits of $2.5 billion and would justify the undiscounted compliance cost of this proposed rule. Finally, we did not include the potential losses associated with the likely disruption to commercial aviation resulting from an in-flight explosion. Such an explosion could immediately raise a terrorism concern. In the preliminary regulatory evaluation, we estimate that the costs associated with a potential disruption could cost approximately $5 billion per accident.

Regulatory Flexibility Determination

The Regulatory Flexibility Act of 1980 (RFA) establishes ''as a principle of regulatory issuance that agencies shall endeavor, consistent with the objective of the rule and of applicable statutes, to fit regulatory and informational requirements to the scale of the business, organizations, and governmental jurisdictions subject to regulation.'' To achieve that principle, the RFA requires agencies to solicit and consider flexible regulatory proposals and to explain the rationale for their actions. The RFA covers a wide-range of small entities, including small businesses, not-for-profit organizations and small governmental jurisdictions.

Agencies must perform a review to determine whether a proposed or final rule will have a significant economic impact on a substantial number of small entities. If the agency determines that it will, the agency must prepare a regulatory flexibility analysis as described in the Act.

The proposed rule would require all Boeing and Airbus airplane operators, including about 18 small business operators, to retrofit their airplanes. We believe that this proposed rule would have a significant impact on a substantial number of small entities. Accordingly, an initial regulatory flexibility analysis, as required by the RFA, is included as part of the Initial Regulatory Analysis that is in the docket.

International Trade Impact Assessment

This proposed rule would impose the same costs on Boeing and Airbus N-registered airplanes operated by domestic entities. It would also impose costs on the airplanes and the operations of domestic entities flying internationally. However, foreign entities flying into the United States would not be affected by the proposed rule and would have a competitive advantage in competing for international business with U.S. domestic carriers. Based on the safety issues involved, we determined that these costs are acceptable to obtain the required level of air travel safety.

Unfunded Mandates Reform Act

The Unfunded Mandates Reform Act of 1995 (the Act) is intended, among other things, to curb the practice of imposing unfunded Federal mandates on State, local, and tribal governments. Title II of the Act requires each Federal agency to prepare a written statement assessing the effects of any Federal mandate in a proposed or final agency rule that may result in an expenditure of $100 million or more (adjusted annually for inflation) in any one year by State, local, and tribal governments, in the aggregate, or by the private sector; such a mandate is deemed to be a ''significant regulatory action.'' We currently use an inflation-adjusted value of $120.7 million in lieu of $100 million.

We note that the rule would impose a significant private sector cost in 2014 and 2015, as the estimated undiscounted retrofitting cost would be about $110 million, which has a present value of about $70 million. Thus, this proposed rule does not contain such a mandate and the requirements of Title II of the Unfunded Mandates Reform Act of 1995 do not apply.

Executive Order 13132, Federalism

The FAA has analyzed this proposed rule under the principles and criteria of Executive Order 13132, Federalism. We determined that this action would not have a substantial direct effect on the States, on the relationship between the national Government and the States, or on the distribution of power and responsibilities among the various levels of government, and therefore would not have federalism implications.

Regulations Affecting Intrastate Aviation in Alaska

Section 1205 of the FAA Reauthorization Act of 1996 (110 Stat. 3213) requires the Administrator, when modifying regulations in title 14 of the CFR in manner affecting intrastate aviation in Alaska, to consider the extent to which Alaska is not served by transportation modes other than aviation, and to establish such regulatory distinctions, as he or she considers appropriate. Because this proposed rule would apply to the certification of future designs of transport category airplanes and their subsequent operation, it could, if adopted, affect intrastate aviation in Alaska. The FAA therefore specifically requests comments on whether there is justification for applying the proposed rule differently in intrastate operations in Alaska.

Plain English

Executive Order 12866 (58 FR 51735, Oct. 4, 1993) requires each agency to write regulations that are simple and easy to understand. We invite your comments on how to make these proposed regulations easier to understand, including answers to questions such as the following:

- Are the requirements in the proposed regulations clearly stated?
- Do the proposed regulations contain unnecessary technical language or jargon that interferes with their clarity?
- Would the regulations be easier to understand if they were divided into more (but shorter) sections?
- Is the description in the preamble helpful in understanding the proposed regulations?

Please send your comments to the address specified in the **ADDRESSES** section.

Environmental Analysis

FAA Order 1050.1E identifies FAA actions that are categorically excluded from preparation of an environmental assessment or environmental impact statement under the National Environmental Policy Act in the absence of extraordinary circumstances. The FAA has determined this proposed rulemaking action qualifies for the categorical exclusion identified in paragraph 312f and involves no extraordinary circumstances.

Regulations That Significantly Affect Energy Supply, Distribution, or Use

We have determined that it is not a ''significant energy action'' under the executive order. The FAA has analyzed this NPRM under Executive Order 13211, Actions Concerning Regulations that Significantly Affect Energy Supply, Distribution, or Use (May 18, 2001). We have determined that it is not a ''significant energy action'' under the executive order because the proposed rule is not likely to have a significant adverse effect on the supply, distribution, or use of energy.

List of Subjects

14 CFR Part 25

Aircraft, Aviation safety, Reporting and recordkeeping requirements.

14 CFR Part 91

Aircraft, Aviation safety, Reporting and recordkeeping requirements.

14 CFR Part 121

Air carriers, Aircraft, Aviation safety, Reporting and recordkeeping requirements, Safety, Transportation.

14 CFR Part 125

Aircraft, Aviation safety, Reporting and recordkeeping requirements.

14 CFR Part 129

Air carriers, Aircraft, Aviation safety, Reporting and recordkeeping requirements, Security measures.

V. The Proposed Amendment

In consideration of the foregoing, the Federal Aviation Administration proposes to amend Chapter 1 of Title 14, Code of Federal Regulations (CFR) parts 25, 91, 121, 125, and 129, as follows:

PART 25—AIRWORTHINESS STANDARDS: TRANSPORT CATEGORY AIRPLANES

1. The authority citation for part 25 continues to read as follows:

Authority: 49 U.S.C. 106(g), 40113, 44701, 44702 and 44704.

2. Amend § 25.1 by adding new paragraphs (c) and (d) to read as follows:

§ 25.1 Applicability.

* * * * *

(c) This part also establishes requirements for holders of type certificates, supplemental type certificates, and field approvals to take specific actions necessary to support the continued airworthiness of transport category airplanes.

(d) This part also establishes requirements for holders or licensees of type certificates for transport category airplanes to introduce design changes necessary for safety into newly produced airplanes.

3. Amend § 25.2 by adding a new paragraph (d) to read as follows:

§ 25.2 Special retroactive requirements.

* * * * *

(d) In addition to the requirements of this section, subpart I of this part contains requirements that apply to:

(1) Holders of type certificates, and supplemental type certificates;

(2) Applicants for type certificates, amendments to type certificates (including service bulletins describing design changes), and supplemental type certificates;

(3) [Reserved];

(4) Licensees of type certificates.

4. Amend § 25.981 by revising paragraphs (b) and (c) and adding paragraphs (d) and (e) to read as follows:

§ 25.981 Fuel tank ignition prevention.

* * * * *

(b) Except as provided in paragraph (c) of this section, no fuel tank Fleet Average Flammability Exposure level on an airplane other than one designed solely for all-cargo operations may exceed three percent, or a fuel tank within the wing of the airplane model being evaluated. If the wing is not a conventional unheated aluminum wing, the analysis must be based on an assumed Equivalent Conventional Unheated Aluminum Wing.

(1) Fleet Average Flammability Exposure is determined in accordance with Appendix L of this part.

(2) Any fuel tank other than a main tank on an airplane other than one designed solely for all-cargo operations must meet the flammability exposure criteria of Appendix K to this part if any portion of the tank is located within the fuselage contour.

(3) As used in this paragraph,

(i) *Equivalent Conventional Unheated Aluminum Wing* is a semi-monocoque aluminum wing of a subsonic airplane that is equivalent in aerodynamic performance, structural capability, fuel tank capacity and tank configuration to the designed wing.

(ii) *Fleet Average Flammability Exposure* is defined in Appendix L to this part and means the percentage of time the fuel tank ullage is flammable for a fleet of an airplane type operating over the range of flight lengths.

(iii) *Main Fuel Tank* means a fuel tank that feeds fuel directly into one or more engines and holds required fuel reserves continually throughout each flight.

(c) Paragraphs (b) and (e) of this section do not apply to a fuel tank if means are provided to mitigate the effects of an ignition of fuel vapors within that fuel tank such that no damage caused by an ignition will prevent continued safe flight and landing.

(d) Critical design configuration control limitations (CDCCL), inspections, or other procedures must be established, as necessary, to prevent development of ignition sources within the fuel tank system pursuant to paragraph (a) of this section, to prevent increasing the flammability exposure of the tanks above that permitted under paragraph (b) of this section, and to prevent degradation of the performance and reliability of any means provided according to paragraphs (a), (b) or (c). These CDCCL, inspections, and procedures must be included in the Airworthiness Limitations section of the instructions for continued airworthiness required by § 25.1529. Visible means of identifying critical features of the design must be placed in areas of the airplane where foreseeable maintenance actions, repairs, or alterations may compromise the critical design configuration limitations (e.g., color-coding of wire to identify separation limitation). These visible means must also be identified as CDCCL.

(e) For airplanes designed solely for all-cargo operations, except as provided in paragraph (c) of this section, the fuel tank installation must include means to minimize the development of flammable vapors in the fuel tanks (in the context of this rule, ''minimize'' means to incorporate practicable design methods to reduce the likelihood of flammable vapors).

