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Transport Airplane Fuel Tank System Design Review, Flammability Reduction, and Maintenance and Inspection Requirements; Proposed Rule

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Parts 21, 25, 91, 121, 125, and 129

[Docket No. FAA–1999; Notice No. 99–18]

RIN 2120–AG62

Transport Airplane Fuel Tank System Design Review, Flammability Reduction, and Maintenance and Inspection Requirements

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Notice of proposed rulemaking (NPRM).

SUMMARY: This proposed rulemaking would require design approval holders of certain turbine-powered transport category airplanes to submit substantiation to the FAA that the design of the fuel tank system of previously certificated airplanes precludes the existence of ignition sources within the airplane fuel tanks. It would also require the affected design approval holders to develop specific fuel tank system maintenance and inspection instructions for any items in the fuel tank system that are determined to require repetitive inspections or maintenance, to assure the safety of the fuel tank system. In addition, the proposed rule would require certain operators of those airplanes to incorporate FAA-approved fuel tank system maintenance and inspection instructions into their current maintenance or inspection program. Three amendments to the airworthiness standards for transport category airplanes are also proposed. The first would define new requirements, based on existing requirements, for demonstrating that ignition sources could not be present in fuel tanks when failure conditions are considered. The second would require future applicants for type certification to identify any safety critical maintenance actions and develop limitations to be placed in the instructions for continued airworthiness for the fuel tank system. The third would require means to minimize development of flammable vapors in fuel tanks, or means to prevent catastrophic damage if ignition does occur. These actions are the result of information gathered from accident investigations and adverse service experience, which has shown that unforeseen failure modes and lack of specific maintenance procedures on certain airplane fuel tank systems may result in degradation of design safety features intended to preclude ignition of vapors within the fuel tank.

DATES: Comments must be received on or before January 27, 2000.

ADDRESSES: Comments on this proposed rulemaking should be mailed or delivered, in duplicate, to: U.S. Department of Transportation, Dockets, Docket No. FAA–1999–6411, 400 Seventh Street SW., Room Plaza 401, Washington DC 20590. Comments may also be sent electronically to the following Internet address: 9–NPRM–CMTS@faa.gov. Comments may be filed and/or examined in Room Plaza 401 between 10 a.m. and 5 p.m. weekdays, except Federal holidays. In addition, the FAA is maintaining an information docket of comments in the Transport Airplane Directorate (ANM–100), Federal Aviation Administration, Northwest Mountain Region, 1601 Lind Avenue SW., Renton, WA 98055–4056. Comments in the information docket may be examined between 7:30 a.m. and 4:00 p.m. weekdays, except Federal holidays.

FOR FURTHER INFORMATION CONTACT: Michael E. Dostert, FAA, Propulsion/Mechanical/Crashworthiness 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

Interested persons are invited to participate in this proposed rulemaking by submitting such written data, views, or arguments as they may desire. Comments relating to the environmental, energy, federalism, or economic impact that might result from adopting the proposals in this notice are also invited. Substantive comments should be accompanied by cost estimates. Commenters should identify the regulatory docket or notice number and submit comments in duplicate to the Docket address specified above. All comments received, as well as a report summarizing each substantive public contact with FAA personnel concerning this rulemaking, will be filed in the docket. All comments received on or before the closing date will be considered by the Administrator before taking action on this proposed rulemaking. Late filed comments will be considered to the extent practicable. The proposals contained in this notice may be changed in light of the comments received. The Docket is available for public inspection before and after the comment closing date.

Commenters wishing the FAA to acknowledge receipt of their comments submitted in response to this notice must include with those comments a pre-addressed, stamped postcard on which the following statement is made: ''Comments to Docket No. FAA–1999–6411.'' The postcard will be date stamped and mailed to the commenter.

Availability of the NPRM

An electronic copy of this document may be downloaded using a modem and suitable communications software from the FAA regulations section of the Fedworld electronic bulletin board service (telephone: 703–321–3339), the *Government Printing Office's* electronic bulletin board service (telephone: 202–512–1661), or the FAA's Aviation Rulemaking Advisory Committee Bulletin Board service (telephone: (800) 322–2722 or (202) 267–5948).

Internet users may reach the FAA's web page at http://www.faa.gov/avr/arm/nprm/nprm.htm or the *Government Printing Office's* webpage at http://www.access.gpo.gov/nara for access to recently published rulemaking documents.

Any person may obtain a copy of this NPRM 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. Communications must identify the notice number or docket number of this NPRM.

Persons interested in being placed on the mailing list for future NPRM's should request from the above office a copy of Advisory Circular No. 11–2A, Notice of Proposed Rulemaking Distribution System, that describes the application procedure.

Background

On July 17, 1996, a 25-year old Boeing 747–100 series airplane was involved in an inflight breakup after takeoff from Kennedy International Airport in New York, resulting in 230 fatalities. The accident investigation conducted by the National Transportation Safety Board (NTSB) indicated that the center wing fuel tank exploded due to an unknown ignition source. The NTSB has issued recommendations intended to reduce heating of the fuel in the center wing fuel tanks on the existing fleet of transport airplanes, reduce or eliminate operation with flammable vapors in the fuel tanks of new type certificated airplanes, and also to reevaluate the fuel system design and maintenance practices on the fleet of transport airplanes. The accident investigation has now focused on mechanical failure as providing the energy source that ignited the fuel vapors inside the tank. This accident has prompted the FAA to examine the underlying safety issues surrounding fuel tank explosions, the adequacy of the existing regulations, the service history of airplanes certificated to these regulations, and existing fuel tank system maintenance practices.

Flammability Characteristics

The flammability characteristics of the various fuels approved for use in transport airplanes results in the presence of flammable vapors in the vapor space of fuel tanks at various times during the operation of the airplane. Vapors from Jet A fuel (the typical commercial turbojet engine fuel) at temperatures below approximately 100°F are too lean to be flammable at sea level; at higher altitudes the fuel vapors become flammable at temperatures above approximately 45°F (at 40,000 feet altitude). However, the regulatory authorities and aviation industry have always presumed that a flammable fuel air mixture exists in the fuel tanks at all times and have adopted the philosophy that the best way to ensure airplane fuel tank safety is to preclude ignition sources within fuel tanks. This philosophy has been based on the application of fail-safe design requirements to the airplane fuel tank system to preclude ignition sources from being present in fuel tanks when component failures, malfunctions, or lightning encounters occur. Possible ignition sources that have been considered include electrical arcs, friction sparks, and autoignition. (The autoignition temperature is the temperature at which the fuel/air mixture will spontaneously ignite due to heat in the absence of an ignition source.) Some events that could produce sufficient electrical energy to create an arc include lightning, electrostatic charging, electromagnetic interference (EMI), or failures in airplane systems or wiring that introduce high-power electrical energy into the fuel tank system. Friction sparks may be caused by mechanical contact between certain rotating components in the fuel tank, such as a steel fuel pump impeller rubbing on the pump inlet check valve. Autoignition of fuel vapors may be caused by failure of components within the fuel tank, or external components or systems that cause components or tank surfaces to reach a high enough temperature to ignite the fuel vapors in the fuel tank.

Existing Regulations/Certification Methods

The current 14 CFR part 25 regulations that are intended to require designs that preclude the presence of ignition sources within the airplane fuel tanks are as follows:

Section 25.901 is a general requirement that applies to all portions of the propulsion installation, which includes the airplane fuel tank system. It requires, in part, that the propulsion and fuel tank systems be designed to ensure fail-safe operation between normal maintenance and inspection intervals, and that the major components be electrically bonded to the other parts of the airplane.

Airplane system fail-safe requirements are provided in §§ 25.901(c) and 25.1309. Section 25.901(c) requires that ''no single failure or malfunction or probable combination of failures will jeopardize the safe operation of the airplane.'' In general, the FAA's policy has been to require applicants to assume the presence of foreseeable latent (undetected) failure conditions when demonstrating that subsequent single failures will not jeopardize the safe operation of the airplane. Certain subsystem designs must also comply with § 25.1309, which requires airplane systems and associated systems to be ''designed so that the occurrence of any failure condition which would prevent the continued safe flight and landing of the airplane is extremely improbable, and the occurrence of any other failure conditions which would reduce the capability of the airplane or the ability of the crew to cope with adverse operating conditions is improbable.'' Compliance with § 25.1309 requires an analysis, and testing where appropriate, considering possible modes of failure, including malfunctions and damage from external sources, the probability of multiple failures and undetected failures, the resulting effects on the airplane and occupants, considering the stage of flight and operating conditions, and the crew warning cues, corrective action required, and the capability of detecting faults.

This provision has the effect of mandating the use of ''fail-safe'' design methods which require that the effect of failures and combinations of failures be considered in defining a safe design. Detailed methods of compliance with §§ 25.1309(b), (c), and (d) are described in Advisory Circular (AC) 25.1309–1A, ''System Design Analysis,'' and are intended as a means to evaluate the overall risk, on average, of an event occurring within a fleet of aircraft. The following guidance involving failures is offered in that AC:

1. In any system or subsystem, a single failure of any element or connection during any one flight must be assumed without consideration as to its probability of failing. This single failure must not prevent the continued safe flight and landing of the airplane.

2. Additional failures during any one flight following the first single failure must also be considered when the probability of occurrence is not shown to be extremely improbable. The probability of these combined failures includes the probability of occurrence of the first failure.

As described in the AC, the FAA fail-safe design concept consists of the following design principles or techniques intended to ensure a safe design. The use of only one of these principles is seldom adequate. A combination of two or more design principles is usually needed to provide a fail-safe design (*i.e.*, to ensure that catastrophic failure conditions are not expected to occur during the life of the fleet of a particular airplane model).

- Design integrity and quality, including life limits, to ensure intended function and prevent failures.
- Redundancy or backup systems that provide system function after the first failure (e.g., two or more engines, two or more hydraulic systems, dual flight controls, etc.)
- Isolation of systems and components so that failure of one element will not cause failure of the other (sometimes referred to as system independence).
- Detection of failures or failure indication.
- Functional verification (the capability for testing or checking the component's condition).
- Proven reliability and integrity to ensure that multiple component or system failures will not occur in the same flight.
- Damage tolerance that limits the safety impact or effect of the failure.
- Designed failure path that controls and directs the failure, by design, to limit the safety impact.
- Flightcrew procedures following the failure designed to assure continued safe flight by specific crew actions.
- Error tolerant design that considers probable human error in the operation, maintenance, and fabrication of the airplane.
- Margins of safety that allow for undefined and unforeseeable adverse flight conditions.

These regulations, when applied to typical airplane fuel tank systems, lead to a requirement for prevention of ignition sources inside fuel tanks. The approval of the installation of mechanical and electrical components inside the fuel tanks was typically based on a qualitative system safety analysis and component testing which showed: (1) that mechanical components would not create sparks or high temperature surfaces in the event of any failure, and (2) that electrical devices would not create arcs of sufficient energy to ignite a fuel-air mixture in the event of a single failure or probable combination of failures.

Section 25.901(b)(2) requires that the components of the propulsion system be ''constructed, arranged, and installed so as to ensure their continued safe operation between normal inspection or overhauls.'' Compliance with this regulation is typically demonstrated by substantiating that the propulsion installation, which includes the fuel tank system, will safely perform its intended function between inspections and overhauls defined in the maintenance instructions.

Section 25.901(b)(4) requires electrically bonding the major components of the propulsion system to the other parts of the airplane. The affected major components of the propulsion system include the fuel tank system. Compliance with this requirement for fuel tank systems has been demonstrated by showing that all major components in the fuel tank are electrically bonded to the airplane structure. This precludes accumulation of electrical charge on the components and the possible arcing in the fuel tank that could otherwise occur. In most cases, electrical bonding is accomplished by installing jumper wires from each major fuel tank system component to airplane structure. Advisory Circular 25–8, ''Auxiliary Fuel Tank Installations,'' also provides guidance for bonding of fuel tank system components and means of precluding ignition sources within transport airplane fuel tanks.