5. Amend part 25 by adding a new subpart I to read as follows:

Subpart I—Continued Airworthiness and Safety Improvements

General

Subpart I—Continued Airworthiness and Safety Improvements

General

§ 25.1801 Purpose and scope.

(a) This subpart establishes requirements for support of the continued airworthiness of and safety improvements for transport category airplanes. These requirements may include performing assessments, developing design changes, developing revisions to Instructions for Continued Airworthiness, and making necessary documentation available to affected persons.

(b) This subpart applies to the following persons, as specified in each section of this subpart:

(1) Holders of type certificates and supplemental type certificates.

(2) Applicants for type certificates and changes to type certificates (including service bulletins describing design changes). Applicants for changes to type certificates must comply with the requirements of this subpart in addition to the airworthiness requirements determined applicable under § 21.101 of this subchapter.

(3) [Reserved]

(4) Holders of type certificates and their licensees producing new airplanes.

§ 25.1803 Definitions.

(a) *Auxiliary Fuel Tank* is a Normally Emptied fuel tank that has been installed pursuant to a supplemental type certificate or field approval to make additional fuel available.

(b) *Fleet Average Flammability Exposure* has the meaning defined in Appendix L of this part.

(c) *FAA Oversight Office* is the aircraft certification office or office of the Transport Airplane Directorate with oversight responsibility for the relevant type certificate, supplemental type certificate, or manufacturer, as determined by the Administrator.

(d) *Normally Emptied* means a fuel tank other than a Main Fuel Tank as defined in 14 CFR 25.981(b).

§ 25.1805–25.1813 [Reserved]

Fuel Tank Flammability

§ 25.1815 Holders of type certificates: Fuel tank flammability safety.

(a) *Applicability.* Except as provided in paragraph (j) of this section, this section applies to transport category, turbine-powered airplanes with a type certificate issued after January 1, 1958, other than those designed solely for all-cargo operations, that, as a result of original type certification or later increase in capacity have:

(1) A maximum type-certificated passenger capacity of 30 or more, or

(2) A maximum payload capacity of 7,500 pounds or more.

(b) *Flammability Exposure Analysis*—(1) *General.* Within 150 days after [effective date of final rule], holders of type certificates must submit for approval to the FAA Oversight Office a flammability exposure analysis of all fuel tanks defined in the type design, as well as all design variations approved under the type certificate that affect flammability exposure. This analysis must be conducted in accordance with appendix L of this part.

(2) *Exception.* This paragraph does not apply to fuel tanks for which the type certificate holder has notified the FAA under paragraph (g) of this section that it will provide design changes and service instructions for an Ignition Mitigation Means (IMM) meeting the requirements of paragraph (c)(2) of this section.

(c) *Design modifications.* For fuel tanks with a Fleet Average Flammability Exposure level exceeding 7 percent, one of the following design modifications must be made.

(1) *Flammability Reduction Means (FRM).* A means must be provided to reduce the fuel tank flammability.

(i) Fuel tanks that are designed to be Normally Emptied must meet the flammability exposure criteria of Appendix K of this part if any portion of the tank is located within the fuselage contour.

(ii) For all other fuel tanks, the FRM must meet all of the requirements of Appendix K of this part, except, instead of complying with paragraph K25.1, the Fleet Average Flammability Exposure level must not exceed 7 percent.

(2) *IMM.* A means must be provided to mitigate the effects of an ignition of fuel vapors within the fuel tank such that no damage caused by an ignition will prevent continued safe flight and landing.

(d) *Design Changes and Service Instructions.* No later than the applicable date stated in Table 1 of this section, holders of type certificates affected by this section must meet one of the following requirements:

(1) *FRM.* The type certificate holder must submit for approval by the FAA Oversight Office design changes and service instructions for installation of fuel tank flammability reduction means (FRM) meeting the criteria of paragraph (c) of this section.

(2) *IMM.* The type certificate holder must submit for approval by the FAA Oversight Office design changes and service instructions for installation of fuel tank IMM that comply with 14 CFR 25.981(c) in effect on [effective date of final rule].

TABLE 1

Model—	Service instruction submittal date
Boeing	
747 Series	December 31, 2005.
737 Series	March 31, 2006.
777 Series	March 31, 2006.
767 Series	September 30, 2006.
757 Series	March 31, 2007.
707/720 Series	December 31, 2007.
Airbus	
A319, A320, A321 Series.	December 31, 2006.
A300, A310 Series	June 30, 2007.
A330, A340 Series	December 31, 2007.
All other affected models.	Within 24 months of effective date of this amendment.

(e) *Instructions for Continued Airworthiness (ICA).* For all fuel tanks, regardless of flammability exposure, no later than the applicable date specified in Table 1 of this section, holders of type certificates affected by this section must submit for approval by the FAA Oversight Office, critical design configuration control limitations (CDCCL), inspections, or other procedures to prevent increasing the flammability exposure of the tanks above that permitted under this section and to prevent degradation of the performance of any means provided under paragraph (c)(1) or (c)(2) of this section. These CDCCL, inspections, and procedures must be included in the Airworthiness Limitations section of the ICA required by 14 CFR 25.1529 or paragraph (f) of this section. Visible means to identify critical features of the design must be placed in areas of the airplane where foreseeable maintenance actions, repairs, or alterations may compromise the critical design configuration limitations. These visible means must also be identified as a CDCCL.

(f) *Airworthiness Limitations.* Unless previously accomplished, no later than the applicable date specified in Table 1 of this section, holders of type certificates affected by this section must establish an Airworthiness Limitations Section (ALS) of the maintenance manual or ICA for each airplane configuration evaluated under paragraph (b)(1) and submit it to the FAA oversight office for approval. The ALS must include a section that contains the (CDCCL), inspections, or other procedures developed under paragraph (e) of this section.

(g) *Compliance Plan for Flammability Exposure Analysis.* Within 60 days after [effective date of final rule], each holder of a type certificate identified in paragraph (a) of this section must submit to the FAA Oversight Office a compliance plan consisting of the following:

(1) A proposed project schedule for submitting the required analysis, or a determination that compliance with paragraph (b) of this section is not required as design changes and service instructions for IMM will be made available.

(2) A proposed means of compliance with paragraph (b) of this section, if applicable.

(3) If the affected holder proposes a means of compliance that differs from that described in FAA advisory material, a detailed explanation of how the proposed means will comply with this section.

(h) *Compliance Plan for Design Changes and Service Instructions.* Within 210 days after [effective date of final rule], each holder of a type certificate required to comply with paragraph (d) of this section must submit to the FAA Oversight Office a compliance plan consisting of the following:

(1) A proposed project schedule, identifying all major milestones, for meeting the compliance dates specified in paragraph (d) of this section.

(2) A proposed means of compliance with paragraph (d) of this section.

(3) If the affected holder proposes a means of compliance that differs from that described in FAA advisory material, a detailed explanation of how the proposed means will comply with this section.

(4) A proposal for submitting a draft of all compliance items required by paragraph (d) of this section for review by the FAA Oversight Office not less than 60 days before the compliance time specified in paragraph (d) of this section.

(5) A proposal for how the approved service information and any necessary modification parts will be made available to affected persons.

(i) *Deficiencies in Compliance Plans.* Each affected type certificate holder must implement the compliance plans as approved under paragraph (g) and (h) of this section. The FAA Oversight Office will notify the affected holder of deficiencies in the proposed compliance plan, or in the type certificate holder's implementation of the plan, and provide the means for correcting those deficiencies. The type certificate holder must submit a corrected plan to the FAA Oversight Office within 30 days after such notification and implement the corrected plan.

(j) *Exceptions.* The requirements of this section do not apply to the following airplane models:

(1) Convair CV–240, 340, 440, including turbine powered conversions.

(2) Lockheed L–188.

(3) Vickers Armstrong Viscount.

(4) Douglas DC–3, including turbine powered conversions.

(5) Bombardier CL–44.

(6) Mitsubishi YS–11.

(7) BAC 1–11.

(8) Concorde.

(9) deHavilland D.H. 106 Comet 4C.

(10) VFW-Vereinigte Flugtechnische VFW–614.

(11) Illyushin Aviation IL 96T.

(12) Bristol Aircraft Britannia 305.

(13) Handley Page Handley Page Herald Type 300.

(14) Avions Marcel Dassault—Breguet Aviation Mercure 100C.

(15) Airbus Caravelle.

(16) Fokker F27.

(17) Maryland Air Service V–27/FH–227.

§ 25.1817 Changes to type certificates affecting fuel tank flammability.

(a) *Applicability.* This section applies to the following design changes to any airplane subject to 14 CFR 25.1815(a) unless the design change converts the airplane to one designed solely for all-cargo operations:

(1) Any fuel tank designed to be Normally Emptied if any of the following occurred before [effective date of final rule]:

(i) The fuel tank was installed on an airplane pursuant to a supplemental type certificate or a field approval;

(ii) An application for a supplemental type certificate or an amendment to a type certificate was made, or

(iii) A field approval was granted.

(2) Installation of a fuel tank designed to be Normally Emptied, including Auxiliary Fuel Tanks, changes to existing fuel tank capacity, and changes that may increase the flammability exposure of an existing fuel tank on airplanes for which an application for a supplemental type certificate or an amendment to a type certificate is made on or after [effective date of final rule].

(b) *Flammability Exposure Analysis*—(1) *General.* By the times specified in paragraphs (b)(1)(i) and (b)(1)(ii) of this section, each person subject to this section must submit for approval to the FAA Oversight Office a flammability exposure analysis of the Auxiliary Fuel Tanks or other affected fuel tanks, as defined in the type design. This analysis must be conducted in accordance with appendix L of this part.

(i) Holders of supplemental type certificates and field approvals: Within 12 months of [effective date of final rule],

(ii) Applicants for supplemental type certificates and for amendments to type certificates: Within 12 months of [effective date of final rule], or before the certificate is issued, whichever occurs later.

(2) *Exception.* This paragraph does not apply to fuel tanks for which the type certificate holder, supplemental type certificate holder, and field approval holder has notified the FAA under paragraph (f) of this section that it will provide design changes and service instructions for an IMM meeting the requirements of § 25.981(c) of this part in effect on [effective date of final rule].

(c) *Impact Assessment.* By the times specified in paragraphs (c)(1) and (c)(2) of this section, each person subject to this section must submit for approval to the FAA Oversight Office an assessment of the fuel tank system, as modified by their design change. The assessment must identify any features of the design change that compromise any critical design configuration control limitation (CDCCL) applicable to any airplane on which the design change is eligible for installation.

(1) Holders of supplemental type certificates and field approvals: Within 6 months of the date of FAA approval of the submission identified in § 25.1815(d) for the applicable airplane model.

(2) Applicants for supplemental type certificates and for amendments to type certificates: Within 6 months of the date of FAA approval of the submission identified in 14 CFR 25.1815(d) for the applicable airplane model or before the certificate is issued, whichever occurs later.

(d) *Design Changes and Service Instructions.* By the times specified in paragraph (e) of this section, each person subject to this section must meet the requirements of paragraphs (d)(1), (d)(2), (d)(3), and (d)(4) of this section, as applicable.

(1) If the application was submitted before June 6, 2001, for any fuel tank exceeding a Fleet Average Flammability Exposure level of 7 percent, submit for approval by the FAA oversight office design changes and service instructions for installation of either:

(i) *IMM.* Fuel tank IMM that comply with 14 CFR 25.981(c) of this part in effect on [effective date of final rule]; or

(ii) *FRM.* Any fuel tank that is designed to be Normally Emptied, including Auxiliary Fuel tanks, must meet the flammability exposure criteria of Appendix K if any portion of the tank is located within the fuselage contour. For all other fuel tanks, the FRM must meet all of the requirements of Appendix K of this part, except, instead of complying with paragraph K25.1, the Fleet Average Flammability Exposure level must not exceed 7 percent.

(2) If the application was made on or after June 6, 2001, comply with the requirements of 14 CFR 25.981, in effect on [effective date of final rule], for all fuel tanks subject to this section.

(3) For design changes adding a fuel tank designed to be Normally Emptied, including Auxiliary Fuel Tanks, or changing fuel tank capacity, establish critical design configuration control limitations (CDCCL), inspections, or other procedures to prevent increasing the flammability exposure of the tanks above that permitted under this section and to prevent degradation of the performance of any means provided according to paragraphs (d)(1)(i) or (d)(1)(ii) of this section. These CDCCL, inspections, and procedures must be included in the Airworthiness Limitations section of the ICA required by 14 CFR 25.1529 of this part. Visible means to identify critical features of the design must be placed in areas of the airplane where foreseeable maintenance actions, repairs, or alterations may compromise the critical design configuration limitations. These visible means must also be identified as CDCCL.

(4) If the assessment required by paragraph (c) of this section identifies any features of the design change that compromise any CDCCL applicable to any airplane on which the design change is eligible for installation, the holder or applicant must submit for approval by the FAA Oversight Office design changes and service instructions for Flammability Impact Mitigation Means (FIMM) that would bring the design change into compliance with the CDCCL. Any fuel tank modified as required by this paragraph must also be evaluated as required by paragraph (b) of this section and comply with paragraphs (d)(1), (d)(2), and (d)(3) of this section, as applicable.

(e) *Compliance Times for Design Changes and Service Instructions.* The following persons subject to this section must comply with the requirements of paragraph (d) of this section at the specified times.

(1) Holders of supplemental type certificates and field approvals: Within 24 months of the date identified in 14 CFR 25.1815(d) for the applicable airplane model.

(2) Applicants for supplemental type certificates and for amendments to type certificates: Within 24 months of the date identified in 14 CFR 25.1815(d) for the applicable airplane model or before the certificate is issued, whichever occurs later.

(f) *Compliance Planning.* By the applicable times specified in Table 2 of this section, each person subject to this section must submit for approval by the FAA Oversight Office compliance plans for the flammability exposure analysis required by paragraph (b) of this section, the impact assessment required by paragraph (c) of this section, and the design changes and service instructions required by paragraph (d) of this section. Each person's compliance plans must include the following:

(1) A proposed project schedule for submitting the required analysis or impact assessment.

(2) A proposed means of compliance with paragraph (d) of this section.

(3) If the affected holder proposes a means of compliance that differs from that described in FAA advisory material, a detailed explanation of how the proposed means will be shown to comply with this section.

(4) For the requirements of paragraph (d) of this section, a proposal for submitting a draft of all design changes, if any are required, and CDCCLs for review by the FAA Oversight Office not less than 60 days before the compliance time specified in paragraph (e) of this section.

(5) For the requirements of paragraph (d) of this section, a proposal for how the approved service information and any necessary modification parts will be made available to affected persons.

TABLE 2.—COMPLIANCE PLANNING DATES

	Flammability exposure analysis plan	Impact assessment plan	Design changes and service instructions plan
STC and Field Approval Holders ...	60 days after [effective date of final rule].	60 days after the date identified in § 25.1815(d) for the applicable airplane model.	240 days after the date identified in § 25.1815(d) for the applicable airplane model.
STC and ATC Applicants	60 days after [effective date of final rule] or before the certificate is issued, whichever occurs later.	60 days after the date identified in § 25.1815(d) for the applicable airplane model or before the certificate is issued, whichever occurs later.	240 days after the date identified in § 25.1815(d) for the applicable airplane model or before the certificate is issued, whichever occurs later.

(g) *Deficiencies in Compliance Plans.* Each person subject to this section must implement the compliance plans as approved under paragraph (f) of this section. The FAA Oversight Office will notify the affected person of deficiencies in the proposed compliance plan, or in the person's implementation of the plan, and of the means for correcting those deficiencies. The person must submit a corrected plan to the FAA oversight office within 30 days after such notification, and implement the corrected plan.

§ 25.1819 Pending type certification projects: Fuel tank flammability safety.

(a) *Applicability.* This section applies to any new type certificate for a transport category airplane, other than one designed solely for all-cargo operations, if the application was made before [effective date of final rule and if the certificate was not issued before [effective date of final rule]. This section applies only if the airplane would have—

(1) A maximum type-certificated passenger capacity of 30 or more, or

(2) A maximum payload capacity of 7,500 pounds or more.

(b) *Flammability Exposure Analysis.* Before issuance of the type certificate, the applicant must submit for approval to the FAA Oversight Office a flammability exposure analysis of all fuel tanks defined in the type design. This analysis must be conducted in accordance with Appendix L of this part.

(c) If the application was made before June 6, 2001, the requirements of paragraphs (c)(1) and (c)(2) of this section apply.

(1) Any fuel tank meeting all of the criteria stated in paragraphs (c)(1)(i), (c)(1)(ii) and (c)(1)(iii) of this section must have FRM or IMM that meet the requirements of 14 CFR 25.981 of this part in effect on [effective date of final rule].

(i) The fuel tank is a fuel tank designed to be Normally Emptied.

(ii) Any portion of the fuel tank is located within the fuselage contour.

(iii) The fuel tank exceeds a Fleet Average Flammability Exposure level of this part, of 7 percent.

(2) All other fuel tanks that exceed a Fleet Average Flammability Exposure level of 7 percent must have either an IMM meeting 14 CFR 25.981(c) of this part in effect on [effective date of final rule] or an FRM meeting the requirements of Appendix K of this part, except, instead of complying with paragraph K25.1, the Fleet Average Flammability Exposure level must not exceed 7 percent.

(d) If the application was made on or after June 6, 2001, the requirements of 14 CFR 25.981 in effect on [effective date of final rule] apply.

(e) Any design change to a type certificate subject to this section that adds an Auxiliary Fuel Tank or fuel tank designed to be Normally Emptied, that increases fuel tank capacity, or that may increase the flammability exposure of an existing fuel tank, must meet the requirements of 14 CFR 25.981 in effect on [effective date of final rule].

(f) For all fuel tanks, regardless of flammability exposure, no later than the applicable date specified in Table 1 of this subpart, holders of type certificates affected by this section must submit for approval by the FAA Oversight Office, critical design configuration control limitations (CDCCL), inspections, or other procedures to prevent increasing the flammability exposure of the tanks above that permitted under paragraph (c) or (d) of this section and to prevent degradation of the performance of any means provided under paragraph (c) or (d) of this section. These CDCCL, inspections, and procedures must be included in the Airworthiness Limitations section of the ICA required by 14 CFR 25.1529. Visible means to identify critical features of the design must be placed in areas of the airplane where foreseeable maintenance actions, repairs, or alterations may compromise the critical design configuration limitations. These visible means must also be identified as CDCCL.

§ 25.1821 Newly produced airplanes: Fuel tank flammability safety.

(a) *Applicability:* This section applies to holders of type certificates for airplanes, other than those designed or produced solely for all-cargo operations, subject to 14 CFR 25.1815(c) of this part when application is made for original certificates of airworthiness or export airworthiness approvals after the applicable dates shown in 14 CFR 25.1815(d) of this part. This section only applies if the FAA has jurisdiction over the organization responsible for final assembly of the airplane.