Section 25.954 requires that the fuel tank system be designed and arranged to prevent the ignition of fuel vapor within the system due to the effects of lightning strikes. Compliance with this regulation is typically shown by incorporation of design features such as minimum fuel tank skin thickness, location of vent outlets out of likely lightning strike areas, and bonding of fuel tank system structure and components. Guidance for demonstrating compliance with this regulation is provided in AC 20–53A, ''Protection of Aircraft Fuel Systems Against Fuel Vapor Ignition Due to Lightning.''

Section 25.981 requires that the applicant determine the highest temperature allowable in fuel tanks that provides a safe margin below the lowest expected autoignition temperature of the fuel that is approved for use in the fuel tanks. No temperature at any place inside any fuel tank where fuel ignition is possible may then exceed that maximum allowable temperature. This must be shown under all probable operating, failure, and malfunction conditions of any component whose operation, failure, or malfunction could increase the temperature inside the tank. Guidance for demonstrating compliance with this regulation has been provided in AC 25.981–1A, ''Guidelines For Substantiating Compliance With the Fuel Tank Temperature Requirements.'' The AC provides a listing of failure modes of fuel tank system components that should be considered when showing that component failures will not create a hot surface that exceeds the maximum allowable fuel tank component or tank surface temperature for the fuel type for which approval is being requested. Manufacturers have demonstrated compliance with this regulation by testing and analysis of components to show that design features, such as thermal fuses in fuel pump motors, preclude an ignition source in the fuel tank when failures such as a seized fuel pump rotor occur.

Airplane Maintenance Manuals and Instructions for Continued Airworthiness

Historically, manufacturers have been required to provide maintenance related information for fuel tank systems in the same manner as for other systems. Prior to 1970, most manufacturers provided manuals containing maintenance information for large transport category airplanes, but there were no standards prescribing minimum content, distribution, and a timeframe in which the information must be made available to the operator. Section 25.1529, as amended by Amendment 25–21 in 1970, required the applicant for a type certificate (TC) to provide airplane maintenance manuals (AMM) to owners of the airplanes. This regulation was amended in 1980 to require that the applicant for type certification provide Instructions for Continued Airworthiness (ICA) prepared in accordance with Appendix H to part 25. In developing the ICA, the applicant is required to include certain information such as a description of the airplane and its systems, servicing information, and maintenance instructions, including the frequency and extent of inspections necessary to provide for the continuing airworthiness of the airplane (including the fuel tank system). As required by Appendix H to part 25, the ICA must also include an FAA-approved Airworthiness Limitations section enumerating those mandatory inspections, inspection intervals, replacement times, and related procedures approved under § 25.571, relating to structural damage tolerance. Currently the Airworthiness Limitations section of the ICA applies only to airplane structure and not to the fuel tank system.

One method of establishing initial scheduled maintenance and inspection tasks is the Maintenance Steering Group (MSG) process, which develops a Maintenance Review Board (MRB) document for a particular airplane model. Operators may incorporate those provisions, along with other maintenance information contained in the ICA, into their maintenance or inspection program.

Section 21.50 requires the holder of a design approval, including the TC or supplemental type certificate (STC) for an airplane, aircraft engine, or propeller for which application was made after January 28, 1981, to furnish at least one set of the complete ICA to the owner of the product for which the application was made. The ICA for original type certificated products must include instructions for the fuel tank system. A design approval holder who has modified the fuel tank system must furnish a complete set of the ICA for the modification to the owner of the product.

Type Certificate Amendments Based on Major Change in Type Design

Over the years, many design changes have been introduced into fuel tank systems that may affect their safety. There are three ways in which major design changes can be approved: (1) the TC holder can apply for an amendment to the type design; (2) any person, including the TC holder, wanting to alter a product by introducing a major change in the type design not great enough to require a new application for a TC, may apply for an STC; and (3) in some instances a person may also make a major alteration to the type design through a field approval. The field approval process is a streamlined method for obtaining approval of relatively simple modifications to airplanes. An FAA Flight Standards Inspector can approve the alteration using Form FAA–337.

Maintenance and Inspection Program Requirements

Airplane operators are required to have extensive maintenance or inspection programs that include provisions relating to fuel tank systems.

Section 91.409(e), which generally applies to other than commercial operations, requires an operator of a large turbojet multiengine airplane or a turbopropeller-powered multiengined airplane to select one of the following four inspection programs:

1. A continuous airworthiness inspection program that is part of a continuous airworthiness maintenance program currently in use by a person holding an air carrier operating certificate, or an operating certificate issued under part 119 for operations under parts 121 or 135, and operating that make and model of airplane under those parts;
2. An approved airplane inspection program approved under § 135.419 and currently in use by a person holding an operating certificate and operations specifications issued under part 119 for part 135 operations;
3. A current inspection program recommended by the manufacturer; or
4. Any other inspection program established by the registered owner or operator of that airplane and approved by the Administrator.

Section 121.367, which is applicable to those air carrier and commercial operations covered by part 121, requires operators to have an inspection program, as well as a program covering other maintenance, preventative maintenance, and alterations.

Section 125.247, which is generally applicable to operation of large airplanes, other than air carrier operations conducted under part 121, requires operators to inspect their airplanes in accordance with an inspection program approved by the Administrator.

Section 129.14 requires a foreign air carrier and each foreign operator of a U.S. registered airplane in common carriage, within or outside the U.S., to maintain the airplane in accordance with an FAA-approved program.

In general, the operators rely on the TC data sheet, MRB reports, ICA's, the Airworthiness Limitations section of the ICA, other manufacturers' recommendations, and their own operating experience to develop the overall maintenance or inspection program for their airplanes.

The intent of the rules governing the inspection and/or maintenance program is to ensure that the inherent level of safety that was originally designed into the system is maintained and that the airplane is in an airworthy condition.

Historically, for fuel tank systems these required programs include operational checks (*e.g.*, preflight and enroute), functional checks following maintenance actions (*e.g.*, component replacement), overhaul of certain components to prevent dispatch delays, and general zonal visual inspections conducted concurrently with other maintenance actions, such as structural inspections. However, specific maintenance instructions to detect and correct conditions that degrade fail-safe capabilities have not been deemed necessary because it has been assumed that the original fail-safe capabilities would not be degraded in service.

Design and Service History Review

The FAA has examined the service history of transport airplanes and performed an analysis of the history of fuel tank explosions on these airplanes. While there were a significant number of fuel tank fires and explosions that occurred during the 1960's and 1970's on several airplane types, in most cases the fire or explosion was found to be related to design practices, maintenance actions, or improper modification of fuel pumps. Some of the events were apparently caused by lightning strikes. In most cases, an extensive design review was conducted to identify possible ignition sources and actions were taken that were intended to prevent similar occurrences. However, recent fuel tank system related accidents have occurred in spite of these efforts.

On May 11, 1990, the center wing fuel tank of a Boeing 737–300 exploded while the airplane was on the ground at Nimoy Aquino International Airport, Manila, Philippines. The airplane was less than one year old. In the accident, the fuel-air vapors in the center wing tank exploded as the airplane was being pushed back from a terminal gate prior to flight. The accident resulted in 8 fatalities and injuries to an additional 30 people. Accident investigators considered a plausible scenario in which damaged wiring located outside the fuel tank may have created a short between 115 volt airplane system wires and 28 volt wires to a fuel tank level switch. This, in combination with a possibly defective fuel level float switch, was investigated as a possible source of ignition. However, a definitive ignition source was never confirmed during the accident investigation. This unexplained accident occurred on a newer airplane, in contrast to the July 17, 1996, accident which occurred on an older Boeing 747 airplane that was approaching the end of its initial design life. These two accidents indicate that the development of an ignition source inside the fuel tank may be related to both the design and maintenance of the fuel tank systems.

National Transportation Safety Board (NTSB) Recommendations

Since the July 17, 1996, accident, the FAA, NTSB, and aviation industry have been reviewing the design features and service history of the Boeing 747 and certain other transport airplane models. Based upon its review, the NTSB has issued the following recommendations to the FAA intended to reduce the exposure to operation with flammable vapors in fuel tanks and address possible degradation of the original type certificated fuel tank system designs on transport airplanes.

Reduced Flammability Exposure

A–96–174: Require the development of and implementation of design or operational changes that will preclude the operation of transport-category airplanes with explosive fuel-air mixtures in the fuel tanks:

Long Term Design Modifications:

(a) Significant consideration should be given to the development of airplane design modification, such as nitrogen-inerting systems and the addition of insulation between heat-generating equipment and fuel tanks. Appropriate modifications should apply to newly certificated airplanes and, where feasible, to existing airplanes.

A–96–175: Require the development of and implementation of design or operational changes that will preclude the operation of transport-category airplanes with explosive fuel-air mixtures in the fuel tanks:

Near Term Operational

(b) Pending implementation of design modifications, require modifications in operational procedures to reduce the potential for explosive fuel-air mixtures in the fuel tanks of transport-category aircraft. In the B–747, consideration should be given to refueling the center wing fuel tank (CWT) before flight whenever possible from cooler ground fuel tanks, proper monitoring and management of the CWT fuel temperature, and maintaining an appropriate minimum fuel quantity in the CWT.

A–96–176: Require that the B–747 Flight Handbooks of TWA and other operators of B–747s and other aircraft in which fuel tank temperature cannot be determined by flightcrews be immediately revised to reflect the increases in CWT fuel temperatures found by flight tests, including operational procedures to reduce the potential for exceeding CWT temperature limitations.

A–96–177: Require modification of the CWT of B–747 airplanes and the fuel tanks of other airplanes that are located near heat sources to incorporate temperature probes and cockpit fuel tank temperature displays to permit determination of the fuel tank temperatures.

Ignition Source Reduction

A–98–36: Conduct a survey of fuel quantity indication system probes and wires in Boeing 747's equipped with systems other than Honeywell Series 1–3 probes and compensators and in other model airplanes that are used in Title 14 Code of Federal Regulations Part 121 service to determine whether potential fuel tank ignition sources exist that are similar to those found in the Boeing 747. The survey should include removing wires from fuel probes and examining the wires for damage. Repair or replacement procedures for any damaged wires that are found should be developed.

A–98–38: Require in Boeing 747 airplanes, and in other airplanes with fuel quantity indication system (FQIS) wire installations that are co-routed with wires that may be powered, the physical separation and electrical shielding of FQIS wires to the maximum extent possible.

A–98–39: Require, in all applicable transport airplane fuel tanks, surge protection systems to prevent electrical power surges from entering fuel tanks through fuel quantity indication system wires.

Service History

The FAA has also reviewed service difficulty reports for the transport airplane fleet and evaluated the certification and design practices utilized on these previously certificated airplanes. In addition, an inspection of fuel tanks on Boeing 747 airplanes was initiated. Representatives from the Air Transport Association (ATA), Association of European Airlines (AEA), the Association of Asia Pacific Airlines (AAPA), the Aerospace Industries Association of America, and the Association Europeenne de Constructeurs de Materiel Aerospatial (AECMA) initiated a joint effort to inspect and evaluate the condition of the fuel tank system installations on a representative sample of airplanes within the transport fleet. Data from initial inspections conducted as part of this effort and shared with the FAA have assisted in establishing a basis for developing corrective action for airplanes within the transport fleet. In addition to the results from these inspections, the FAA has received reports of anomalies on in-service airplanes that have necessitated actions to preclude development of ignition sources in or adjacent to airplane fuel tanks. The following provides a summary of findings from design evaluations, service difficulty reports, and a review of current airplane maintenance practices.