(b) Any fuel tank meeting all of the criteria stated in paragraphs (b)(1), (b)(2) and (b)(3) of this section must have flammability reduction means (FRM) or ignition mitigation means (IMM) that meet the requirements of 14 CFR 25.981 in effect on [effective date of final rule].

(1) The fuel tank is Normally Emptied.

(2) Any portion of the fuel tank is located within the fuselage contour.

(3) The fuel tank exceeds a Fleet Average Flammability Exposure level of 7 percent.

(c) All other fuel tanks that exceed an Fleet Average Flammability Exposure level of 7 percent must have an IMM that meets 14 CFR 25.981(c) in effect on [effective date of final rule] or an FRM that meets all of the requirements of Appendix K to this part, except instead of complying with paragraph K25.1, the Fleet Average Flammability Exposure level must not exceed 7 percent.

6. Part 25 is amended by adding a new appendix K to read as follows:

Appendix K to Part 25—Fuel Tank System Flammability Reduction Means

K25.1 Fuel tank flammability exposure requirements

(a) The Fleet Average Flammability Exposure level of each fuel tank, as determined in accordance with Appendix L of this part, must not exceed 3 percent of the Flammability Exposure Evaluation Time (FEET), as defined in Appendix L of this part. If flammability reduction means (FRM) are used, neither time periods when any FRM is operational but the fuel tank is not inert, nor time periods when any FRM is inoperative may contribute more than 1.8 percent to the 3 percent average fleet flammability exposure of a tank.

(b) The Fleet Average Flammability Exposure, as defined in Appendix L of this part, of each fuel tank for ground, takeoff and climb phases of flight during warm days must not exceed 3 percent of FEET in each of these phases. The analysis must consider the following conditions.

(1) The analysis must use the subset of flights starting with a sea level ground ambient temperature of 80°F (standard day plus 21°F atmosphere) or more, from the flammability exposure analysis done for overall performance.

(2) For the ground, takeoff, and climb phases of flight, the average flammability exposure must be calculated by dividing the time during the specific flight phase the fuel tank is flammable by the total time of the specific flight phase.

(3) Compliance with this paragraph may be shown using only those flights for which the airplane is dispatched with the flammability reduction means operational.

K25.2 Showing compliance

(a) The applicant must provide data from analysis, ground testing, and flight testing, or any combination of these, that:

(1) Validate the parameters used in the analysis required by paragraph K25.1;

(2) Substantiate that the FRM is effective at limiting flammability exposure in all compartments of each tank for which the FRM is used to show compliance with paragraph K25.1; and

(3) Describe the circumstances under which the FRM would not be operated during each phase of flight.

(b) The applicant must validate that the FRM meets the requirements of paragraph K25.1 with any combination of engine model, engine thrust rating, fuel type, and relevant pneumatic system configuration for which approval is sought.

K25.3 Reliability indications and maintenance access

(a) Reliability indications must be provided to identify latent failures of the FRM.

(b) Sufficient accessibility to FRM reliability indications must be provided for maintenance personnel or the flightcrew.

(c) The access doors and panels to the fuel tanks with FRMs (including any tanks that communicate with a tank via a vent system), and to any other confined spaces or enclosed areas that could contain hazardous atmosphere under normal conditions or failure conditions must be permanently stenciled, marked, or placarded to warn maintenance personnel of the possible presence of a potentially hazardous atmosphere.

K25.4 Airworthiness limitations and procedures

(a) If FRM is used to comply with paragraph K25.1, Airworthiness Limitations must be identified for all maintenance or inspection tasks required to identify failures of components within the FRM that are needed to meet paragraph K25.1.

(b) Maintenance procedures must be developed to identify any hazards to be considered during maintenance of the FRM. These procedures must be included in the instructions for continued airworthiness (ICA).

K25.5 Reliability reporting

The effects of airplane component failures on FRM reliability must be assessed on an on-going basis. The applicant must do the following:

(a) Demonstrate effective means to ensure collection of FRM reliability data. The means must provide data affecting FRM reliability, such as component failures.

(b) Provide a report to the FAA on a quarterly basis for the first five years after service introduction. After that period, continued quarterly reporting may be replaced with other reliability tracking methods found acceptable to the FAA or eliminated if it is established that the reliability of the FRM meets, and will continue to meet, the exposure requirements of paragraph K25.1.

(c) Develop service instructions or revise the applicable airplane manual, according to a schedule approved by the FAA Oversight Office, as defined in Subpart I of this part, to correct any failures of the FRM that occur in service that could increase any fuel tank's Fleet Average Flammability Exposure to more than that required by paragraph K25.1.

7. Part 25 is amended by adding a new appendix L to read as follows:

Appendix L to Part 25—Fuel Tank Flammability Exposure and Reliability Analysis

L25.1 General

(a) This appendix specifies the requirements for conducting fuel tank fleet average flammability exposure analyses required to meet § 25.981(b) and Appendix K of this part. This appendix defines parameters affecting fuel tank flammability that must be used in performing the analysis. These include parameters that affect all airplanes within the fleet, such as a statistical distribution of ambient temperature, fuel flash point, flight lengths, and airplane descent rate. Demonstration of compliance also requires application of factors specific to the airplane model being evaluated. Factors that need to be included are maximum range, cruise mach number, typical altitude where the airplane begins initial cruise phase of flight fuel temperature during both ground and flight times, and the performance of a flammability reduction means (FRM) if installed.

(b) The FAA program defined in FAA document, Fuel Tank Flammability Assessment Method Users Manual, must be used as the means of compliance with § 25.981(b) and appendix K. [You must proceed in accordance with FAA document, Fuel Tank Flammability Assessment Method Users Manual. The Director of the Federal Register approves this incorporation by reference in accordance with 5 U.S.C. 552(a) and 1 CFR part 51. You may obtain a copy from the following Web site: *http://www.fire.tc.faa.gov/systems/fueltank/FTFAM.stm_*. You may inspect a copy at the Transport Airplane Directorate, Aircraft Certification Service, 1601 Lind Avenue, SW., Renton, Washington 98055–4056 or at the Office of the Federal Register, 800 North Capitol Street, NW., Suite 700, Washington, DC. The following definitions, input variables, and data tables must be used in the program to determine fleet average flammability exposure for a specific airplane model.

L25.2 Definitions

(a) *Bulk Average Fuel Temperature* means the average fuel temperature within the fuel tank or different sections of the tank if the tank is subdivided by baffles or compartments.

(b) *Flammability Exposure Evaluation Time (FEET).* The time from the start of preparing the airplane for flight, through the flight and landing, until all payload is unloaded, and all passengers and crew have disembarked. In the Monte Carlo program, the flight time is randomly selected from the Flight Length Distribution (Table 3), the pre-flight times are provided as a function of the flight time, and the post-flight time is a constant 30 minutes.

(c) *Flammable.* With respect to a fluid or gas, flammable means susceptible to igniting readily or to exploding (14 CFR Part 1, Definitions). A non-flammable ullage is one where the fuel-air vapor is too lean or too rich to burn or is inert as defined below. For the purposes of this appendix, a fuel tank that is not inert is considered flammable when the bulk average fuel temperature within the tank is within the flammable range for the fuel type being used. For any fuel tank that is subdivided into sections by baffles or compartments, the tank is considered flammable when the bulk average fuel temperature within any section of the tank, that is not inert, is within the flammable range for the fuel type being used.

(d) *Flash Point.* The flash point of a flammable fluid means the lowest temperature at which the application of a flame to a heated sample causes the vapor to ignite momentarily, or "flash." Table 1 of this appendix provides the flash point for the standard fuel to be used in the analysis.

(e) *Fleet average flammability exposure* is the percentage of the flammability exposure evaluation time (FEET) the fuel tank ullage is flammable for a fleet of an airplane type operating over the range of flight lengths in a world-wide range of environmental conditions and fuel properties as defined in this appendix.

(f) *Gaussian Distribution* is another name for the normal distribution, a symmetrical frequency distribution having a precise mathematical formula relating the mean and standard deviation of the samples. Gaussian distributions yield bell shaped frequency curves having a preponderance of values around the mean with progressively fewer observations as the curve extends outward.

(g) *Hazardous atmosphere.* An atmosphere that may expose maintenance personnel, passengers or flight crew to the risk of death, incapacitation, impairment of ability to self-rescue (that is, escape unaided from a confined space), injury, or acute illness.

(h) *Inert.* For the purpose of this appendix, the tank is considered inert when the bulk average oxygen concentration within each compartment of the tank is 12 percent or less from sea level up to 10,000 feet altitude, then linearly increasing from 12 percent at 10,000 feet to 14.5 percent at 40,000 feet altitude, and extrapolated linearly above that altitude.

(i) *Inerting.* A process where a noncombustible gas is introduced into the ullage of a fuel tank so that the ullage becomes non-flammable.

(j) *Monte Carlo Analysis.* The analytical method that is specified in this appendix as the compliance means for assessing the fleet average flammability exposure time for a fuel tank.

(k) *Standard deviation* is a statistical measure of the dispersion or variation in a distribution, equal to the square root of the arithmetic mean of the squares of the deviations from the arithmetic means.

(l) *Transport Effects.* For purposes of this appendix, transport effects are the change in fuel vapor concentration in a fuel tank caused by low fuel conditions and fuel condensation and vaporization.

(m) *Ullage.* The volume within the fuel tank not occupied by liquid fuel.