Aging Airplane Related Phenomena

Fuel tank inspections initiated as part of the Boeing 747 accident investigation identified aging of fuel tank system components, contamination, corrosion of components and copper-sulfur deposits on components as possible conditions that could contribute to development of ignition sources within the fuel tanks. Results of detailed inspection of the fuel pump wiring on several Boeing 747 airplanes showed debris within the fuel tanks consisting of lockwire, rivets, and metal shavings. Debris was also found inside scavenge pumps. Corrosion and damage to insulation on FQIS probe wiring was found on wiring of 6 out of 8 probes removed from in-service airplanes. In addition, inspection of airplane fuel tank system components from out-of-service (retired) airplanes, initiated following the accident, revealed damaged wiring and corrosion buildup of conductive copper-sulfur deposits on the FQIS wiring on some Boeing 747 airplanes. The conductive deposits or damaged wiring may result in a location where arcing could occur if high power electrical energy was transmitted to the FQIS wiring from another airplane source. While the effects of corrosion on fuel tank system safety have not been fully evaluated, the FAA is developing a research program to obtain a better understanding of the effects of copper-sulfur deposits and corrosion on airplane fuel tank system safety.

Wear or chafing of electrical power wires routed in conduits that are located inside fuel tanks can result in arcing through the conduits. On December 9, 1997, the FAA issued Airworthiness Directive (AD) 96–26–06, applicable to certain Boeing 747 airplanes, which required inspection of electrical wiring routed within conduits to fuel pumps located in the wing fuel tanks and replacement of any damaged wiring. Inspection reports indicated that many instances of wear had occurred on Teflon sleeves installed over the wiring to protect it from damage and possible arcing to the conduit.

Inspections of wiring to fuel pumps on Boeing 737 airplanes with over 35,000 flight hours have shown significant wear to the insulation of wires inside conduits that are located in fuel tanks. In nine reported cases, wear resulted in arcing to the fuel pump wire conduit on airplanes with greater than 50,000 flight hours. In one case, wear resulted in burnthrough of the conduit into the interior of the 737 main tank fuel cell. On May 14, 1998, the FAA issued a telegraphic AD, T98–11–52, which required inspection of wiring to Boeing 737 airplane fuel pumps routed within electrical conduits and replacement of any damaged wiring. Results of these inspections showed that wear of the wiring occurred in many instances, particularly on those airplanes with high numbers of flight cycles and operating hours.

The FAA has also received reports of corrosion on bonding jumper wires within the fuel tanks on one in-service Airbus A300 airplane. The manufacturer investigating this event did not have sufficient evidence to determine conclusively the level of damage and corrosion found on the jumper wires. Although the airplane was in long-term storage, it does not explain why a high number of damaged/corroded jumper wires were found concentrated in a specific area of the wing tanks. Further inspections of a limited number of other Airbus models did not reveal similar extensive corrosion or damage to bonding jumper wires. However, they did reveal evidence of the accumulation of copper-sulfur deposits around the outer braid of some jumper wires. Tests by the manufacturer have shown that these deposits did not affect the bonding function of the leads. Airbus has developed a one-time-inspection service bulletin for all its airplanes to ascertain the extent of the copper-sulfur deposits and to ensure that the level of jumper wire damage found on the one A300 airplane is not widespread.

On March 30, 1998, the FAA received reports of three recent instances of electrical arcing within fuel pumps installed in fuel tanks on Lockheed L–1011 airplanes. In one case, the electrical arc had penetrated the pump and housing and entered the fuel tank. Preliminary investigation indicates that features incorporated into the fuel pump design that were intended to preclude overheating and arc-through into the fuel tank may not have functioned as intended due to discrepancies introduced during overhaul of the pumps. Emergency AD 98–08–09 was issued April 3, 1998, to specify a minimum quantity of fuel to be carried in the fuel tanks for the purpose of covering the pumps with liquid fuel and thereby precluding ignition of vapors within the fuel tank until such time as terminating corrective action could be developed.

Unforeseen Fuel Tank System Failures

After an extensive review of the Boeing 747 design following the July 17, 1996, accident, the FAA determined that during original certification of the fuel tank system, the degree of tank contamination and the significance of certain failure modes of fuel tank system components had not been considered to the degree that more recent service experience indicates is needed. For example, in the absence of contamination, the FQIS had been shown to preclude creating an arc if FQIS wiring were to come in contact with the highest level of electrical voltage on the airplane. This was shown by demonstrating that the voltage needed to cause an arc in the fuel probes due to an electrical short condition was well above any voltage level available in the airplane systems. However, recent testing has shown that if contamination, such as conductive debris (lock wire, nuts, bolts, steel wool, corrosion, copper-sulfur deposits, metal filings, etc.) is placed within gaps in the fuel probe, the voltage needed to cause an arc is within values that may occur due to a subsequent electrical short or induced current on the FQIS probe wiring from electromagnetic interference caused by adjacent wiring. These anomalies, by themselves, could not lead to an electrical arc within the fuel tanks without the presence of an additional failure. If any of these anomalies were combined with a subsequent failure within the electrical system that creates an electrical short, or if high-intensity radiated fields (HIRF) or electrical current flow in adjacent wiring induces EMI voltage in the FQIS wiring, sufficient energy could enter the fuel tank and cause an ignition source within the tank.

On November 26, 1997, in Docket No. 97–NM–272–AD, the FAA proposed a requirement for operators of Boeing 747–100, -200, and -300 series airplanes to install components for the suppression of electrical transients and/or the installation of shielding and separation of fuel quantity indicating system wiring from other airplane system wiring. After reviewing the comments received on the proposed requirements, the FAA issued AD 98–20–40 on September 23, 1998 that requires the installation of shielding and separation of the electrical wiring of the fuel quantity indication system. On April 14, 1998, the FAA proposed a similar requirement for Boeing 737–100, -200, -300, -400, and -500 series airplanes in Docket No. 98–NM–50–AD, which led to the FAA issuing AD 99–03–04 on January 26, 1999. The FAA action required in those two airworthiness directives is intended to preclude high levels of electrical energy from entering the airplane fuel tank wiring due to electromagnetic interference or electrical shorts. All later model Boeing 747 and 737 FQIS's have wire separation and fault isolation features that may meet the intent of these AD actions. This proposed rulemaking will require evaluation of these later designs.

Other examples of unanticipated failure conditions include incidents of parts from fuel pump assemblies impacting or contacting the rotating fuel pump impeller. The first design anomaly was identified when two incidents of damage to fuel pumps were reported on Boeing 767 airplanes. In both cases objects from a fuel pump inlet diffuser assembly were ingested into the fuel pump, causing damage to the pump impeller and pump housing. The damage could have caused sparks or hot debris from the pump to enter the fuel tank. To address this unsafe condition, the FAA issued AD 97–19–15. This AD requires revision of the airplane flight manual to include procedures to switch off the fuel pumps when the center tank approaches empty. The intent of this interim action is to maintain liquid fuel over the pump inlet so that any debris generated by a failed fuel pump will not come in contact with fuel vapors and cause a fuel tank explosion.

The second design anomaly was reported on Boeing 747–400 series airplanes. The reports indicated that inlet adapters of the override/jettison pumps of the center wing fuel tank were found to be worn. Two of the inlet adapters had worn down enough to cause damage to the rotating blades of the inducer. The inlet check valves also had significant damage. Another operator reported damage to the inlet adapter that was so severe that contact had occurred between the steel disk of the inlet check valve and the steel screw that holds the inducer in place. Wear to the inlet adapters has been attributed to contact between the inlet check valve and the adapter. Such excessive wear of the inlet adapter can lead to contact between the inlet check valve and inducer, which could result in pieces of the check valve being ingested into the inducer and damaging the inducer and impellers. Contact between the steel disk of the inlet check valve and the steel rotating inducer screw can cause sparks. To address this unsafe condition, the FAA issued an immediately adopted rule, AD 98–16–19, on July 30, 1998.

Another design anomaly was reported in 1989 when a fuel tank ignition event occurred in an auxiliary fuel tank during refueling of a Beech 400 airplane. The auxiliary fuel tank had been installed under an STC. Polyurethane foam had been installed in portions of the tank to minimize the potential of a fuel tank explosion if uncontained engine debris penetrated those portions of the tank. The accident investigation indicated that electrostatic charging of the foam during refueling resulted in ignition of fuel-air vapors in portions of the adjacent fuel tank system that did not contain the foam. The fuel vapor explosion caused distortion of the tank and fuel leakage from a failed fuel line. Modifications to the design, including use of more conductive polyurethane foam and installation of a standpipe in the refueling system, were incorporated to prevent reoccurrence of electrostatic charging and resulting fuel tank ignition source.

Review of Fuel Tank System Maintenance Practices

In addition to the review of the design features and service history of the Boeing 747 and other airplane models in the transport airplane fleet, the FAA has also reviewed the current fuel tank system maintenance practices for these airplanes.

Typical transport category airplane fuel tank systems are designed with redundancy and fault indication features such that single component failures do not result in any significant reduction in safety. Therefore, fuel tank systems historically have not had any life-limited components or specific detailed inspection requirements, unless mandated by airworthiness directives. Most of the components are ''on condition,'' meaning that some test, check, or other inspection is performed to determine continued serviceability, and maintenance is performed only if the inspection identifies a condition requiring correction. Visual inspection of fuel tank system components is by far the predominant method of inspection for components such as boost pumps, fuel lines, couplings, wiring, etc. Typically these inspections are conducted concurrently with zonal inspections or internal or external fuel tank structural inspections. These inspections normally do not provide information regarding the continued serviceability of components within the fuel tank system, unless the visual inspection indicates a potential problem area. For example, it would be difficult, if not impossible, to detect certain degraded fuel tank system conditions, such as worn wiring routed through conduit to fuel pumps, debris inside fuel pumps, corrosion to bonding wire interfaces, etc., without dedicated intrusive inspections that are much more extensive than those normally conducted.

Listing of Deficiencies

The list provided below summarizes fuel tank system design features, malfunctions, failures, and maintenance related actions that have been identified through service experience to result in a degradation of the safety features of airplane fuel tank systems. This list was developed from service difficulty reports and incident and accident reports. These anomalies occurred on in-service transport category airplanes contrary to the intent of regulations and policies intended to preclude the development of ignition sources within airplane fuel tank systems.

1. *Pumps:*

• Ingestion of the pump inducer into the pump impeller and generation of debris into the fuel tank.

• Pump inlet case degradation, allowing the pump inlet check valve to contact the impeller.

• Stator winding failures during operation of the fuel pump. Subsequent failure of a second phase of the pump resulting in arcing through the fuel pump housing.

• Deactivation of thermal protective features incorporated into the windings of pumps due to inappropriate wrapping of the windings.

• Omission of cooling port tubes between the pump assembly and the pump motor assembly during fuel pump overhaul.

• Extended dry running of fuel pumps in empty fuel tanks, which was contrary to the manufacturer's recommended procedures.

• Use of steel impellers that may produce sparks if debris enters the pump.

• Debris lodged inside pumps.

• Arcing due to the exposure of electrical connections within the pump housing that have been designed with inadequate clearance to the pump cover.

• Thermal switches resetting over time to a higher trip temperature.

• Flame arrestors falling out of their respective mounting.

• Internal wires coming in contact with the pump rotating group, energizing the rotor and arcing at the impeller/adapter interface.

• Poor bonding across component interfaces.

• Insufficient ground fault current protection capability.

• Poor bonding of components to structure.

2. *Wiring to pumps in conduits located inside fuel tanks:*

• Wear of Teflon sleeving and wiring insulation allowing arcing from wire through metallic conduits into fuel tanks.

3. *Fuel pump connectors:*

• Electrical arcing at connections within electrical connectors due to bent pins or corrosion.

• Fuel leakage and subsequent fuel fire outside of the fuel tank caused by corrosion of electrical connectors inside the pump motor which lead to electrical arcing through the connector housing (connector was located outside the fuel tank).

• Selection of improper materials in connector design.

4. *FQIS wiring:*

• Degradation of wire insulation (cracking), corrosion and copper-sulfur deposits at electrical connectors.