L25.3 Fuel tank flammability exposure analysis

(a) A flammability exposure analysis must be conducted for the fuel tank under evaluation to determine fleet average flammability exposure for the airplane and fuel types under evaluation. For fuel tanks that are subdivided by baffles or compartments, an analysis must be performed either for each section of the tank, or for the section of the tank having the highest flammability exposure. Consideration of transport effects is not allowed in the analysis. The Monte Carlo program is contained in FAA document, Fuel Tank Flammability Assessment Method Users Manual. The parameters specified in sections L25.3(b) and (c) must be used in the fuel tank flammability exposure "Monte Carlo" analysis.

(b) The following parameters are defined in the Monte Carlo analysis and provided in paragraph L25.4:

(1) Cruise Ambient Temperature—as defined in this appendix.

(2) Ground Temperature—as defined in this appendix.

(3) Fuel Flash Point—as defined in this appendix.

(4) Flight Length Distribution—that must be used is defined in Table 2 of this appendix.

(5) Airplane Climb and Descent Profiles—the applicant must use the climb and descent profiles defined in the users manual.

(c) Parameters that are specific to the particular airplane model under evaluation that must be provided as inputs to the Monte Carlo analysis are:

(1) Airplane Cruise Altitude.

(2) Fuel Tank Quantities. If fuel quantity affects fuel tank flammability, inputs to the Monte Carlo analysis must be provided that represent the actual fuel quantity within the fuel tank or compartment of the fuel tank throughout each of the flights being evaluated. Input values for this data must be obtained from ground and flight test data or the approved FAA fuel management procedures.

(3) Airplane Cruise Mach Number.

(4) Airplane Maximum Range.

(5) Fuel Tank Thermal Characteristics. If fuel temperature affects fuel tank flammability, inputs to the Monte Carlo analysis must be provided that represent the actual bulk average fuel temperature within the fuel tank throughout each of the flights being evaluated. For fuel tanks that are subdivided by baffles or compartments, bulk average fuel temperature inputs must be provided either for each section of the tank or for the section of the tank having the highest flammability exposure. Input values for these data must be obtained from ground and flight test data or a thermal model of the tank that has been validated by ground and flight test data.

(6) Maximum airplane operating temperature limit as defined by any limitations in the airplane flight manual.

(d) Fuel Tank FRM Model. If FRM is used, an FAA approved Monte Carlo program must be used to show compliance with the flammability requirements of § 25.981 and Appendix K of this part. The program must determine the time periods during each flight phase when the fuel tank or compartment with the FRM would be flammable. The following factors must be considered in establishing these time periods:

(1) Any time periods throughout the flammability exposure evaluation time and under the full range of expected operating conditions, when the FRM is operating properly but fails to maintain a non-flammable fuel tank because of the effects of the fuel tank vent system or other causes,

(2) If dispatch with the system inoperative under the Master Minimum Equipment List (MMEL) is requested, the time period assumed in the reliability analysis, (60 flight hours must be used for a 10-day MMEL dispatch limit unless an alternative period has been approved by the Administrator),

(3) Frequency and duration of time periods of FRM inoperability, substantiated by test or analysis acceptable to the FAA, caused by latent or known failures, including airplane system shut-downs and failures that could cause the FRM to shut down or become inoperative,

(4) Effects of failures of the FRM that could increase the flammability exposure of the fuel tank,

(5) Oxygen Evolution: If an FRM is used that is affected by oxygen concentrations in the fuel tank, the time periods when oxygen evolution from the fuel results in the fuel tank or compartment exceeding the inert level. The applicant must include any times when oxygen evolution from the fuel in the tank or compartment under evaluation would result in a flammable fuel tank. The oxygen evolution rate that must be used is defined in the user's manual.

(6) If an inerting system FRM is used, the effects of any air that may enter the fuel tank following the last flight of the day due to changes in ambient temperature, as defined in Table 4, during a 12-hour overnight period.

(e) The applicant must submit to the FAA oversight office for approval the fuel tank flammability analysis, including the airplane-specific parameters identified under paragraph L25.3(c) of this appendix and any deviations from the parameters identified in paragraph L25.3(b), that affect flammability exposure, substantiating data, and any airworthiness limitations and other conditions assumed in the analysis, must be submitted.

L25.4 Variables and data tables

The following data must be used when conducting a flammability exposure analysis to determine the fleet average flammability exposure. Variables used to calculate fleet flammability exposure must include atmospheric ambient temperatures, flight length, flammability exposure evaluation time, fuel flash point, thermal characteristics of the fuel tank, overnight temperature drop, and oxygen evolution from the fuel into the ullage.

(a) Atmospheric Ambient Temperatures and Fuel Properties.

(1) In order to predict flammability exposure during a given flight, the variation of ground ambient temperatures, cruise ambient temperatures, and a method to compute the transition from ground to cruise and back again must be used. The variation of the ground and cruise ambient temperatures and the flash point of the fuel is defined by a Gaussian curve, given by the 50 percent value and a ± 1-standard deviation value.

(2) Ambient Temperature: Under the program, the ground and cruise ambient temperatures are linked by a set of assumptions on the atmosphere. The temperature varies with altitude following the International Standard Atmosphere (ISA) rate of change from the ground ambient temperature until the cruise temperature for the flight is reached. Above this altitude, the ambient temperature is fixed at the cruise ambient temperature. This results in a variation in the upper atmospheric temperature. For cold days, an inversion is applied up to 10,000 feet, and then the ISA rate of change is used.

(3) Fuel properties:

(A) For Jet A fuel, the variation of flash point of the fuel is defined by a Gaussian curve, given by the 50 percent value and a ± 1-standard deviation, as shown in Table 1.

(B) The flammability envelope of the fuel that must be used for the flammability exposure analysis is a function of the flash point of the fuel selected by the Monte Carlo for a given flight. The flammability envelope for the fuel is defined by the upper flammability limit (UFL) and lower flammability limit (LFL) as follows:

(i) LFL at sea level = flash point temperature of the fuel at sea level minus 10 °F. LFL decreases from sea level value with increasing altitude at a rate of 1 °F per 808 feet.

(ii) UFL at sea level = flash point temperature of the fuel at sea level plus 63.5 °F. UFL decreases from the sea level value with increasing altitude at a rate of 1 °F per 512 feet.

(4) For each flight analyzed, a separate random number must be generated for each of the three parameters (ground ambient temperature, cruise ambient temperature, and fuel flash point) using the Gaussian distribution defined in Table 1.

TABLE 1.—GAUSSIAN DISTRIBUTION FOR GROUND AMBIENT TEMPERATURE, CRUISE AMBIENT TEMPERATURE, AND FUEL FLASH POINT

Parameter	Temperature in deg F		
	Ground ambient temperature	Cruise ambient temperature	Fuel flash point (FP)
Mean Temp	59.95	−70	120
Neg 1 std dev	20.14	8	8
Pos 1 std dev	17.28	8	8

(b) The Flight Length Distribution defined in Table 2 must be used in the Monte Carlo analysis.

TABLE 2.—FLIGHT LENGTH DISTRIBUTION

Flight length (NM)		Airplane maximum range—nautical miles (NM)									
From	To	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
		Distribution of flight lengths (percentage of total)									
0	200	11.7	7.5	6.2	5.5	4.7	4.0	3.4	3.0	2.6	2.3
200	400	27.3	19.9	17.0	15.2	13.2	11.4	9.7	8.5	7.5	6.7
400	600	46.3	40.0	35.7	32.6	28.5	24.9	21.2	18.7	16.4	14.8
600	800	10.3	11.6	11.0	10.2	9.1	8.0	6.9	6.1	5.4	4.8
800	1000	4.4	8.5	8.6	8.2	7.4	6.6	5.7	5.0	4.5	4.0
1000	1200	0.0	4.8	5.3	5.3	4.8	4.3	3.8	3.3	3.0	2.7
1200	1400	0.0	3.6	4.4	4.5	4.2	3.8	3.3	3.0	2.7	2.4
1400	1600	0.0	2.2	3.3	3.5	3.3	3.1	2.7	2.4	2.2	2.0
1600	1800	0.0	1.2	2.3	2.6	2.5	2.4	2.1	1.9	1.7	1.6
1800	2000	0.0	0.7	2.2	2.6	2.6	2.5	2.2	2.0	1.8	1.7
2000	2200	0.0	0.0	1.6	2.1	2.2	2.1	1.9	1.7	1.6	1.4
2200	2400	0.0	0.0	1.1	1.6	1.7	1.7	1.6	1.4	1.3	1.2
2400	2600	0.0	0.0	0.7	1.2	1.4	1.4	1.3	1.2	1.1	1.0
2600	2800	0.0	0.0	0.4	0.9	1.0	1.1	1.0	0.9	0.9	0.8
2800	3000	0.0	0.0	0.2	0.6	0.7	0.8	0.7	0.7	0.6	0.6
3000	3200	0.0	0.0	0.0	0.6	0.8	0.8	0.8	0.8	0.7	0.7
3200	3400	0.0	0.0	0.0	0.7	1.1	1.2	1.2	1.1	1.1	1.0
3400	3600	0.0	0.0	0.0	0.7	1.3	1.6	1.6	1.5	1.5	1.4
3600	3800	0.0	0.0	0.0	0.9	2.2	2.7	2.8	2.7	2.6	2.5
3800	4000	0.0	0.0	0.0	0.5	2.0	2.6	2.8	2.8	2.7	2.6
4000	4200	0.0	0.0	0.0	0.0	2.1	3.0	3.2	3.3	3.2	3.1
4200	4400	0.0	0.0	0.0	0.0	1.4	2.2	2.5	2.6	2.6	2.5
4400	4600	0.0	0.0	0.0	0.0	1.0	2.0	2.3	2.5	2.5	2.4
4600	4800	0.0	0.0	0.0	0.0	0.6	1.5	1.8	2.0	2.0	2.0
4800	5000	0.0	0.0	0.0	0.0	0.2	1.0	1.4	1.5	1.6	1.5
5000	5200	0.0	0.0	0.0	0.0	0.0	0.8	1.1	1.3	1.3	1.3
5200	5400	0.0	0.0	0.0	0.0	0.0	0.8	1.2	1.5	1.6	1.6
5400	5600	0.0	0.0	0.0	0.0	0.0	0.9	1.7	2.1	2.2	2.3
5600	5800	0.0	0.0	0.0	0.0	0.0	0.6	1.6	2.2	2.4	2.5
5800	6000	0.0	0.0	0.0	0.0	0.0	0.2	1.8	2.4	2.8	2.9
6000	6200	0.0	0.0	0.0	0.0	0.0	0.0	1.7	2.6	3.1	3.3
6200	6400	0.0	0.0	0.0	0.0	0.0	0.0	1.4	2.4	2.9	3.1
6400	6600	0.0	0.0	0.0	0.0	0.0	0.0	0.9	1.8	2.2	2.5
6600	6800	0.0	0.0	0.0	0.0	0.0	0.0	0.5	1.2	1.6	1.9
6800	7000	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.8	1.1	1.3
7000	7200	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.7	0.8
7200	7400	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.5	0.7
7400	7600	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.5	0.6
7600	7800	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.5	0.7
7800	8000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.6	0.8
8000	8200	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.8
8200	8400	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	1.0
8400	8600	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	1.3
8600	8800	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	1.1
8800	9000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.8
9000	9200	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5
9200	9400	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
9400	9600	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
9600	9800	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
9800	10000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1