• Unshielded FQIS wires routed in wire bundles with high voltage wires.

5. FQIS probes:

• Corrosion and copper-sulfur deposits causing reduced breakdown voltage in FQIS wiring.

• Terminal block wiring clamp (strain relief) features at electrical connections on fuel probes causing damage to wiring insulation.

• Contamination in the fuel tanks causing reduced arc path between FQIS probe walls (steel wool, lock wire, nuts, rivets, bolts; mechanical impact damage to probes).

6. Bonding straps:

• Corrosion to bonding straps.

• Loose or improperly grounded attachment points.

• Static bonds on fuel tank system plumbing connections inside the fuel tank worn due to mechanical wear of the plumbing from wing movement and corrosion.

7. Electrostatic charge:

• Use of non-conductive reticulated polyurethane foam that holds electrostatic charge buildup.

• Spraying of fuel into fuel tanks through inappropriately designed refueling nozzles or pump cooling flow return methods.

Fuel Tank Flammability

In addition to the review of potential fuel tank ignition, the FAA has undertaken a parallel effort to address the threat of fuel tank explosions by eliminating or significantly reducing the presence of explosive fuel air mixtures within the fuel tanks of new type designs, in-production, and the existing fleet of transport airplanes. On April 3, 1997, the FAA published a notice in the **Federal Register** (62 FR 16014) that requested comments concerning the 1997 NTSB recommendations regarding reduced flammability listed earlier in this notice. That notice provided significant discussion of service history, background, and issues relating to reducing flammability in transport airplane fuel tanks. Comments received from that notice indicated that additional information was needed before the FAA could initiate rulemaking action to address the recommendations.

On January 23, 1998, the FAA published a notice in the **Federal Register** that established an Aviation Rulemaking Advisory Committee (ARAC) working group, the Fuel Tank Harmonization Working Group (FTHWG), tasked to achieve this goal. The ARAC consists of interested parties, including the public, and provides a public process for advice to be given to the FAA concerning development of new regulations. The FTHWG evaluated numerous possible means of reducing or eliminating hazards associated with explosive vapors in fuel tanks. On July 23, 1998, the ARAC submitted its report to the FAA. The full report has been placed in a docket that was created for this ARAC working group (Docket No. FAA–1998–4183). That docket can be reviewed on the U.S. Department of Transportation electronic Document Management System on the Internet at http://dms.dot.gov. The full report has also been placed in the docket for this rulemaking.

The report provided a recommendation for the FAA to initiate rulemaking action to amend § 25.981, applicable to new type design airplanes, to include a requirement to limit the time transport airplane fuel tanks could operate with flammable vapors in the vapor space of the tank. The recommended regulatory text proposed, ''Limiting the development of flammable conditions in the fuel tanks, based on the intended fuel types, to less than 7 percent of the expected fleet operational time, or providing means to mitigate the effects of an ignition of fuel vapors within the fuel tanks such that any damage caused by an ignition will not prevent continued safe flight and landing.'' The report discussed various options of showing compliance with this proposal, including managing heat input to the fuel tanks, installation of inerting systems or polyurethane fire suppressing foam, and suppressing an explosion if one occurred, etc.

The level of flammability defined in the proposal was established based upon comparison of the safety record of center wing fuel tanks that, in certain airplanes, are heated by equipment located under the tank, and unheated fuel tanks located in the wing. The FTHWG concluded that the safety record of fuel tanks located in the wings was adequate and that if the same level could be achieved in center wing fuel tanks, the overall safety objective would be achieved. Results from thermal analyses documented in the report indicate that center wing fuel tanks that are heated by air conditioning equipment located beneath them are flammable, on a fleet average basis, for up to 30 percent of the fleet operating time.

During the ARAC process it was also determined that certain airplane types do not locate heat sources adjacent to the fuel tanks. These airplanes provide significantly reduced flammability exposure, near the 5 percent value of the wing tanks. The group therefore determined that it would be feasible to design new airplanes such that fuel tank operation in the flammable range would be limited to near that of the wing fuel tanks. The primary method of compliance with the requirement proposed by the ARAC would likely be to control heat transfer into and out of fuel tanks such that heating of the fuel would not occur. Design features such as locating the air conditioning equipment away from the fuel tanks, providing ventilation of the air conditioning bay to limit heating and cool fuel tanks, and/or insulating the tanks from heat sources, would be practical means of complying with the regulation proposed by the ARAC.

In addition to its recommendation to revise § 25.981, the ARAC also recommended that the FAA continue to evaluate means for minimizing the development of flammable vapors within the fuel tanks to determine whether other alternatives, such as ground based inerting of fuel tanks, could be shown to be cost effective.

Discussion of the Proposal

The FAA review of the service history, design features, and maintenance instructions of the transport airplane fleet indicates that aging of fuel tank system components and unforeseen fuel tank system failures and malfunctions have become a safety issue for the fleet of turbine-powered transport category airplanes. The FAA proposes to amend the current regulations in four areas.

The first area of concern encompasses the possibility of the development of ignition sources within the existing transport airplane fleet. Many of the design practices used on airplanes in the existing fleet are similar. Therefore anomalies that have developed on specific airplane models within the fleet could develop on other airplane models. As a result, the FAA considers that a one-time design review of the fuel tank system for transport airplane models in the current fleet is needed.

The second area of concern encompasses the need to require the design of future transport category airplanes to more completely address potential failures in the fuel tank system that could result in an ignition source in the fuel tank system.

Third, certain airplane types are designed with heat sources adjacent to the fuel tank, which results in heating of the fuel and a significant increase in the formation of flammable vapors in the tank. The FAA considers that fuel tank safety can be enhanced by reducing the time fuel tanks operate with flammable vapors in the tank and is therefore proposing a requirement to provide means to minimize the development of flammable vapors in fuel tanks or provide means to prevent catastrophic damage if ignition does occur.

Fourth, the FAA considers that it is necessary to impose operational requirements so that any required maintenance or inspection actions will be included in each operator's FAA-approved program.