(c) Overnight Temperature Drop. For airplanes on which FRM is installed, the overnight temperature drop for this appendix is defined using:

(1) A temperature at the beginning of the overnight period that equals the landing temperature of the previous flight that is a random value based on a Gaussian distribution; and

(2) An overnight temperature drop that is a random value based on a Gaussian distribution.

(3) For any flight that will end with an overnight ground period (one flight per day out of an average of number of flights per day, depending on utilization of the particular airplane model being evaluated), the landing outside air temperature (OAT) is

to be chosen as a random value from the following Gaussian curve:

TABLE 3.—LANDING OUTSIDE AIR TEMPERATURE

Parameter	Landing outside air temperature °F
Mean Temperature	58.68
negative 1 std dev	20.55
positive 1 std dev	13.21

(4) The outside ambient air temperature (OAT) overnight temperature drop is to be chosen as a random value from the following Gaussian curve:

TABLE 4.—OUTSIDE AIR TEMPERATURE (OAT) DROP

Parameter	OAT drop temperature °F
Mean Temp	12.0
1 std dev	6.0

(d) Number of Simulated Flights Required in Analysis. In order for the Monte Carlo analysis to be valid for showing compliance with the fleet average and warm day flammability exposure requirements, the applicant must run the analysis for a minimum number of flights to ensure that the fleet average and warm day flammability exposure for the fuel tank under evaluation meets the applicable flammability limits defined in Table 5.

TABLE 5.—FLAMMABILITY EXPOSURE LIMIT

Minimum number of flights in Monte Carlo analysis	Maximum acceptable Monte Carlo average fuel tank flammability exposure (%) to meet 3% requirements	Maximum acceptable Monte Carlo average fuel tank flammability exposure (%) to meet 7% requirements
10,000	2.91	6.79
100,000	2.98	6.96
1,000,000	3.00	7.00

PART 91—GENERAL OPERATING AND FLIGHT RULES

8. The authority citation for part 91 continues to read as follows:

Authority: 49 U.S.C. 1155, 40103, 40113, 40120, 44101, 44111, 44701, 44709, 44711, 44715, 44716, 11417, 44722, 46306, 36315, 46316, 46504, 46506–46507, 47122, 47508, 47528–47531, articles 12 and 20 of the Convention on International Civil Aviation (61 stat. 1180).

9. Amend § 91.1 by adding a new paragraph (d) to read as follows:

§ 91.1 Applicability.

* * * * *

(d) This part also establishes requirements for operators to take actions to support the continued airworthiness of each airplane.

10. Amend part 91 by adding a new subpart L to read as follows:

Subpart L—Continued Airworthiness and Safety Improvements

Sec.
91.1501 Purpose and definition.
91.1503–91.1507 [Reserved]
91.1509 Flammability reduction means.

Subpart L—Continued Airworthiness and Safety Improvements

§ 91.1501 Purpose and definition.

(a) This subpart establishes requirements for operators to take actions necessary to support the continued airworthiness of each airplane. Such actions may include, but are not limited to, revising the inspection program, incorporating design changes, and incorporating revisions to Instructions for Continued Airworthiness (ICA).

(b) For purposes of this subpart, the ''FAA Oversight Office'' is the aircraft certification office or office of the Transport Airplane Directorate with oversight responsibility for the relevant type certificate or supplemental type certificate, as determined by the Administrator.

§§ 91.1503–91.1507 [Reserved]

§ 91.1509 Flammability reduction means.

(a) *Applicability.* This section applies to persons operating transport category, turbine-powered airplanes for which development of an ignition mitigation means (IMM), flammability reduction means (FRM), or Flammability Impact Mitigation Means (FIMM) is required under §§ 25.1815, 25.1817, or 25.1819 of this chapter.

(b) *New Production Airplanes.* Except in accordance with § 91.213 of this part, no person may operate an airplane on which IMM or FRM has been installed by the type certificate holder or licensee under 14 CFR 25.1821 unless the IMM or FRM is operational.

(c) *Auxiliary Fuel Tanks.* After the applicable date stated in paragraphs (e)(1) and (e)(2), no person may operate any airplane subject to this section that has an Auxiliary fuel tank installed pursuant to a field approval, unless the following requirements are met:

(1) The person complies with 14 CFR 25.1817 by the applicable date stated in that section.

(2) The person installs IMM, FRM, or FIMM, as applicable, that is approved by the FAA Oversight Office.

(3) Except in accordance with § 91.213 of this part, the IMM, FRM, or FIMM, as applicable, are operational.

(d) *Retrofit.* After the dates specified in paragraph (e) of this section, no person may operate an airplane to which this section applies unless the requirements of paragraphs (d)(1) and (d)(2) of this section are met.

(1) IMM, FRM, and FIMM, if required by §§ 25.1815, 25.1817, or 25.1819 of this chapter, that are approved by the FAA Oversight Office, are installed in at least the percentage of the operator's fleet of each airplane model indicated in the applicable column of Table 1 of this section.

(2) Except in accordance with § 91.213 of this part, the IMM, FRM, and FIMM, as applicable, are operational.

(e) *Compliance Times.* The installations required by paragraph (d) of this section must be accomplished no later than the applicable dates specified in paragraph (e)(1) or (e)(2) of this section.

(1) The applicable dates specified in Table 1.

TABLE 1

Model	Compliance date for 50% of fleet	Compliance date for 100% of fleet
Boeing		
747 Series	December 31, 2009	December 31, 2012.
737 Series	March 31, 2010	March 31, 2013.
777 Series	March 31, 2010	March 31, 2013.
767 Series	September 30, 2010	September 30, 2013.
757 Series	March 31, 2011	March 31, 2014.
707/720 Series	December 31, 2011	December 31, 2014.
Airbus		
A319, A320, A321 Series	December 31, 2010	December 31, 2013.
A300, A310 Series	June 30, 2011	June 30, 2014.
A330, A340 Series	December 31, 2011	December 31, 2014.
All other affected models	Within 4 years after the effective date of this amendment.	Within 7 years after the effective date of this amendment.

(2) For those persons that have only one airplane of a model identified in Table 1, the compliance date is that stated for 100% of Fleet in Table 1 of this section.

(f) *Early Compliance.* Notwithstanding paragraphs (c) and (d) of this section, no person may operate an airplane on which IMM, FRM or FIMM has been installed unless the IMM, FRM or FIMM is operational, except in accordance with § 91.213 of this part.

(g) *Inspection Program Revisions.* No person may operate an airplane to which this section applies after the date specified in paragraph (g)(1) or (g)(2) of this section, as applicable, unless the inspection program for that airplane is revised to include applicable airworthiness limitations that are approved by the FAA Oversight Office under §§ 25.1815, 25.1817 or 25.1819 of this chapter.

(1) For any airplane that must be modified in accordance with paragraph (d) of this section, the date of return to service after those modifications are accomplished.

(2) For any airplane that is not required to be modified in accordance with paragraph (d) of this section, the date one year after the date of approval of the airworthiness limitations by the FAA Oversight Office.

(h) After the inspection program is revised as required by paragraph (g) of this section, before returning an airplane to service after any alteration for which airworthiness limitations are required by §§ 25.1817, or 25.1819 of this chapter, the person must revise the inspection program for the airplane to include those airworthiness limitations.

(i) The inspection program changes identified in paragraphs (g) and (h) of this section must be submitted to the operator's Principal Inspector or the Flight Standards District Office (FSDO) responsible for review and approval prior to incorporation.

§ 91.410 [Redesignated as § 91.1505]

11. Redesignate § 91.410 as new § 91.1505.

§ 91.410 [Added and Reserved]

12. A new § 91.410 is added and reserved.

PART 121—OPERATING REQUIREMENTS: DOMESTIC, FLAG, AND SUPPLEMENTAL OPERATIONS

13. The authority citation for part 121 continues to read as follows:

Authority: 49 U.S.C. 106(g), 40113, 40119, 41706, 44101, 44701–44702, 44705, 44709–44711, 44713, 44716–44717, 44722, 44901, 44903–44904, 44012, 46105, 46105, 46301.

14. Amend § 121.1 by adding a new paragraph (g) to read as follows:

§ 121.1 Applicability.

* * * * *

(g) This part also establishes requirements for operators to take actions to support the continued airworthiness of each airplane.

15. Amend part 121 by adding a new Subpart AA to read as follows:

Subpart AA—Continued Airworthiness and Safety Improvements

Subpart AA—Continued Airworthiness and Safety Improvements

§ 121.1101 Purpose and definition.

(a) This subpart requires persons holding an air carrier or operating certificate under part 119 of this chapter to support the continued airworthiness of each airplane. These requirements may include, but are not limited to, revising the maintenance program, incorporating design changes, and incorporating revisions to Instructions for Continued Airworthiness.

(b) For purposes of this subpart, the ''FAA Oversight Office'' is the aircraft certification office or office of the Transport Airplane Directorate with oversight responsibility for the relevant type certificate or supplemental type certificate, as determined by the Administrator.

§ 121.1103–121.1115 [Reserved]

§ 121.1117 Flammability reduction means.

(a) *Applicability.* This section applies to certificate holders operating transport category, turbine-powered airplanes for which development of an ignition mitigation means (IMM), flammability reduction means (FRM), or Flammability Impact Mitigation Means (FIMM) is required under §§ 25.1815, 25.1817, or 25.1819 of this chapter.

(b) *New Production Airplanes.* Except in accordance with § 121.628 of this part, no person may operate an airplane on which IMM or FRM has been installed by the type certificate holder or licensee under 14 CFR 25.1821 unless the IMM or FRM is operational.

(c) *Auxiliary Fuel Tanks.* After the applicable date stated in paragraphs (e)(1) and (e)(2) of this section, no certificate holder may operate any airplane subject to this section that has an Auxiliary Fuel Tank installed pursuant to a field approval, unless the following requirements are met:

(1) The certificate holder complies with 14 CFR 25.1817 by the applicable date stated in that section.

(2) The certificate holder installs IMM, FRM or FIMM, as applicable, that

is approved by the FAA Oversight Office.

(3) Except in accordance with § 121.628 of this part, the IMM, FRM or FIMM, as applicable, are operational.

(d) *Retrofit.* After the dates specified in paragraph (e) of this section, no certificate holder may operate an airplane to which this section applies unless the requirements of paragraphs (d)(1) and (d)(2) of this section are met.

(1) IMM, FRM or FIMM, if required by §§ 25.1815, 25.1817, or 25.1819 of this chapter, that are approved by the FAA Oversight Office, are installed in at least the percentage of the operator's fleet of each airplane model indicated in the applicable column of Table 1 of this section.

(2) Except in accordance with § 121.628 of this part, the IMM, FRM or FIMM, as applicable, are operational.

(e) *Compliance Times.* The installations required by paragraph (d) of this section must be accomplished no later than the applicable dates specified in paragraph (e)(1) or (e)(2) of this section.

(1) The applicable dates specified in Table 1.

TABLE 1

Model	Compliance date for 50% of fleet	Compliance date for 100% of fleet
Boeing		
747 Series	December 31, 2009	December 31, 2012.
737 Series	March 31, 2010	March 31, 2013.
777 Series	March 31, 2010	March 31, 2013.
767 Series	September 30, 2010	September 30, 2013.
757 Series	March 31, 2011	March 31, 2014.
707/720 Series	December 31, 2011	December 31, 2014.
Airbus		
A319, A320, A321 Series	December 31, 2010	December 31, 2013.
A300, A310 Series	June 30, 2011	June 30, 2014.
A330, A340 Series	December 31, 2011	December 31, 2014.
All other affected models	Within 4 years after the effective date of this amendment.	Within 7 years after the effective date of this amendment.

(2) For those certificate holders that have only one airplane of a model identified in Table 1, the compliance date is that stated for 100 percent of Fleet in Table 1 of this section.

(f) *Early Compliance.* Notwithstanding paragraphs (c) and (d) of this section, no person may operate an airplane on which IMM or FRM has been installed unless the IMM or FRM is operational, except in accordance with § 121.628 of this part.

(g) *Maintenance Program Revisions.* No certificate holder may operate an airplane to which this section applies after the date specified in paragraph (g)(1) or (g)(2) of this section, as applicable, unless the maintenance program for that airplane is revised to include applicable airworthiness limitations that are approved by the FAA Oversight Office under §§ 25.1815, 25.1817 or 25.1819 of this chapter.

(1) For any airplane that must be modified in accordance with paragraph (d) of this section, the date of return to service after those modifications are accomplished.

(2) For any airplane that is not required to be modified in accordance with paragraph (d) of this section, the date one year after the date approval of the airworthiness limitations by the FAA Oversight Office.

(h) After the maintenance program is revised as required by paragraph (g) of this section, before returning an airplane to service after any alteration for which airworthiness limitations are required by §§ 25.1817, or 25.1819 of this chapter, the certificate holder must revise the maintenance program for the airplane to include those airworthiness limitations.

(i) The maintenance program changes identified in paragraphs (g) and (h) of this section must be submitted to the operator's Principal Inspector responsible for review and approval prior to incorporation

§ 121.368 [Redesignated as § 121.1105]

16. Redesignate 121.368 as new § 121.1105.

§ 121.368 [Added and Reserved]

17. A new § 121.368 is added and reserved.

§ 121.370 [Redesignated as § 121.1107]

18. Redesignate § 121.370 as new § 121.1107.

§ 121.370 [Added and Reserved]

19. A new § 121.370 is added and reserved.

§ 121.370a [Redesignated as § 121.1109]

20–21. Redesignate § 121.370a as new § 121.1109.

§ 121.370a [Added and Reserved]

PART 125—CERTIFICATION AND OPERATIONS; AIRPLANES HAVING A SEATING CAPCITY OF 20 OR MORE PASSENGERS OR A MAXIMUM PAYLOAD CAPACITY OF 6,000 POUNDS OR MORE; AND RULES GOVERNING PERSONS ON BOARD SUCH AIRCRAFT

22. The authority citation for part 125 continues to read as follows:

Authority: 49 U.S.C. 106(g), 40113, 44701–44702, 44705, 44710–44711, 44713, 44716–44717, 44722

23. Amend § 125.1 by adding a new paragraph (e) to read as follows:

§ 125.1 Applicability.

* * * * *

(e) This part also establishes requirements for operators to take actions to support the continued airworthiness of each airplane.

24. Amend part 125 by adding a new subpart M to read as follows:

Subpart M—Continued Airworthiness and Safety Improvements

Sec.

Subpart M—Continued Airworthiness and Safety Improvements

§ 125.501 Purpose and definition.

(a) This subpart establishes requirements for operators to take actions necessary to report the continued airworthiness of each airplane. Such actions may include, but are not limited to, revising the inspection program, incorporating design changes, and incorporating revisions to Instructions for Continued Airworthiness.

(b) For purposes of this subpart, the ''FAA Oversight Office'' is the aircraft certification office or office of the Transport Airplane Directorate with oversight responsibility for the relevant type certification or supplemental type certificate, as determined by the Administrator.

§§ 125.503–125.507 [Reserved]

§ 125.509 Flammability reduction means.

(a) *Applicability.* This section applies to certificate holders operating transport category, turbine-powered airplanes for which development of an ignition mitigation means (IMM), flammability reduction means (FRM), or Flammability Impact Mitigation Means (FIMM) is required under §§ 25.1815, 25.1817, or 25.1819 of this chapter.

(b) *New Production Airplanes.* Except in accordance with § 125.201 of this part, no person may operate an airplane on which IMM or FRM has been installed by the type certificate holder or licensee under 14 CFR 25.1821 unless the IMM or FRM is operational.

(c) *Auxiliary Fuel Tanks.* After the applicable date stated in paragraphs (e)(1) and (e)(2) of this section, no certificate holder may operate any airplane subject to this section that has an Auxiliary Fuel Tank installed pursuant to a field approval, unless the following requirements are met—

(1) The certificate holder complies with 14 CFR 25.1817 by the applicable date stated in that section.

(2) The certificate holder installs IMM, FRM or FIMM, as applicable, that is approved by the FAA Oversight Office.

(3) Except in accordance with § 125.201 of this part, the IMM, FRM or FIMM, as applicable, are operational.

(d) *Retrofit.* After the dates specified in paragraph (e) of this section, no certificate holder may operate an airplane to which this section applies unless the requirements of paragraphs (d)(1) and (d)(2) of this section are met.

(1) IMM, FRM or FIMM, if required by §§ 25.1815, 25.1817, or 25.1819 of this chapter, that are approved by the FAA Oversight Office, are installed in at least the percentage of the operator's fleet of each airplane model indicated in the applicable column of Table 1 of this section.

(2) Except in accordance with § 125.201 of this part, the IMM, FRM or FIMM, as applicable, are operational.

(e) *Compliance Times.* The installations required by paragraph (d) of this section must be accomplished no later than the applicable dates specified in paragraph (e)(1) or (e)(2) of this section.

(1) The applicable dates specified in Table 1.

TABLE 1

Model	Compliance date for 50% of fleet	Compliance date for 100% of fleet
Boeing		
747 Series	December 31, 2009	December 31, 2012.
737 Series	March 31, 2010	March 31, 2013.
777 Series	March 31, 2010	March 31, 2013.
767 Series	September 30, 2010	September 30, 2013.
757 Series	March 31, 2011	March 31, 2014.
707/720 Series	December 31, 2011	December 31, 2014.
Airbus		
A319, A320, A321 Series	December 31, 2010	December 31, 2013.
A300, A310 Series	June 30, 2011	June 30, 2014.
A330, A340 Series	December 31, 2011	December 31, 2014.
All other affected models	Within 4 years after the effective date of this amendment.	Within 7 years after the effective date of this amendment.

(2) For those certificate holders that have only one airplane of a model identified in Table 1, the compliance date is that stated for 100 percent of Fleet in Table 1 of this section.

(f) *Early Compliance.* Notwithstanding paragraphs (c) and (d) of this section, no person may operate an airplane on which IMM or FRM has been installed unless the IMM or FRM is operational, except in accordance with § 125.201 of this part.

(g) *Maintenance Program Revisions.* No certificate holder may operate an airplane to which this section applies after the date specified in paragraph (g)(1) or (g)(2) of this section, as applicable, unless the maintenance program for that airplane is revised to include applicable airworthiness limitations that are approved by the FAA Oversight Office under §§ 25.1815, 25.1817 or 25.1819 of this chapter.

(1) For any airplane that must be modified in accordance with paragraph (d) of this section, the date of return to service after those modifications are accomplished.

(2) For any airplane that is not required to be modified in accordance with paragraph (d) of this section, the date one year after the date approval of the airworthiness limitations by the FAA Oversight Office.

(h) After the maintenance program is revised as required by paragraph (g) of this section, before returning an airplane to service after any alteration for which airworthiness limitations are required by §§ 25.1817, or 25.1819 of this chapter, the certificate holder must revise the maintenance program for the airplane to include those airworthiness limitations.

(i) The maintenance program changes identified in paragraphs (g) and (h) of this section must be submitted to the operator's Principal Inspector responsible for review and approval prior to incorporation.

§ 125.248 [Redesignated as § 125.505]

25. Redesignate § 125.248 as new § 125.505.

§ 125.248 [Added and Reserved]

26. A new § 125.248 is added and reserved.

PART 129—OPERATIONS: FOREIGN AIR CARRIERS AND FOREIGN OPERATORS OF U.S.-REGISTERED AIRCRAFT ENGAGED IN COMMON CARRIAGE

27. The authority citation for part 129 continues to read as follows:

Authority: 49 U.S.C. 1372, 49113, 440119, 44101, 44701–44702, 447–5, 44709–44711, 44713, 44716–44717, 44722, 44901–44904, 44906, 44912, 44105, 107–71 sec. 104.

28. Amend § 129.1 by revising paragraph (b), and adding a new paragraph (d) to read as follows:

§ 129.1 Applicability and definition.

* * * * *

(b) *Operations of U.S.-registered aircraft solely outside the United States.* In addition to the operations specified under paragraph (a) of this section, §§ 129.14 and 129.20 and subpart B of this part also apply to U.S.-registered aircraft operated solely outside the United States in common carriage by a foreign person or foreign air carrier.

* * * * *

(d) This part also establishes requirements for an operator to take actions to support the continued airworthiness of each airplane.

29. Amend part 129 by adding subpart A and designating § 129.1 through § 129.15 and § 129.17 through § 129.29 into subpart A to read as follows:

Subpart A—General

Sec.
129.1 Applicability and definitions.
129.11 Operations specifications.
129.13 Airworthiness and registration certificates.
129.14 Maintenance program and minimum equipment list requirements for U.S. registered aircraft.
129.15 Flight crewmember certificates.
129.17 Radio equipment.
129.18 Collision avoidance system.
129.19 Air traffic rules and procedures.
129.20 Digital flight data recorders.
129.21 Control of traffic.
129.23 Transport category cargo service airplanes: Increased zero fuel and landing weights.
129.25 Airplane security.
129.28 Flightdeck security.
129.29 Smoking prohibitions.

30. Amend part 129 by adding subpart B to read as follows:

Subpart B—Continued Airworthiness and Safety Improvements

Sec.
129.101 Purpose and definition.
129.103–129.115 [Reserved]
129.117 Flammability reduction means.

Subpart B—Continued Airworthiness and Safety Improvements

§ 129.101 Purpose and definition.

(a) This subpart requires a foreign person or foreign air carrier operating a U.S.-registered airplane in common carriage to support the continued airworthiness of each airplane. These requirements may include, but are not limited to, revising the maintenance program, incorporating design changes, and incorporating revisions to Instructions for Continued Airworthiness.

(b) For purposes of this subpart, the ''FAA Oversight Office'' is the aircraft certification office or office of the Transport Airplane Directorate with oversight responsibility for the relevant type certificate or supplemental type certificate, as determined by the Administrator.

§§ 129.103–129.115 [Reserved]

§ 129.117 Flammability reduction means.

(a) *Applicability.* This section applies to foreign persons and foreign air carriers operating transport category, turbine-powered airplanes for which development of an ignition mitigation means (IMM), flammability reduction means (FRM), or Flammability Impact Mitigation Means (FIMM) is required under §§ 25.1815, 25.1817, or 25.1819 of this chapter.

(b) *New Production Airplanes.* Except in accordance with § 129.14 of this part, no foreign person or foreign air carrier may operate an airplane on which IMM or FRM has been installed by the type certificate holder or licensee under 14 CFR 25.1821 unless the IMM or FRM is operational.

(c) *Auxiliary Fuel Tanks.* After the applicable date stated in paragraphs (e)(1) and (e)(2), no foreign person or foreign air carrier may operate any airplane subject to this section that has an Auxiliary Fuel Tank installed pursuant to a field approval, unless the following requirements are met:

(1) The foreign person or foreign air carrier complies with 14 CFR 25.1817 by the applicable date stated in that section.

(2) The foreign person or foreign air carrier installs IMM, FRM or FIMM, as applicable, that are approved by the FAA Oversight Office.

(3) Except in accordance with § 129.14 of this part, the IMM, FRM or FIMM, as applicable, are operational.

(d) *Retrofit.* After the dates specified in paragraph (e) of this section, no foreign person or foreign air carrier may operate an airplane to which this section applies unless the requirements of paragraphs (d)(1) and (d)(2) of this section are met.

(1) IMM, FRM or FIMM, if required by §§ 25.1815, 25.1817, or 25.1819 of this chapter, that are approved by the FAA Oversight Office, are installed in at least the percentage of the operator's fleet of each airplane model indicated in the applicable column of Table 1 of this section.

(2) Except in accordance with § 129.14 of this part, the IMM, FRM or FIMM, as applicable, are operational.

(e) *Compliance Times.* The installations required by paragraph (d) of this section must be accomplished no later than the applicable dates specified in paragraph (e)(1) or (e)(2) of this section.

(1) The applicable dates specified in Table 1.

TABLE 1

Model	Compliance date for 50% of fleet	Compliance date for 100% of fleet
Boeing		
747 Series	December 31, 2009	December 31, 2012.
737 Series	March 31, 2010	March 31, 2013.
777 Series	March 31, 2010	March 31, 2013.
767 Series	September 30, 2010	September 30, 2013.
757 Series	March 31, 2011	March 31, 2014.
707/720 Series	December 31, 2011	December 31, 2014.
Airbus		
A319, A320, A321 Series	December 31, 2010	December 31, 2013.

TABLE 1—Continued

Model	Compliance date for 50% of fleet	Compliance date for 100% of fleet
A300, A310 Series	June 30, 2011	June 30, 2014.
A330, A340 Series	December 31, 2011	December 31, 2014.
All other affected models	Within 4 years after the effective date of this amendment.	Within 7 years after the effective date of this amendment.

(2) For those foreign persons or foreign air carriers that have only one airplane of a model identified in Table 1, the compliance date is that stated for 100 percent of Fleet in Table 1 of this section.

(f) *Early Compliance.* Notwithstanding paragraphs (c) and (d) of this section, no person may operate an airplane on which IMM or FRM has been installed unless the IMM or FRM is operational, except in accordance with § 129.14 of this part.

(g) *Maintenance Program Revisions.* No foreign person or foreign air carrier may operate an airplane to which this section applies after the date specified in paragraph (g)(1) or (g)(2) of this section, as applicable, unless the maintenance program for that airplane is revised to include applicable airworthiness limitations that are approved by the FAA Oversight Office under §§ 25.1815, 25.1817 or 25.1819 of this chapter.

(1) For any airplane that must be modified in accordance with paragraph (d) of this section, the date of return to service after those modifications are accomplished.

(2) For any airplane that is not required to be modified in accordance with paragraph (d) of this section, the date one year after the date approval of the airworthiness limitations by the FAA Oversight Office.

(h) After the maintenance program is revised as required by paragraph (g) of this section, before returning an airplane to service after any alteration for which airworthiness limitations are required by §§ 25.1817, or 25.1819 of this chapter, the foreign person or foreign air carrier must revise the maintenance program for the airplane to include those airworthiness limitations.

(i) The maintenance program changes identified in paragraphs (g) and (h) of this section must be submitted to the operator's Principal Inspector for review and approval prior to incorporation.

§ 129.16 [Redesignated as § 129.109]

31. Redesignate § 129.16 as new § 129.109.

§ 129.16 [Added and Reserved]

32. A new § 129.16 is added and reserved.

§ 129.32 [Redesignated as § 129.107]

33. Redesignate § 129.32 as new § 129.107.

§ 129.32 [Added and Reserved]

34. A new § 129.32 is added and reserved.

§ 129.33 [Redesignated as § 129.105]

35. Redesignate § 129.33 as new § 129.105.

§ 129.33 [Added and Reserved]

36. A new § 129.33 is added and reserved.

Issued in Washington, DC, on November 17, 2005.

Dorenda D. Baker,

Acting Director, Aircraft Certification Service.

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