Proposed SFAR

Historically, the FAA has worked together with the TC holders when safety issues arise to identify solutions and actions that need to be taken. Some of the safety issues that have been addressed by this voluntary cooperative process include those involving aging aircraft structure, thrust reversers, cargo doors, and wing icing protection. While some manufacturers have aggressively completed these safety reviews, others have not applied the resources necessary to complete these reviews in a timely manner, which delayed the adoption of corrective action. Although these efforts have frequently been successful in achieving the desired safety objectives, a more uniform and expeditious response is considered necessary to address fuel tank safety issues.

While maintaining the benefits of FAA–TC holder cooperation, the FAA considers that a Special Federal Aviation Regulation (SFAR) provides a means for the FAA to establish clear expectations and standards, as well as a timeframe within which the design approval holders and the public can be confident that fuel tank safety issues on the affected airplanes will be uniformly examined.

This proposed rulemaking is intended to ensure that the design approval holder completes a comprehensive assessment of the fuel tank system and develops any required inspections, maintenance instructions, or modifications.

Safety Review

The proposed SFAR would require the design approval holder to perform a safety review of the fuel tank system to show that fuel tank fires or explosions will not occur on airplanes of the approved design. In conducting the review, the design approval holder would be required to demonstrate compliance with the standards proposed in this notice for § 25.981(a) and (b) (discussed below) and the existing standards of § 25.901. As part of this review, the design approval holder would be required to submit a report to the cognizant FAA Aircraft Certification Office (ACO) that substantiates that the fuel tank system is fail-safe.

The FAA intends that those failure conditions listed previously in this notice, and any other foreseeable failures, should be assumed when performing the system safety analysis needed to substantiate that the fuel tank system design is fail-safe. The system safety analysis should be prepared considering all airplane inflight, ground, service, and maintenance conditions, assuming that an explosive fuel air mixture is present in the fuel tanks at all times, unless the fuel tank has been purged of fuel vapor for maintenance. The design approval holder would be expected to develop a failure modes and effects analysis (FMEA) for all components in the fuel tank system. Analysis of the FMEA would then be used to determine whether single failures, alone or in combination with foreseeable latent failures, could cause an ignition source to exist in a fuel tank. A subsequent quantitative fault tree analysis should then be developed to determine whether combinations of failures expected to occur in the life of the affected fleet could cause an ignition source to exist in a fuel tank system.

Because fuel tank systems typically have few components within the fuel tank, the number of possible sources of ignition is limited. The system safety analysis required by this proposed rule would include all components or systems that could introduce a source of fuel tank ignition. This may require analysis of not only the fuel tank system components, (e.g., pumps, fuel pump power supplies, fuel valves, fuel quantity indication system probes, wiring, compensators, densitometers, fuel level sensors, etc.), but also other airplane systems that may affect the fuel tank system. For example, failures in airplane wiring or electromagnetic interference from other airplane systems could cause an ignition source in the airplane fuel tank system under certain conditions and therefore would have to be included in the system safety analysis. A proposed revision to AC 25.981–1A, discussed later in this document, is being developed to provide guidance on performing the safety review.

The intent of the design review proposed in this notice is to assure that each fuel tank system design that is affected by this action will be fully assessed and that the design approval holder identifies any required modifications, added flight deck or maintenance indications, and/or maintenance actions necessary to meet the fail-safe criteria.

Maintenance Instructions

The FAA anticipates that the safety review would identify critical areas of the fuel tank and other related systems that would require maintenance actions to account for the affects of aging, wear, corrosion, and possible contamination on the fuel tank system. For example, service history indicates that copper-sulfur deposits may form on fuel tank components, including bonding straps and FQIS components, which could degrade the intended design capabilities by providing a mechanism by which arcing could occur. Therefore, it might be necessary to provide maintenance instructions to identify and eliminate such deposits.

The proposed SFAR would require that the design approval holder develop any specific maintenance and inspection instructions necessary to maintain the design features required to preclude the existence or development of an ignition source within the fuel tank system. These instructions would have to be established to ensure that an ignition source will not develop throughout the remaining operational life of the airplane.

Possible Airworthiness Directives

The design review may also result in identification of unsafe conditions on certain airplane models that would require issuance of airworthiness directives. For example, as discussed previously in this notice, the FAA has required or proposed requirements for design changes to the Boeing 737, 747, and 767; Boeing Douglas Products Division DC–10 and Lockheed L–1011 airplanes. Design practices utilized on these models may be similar to those of other airplane types; therefore, the FAA expects that modifications to airplanes with similar design features may also be required.

The number and scope of any possible AD's may vary by airplane type design. For example, wiring separation and shielding of FQIS wires on newer technology airplanes significantly reduces the likelihood of an electrical short causing an electrical arc in the fuel tank; many newer transport airplanes do not route electrical power wiring to fuel pumps inside the airplane fuel tanks. Therefore, some airplane models may not require significant modifications or additional dedicated maintenance procedures. Other models may require significant modifications or more maintenance. For example, the FQIS wiring on some older technology airplanes is routed in wire bundles with high voltage power supply wires. The original failure analyses conducted on these airplane types did not consider the possibility that the fuel quantity indication system may become degraded allowing a significantly lower voltage level to produce a spark inside the fuel tank. Causes of degradation observed in service include aging, corrosion, or undetected contamination of the system. As previously discussed, the FAA has issued AD actions for certain Boeing 737 and 747 airplanes to address this condition. Modification of similar types of installations on other airplane models may be required to address this unsafe condition and to achieve a fail-safe design.

It should be noted that any design changes may, in themselves, require maintenance actions. For example, transient protection devices typically require scheduled maintenance in order to detect latent failure of the suppression feature. As a part of the required design review, the manufacturer would define the necessary maintenance procedures and intervals for any required maintenance actions.

Applicability of the Proposed SFAR

As proposed, the SFAR would apply to holders of TCs, and STCs for modifications that affect the fuel tank systems of turbine-powered transport category airplanes, for which the TC was issued after January 1, 1958, and the airplane has a maximum type certificated passenger capacity of 30 or more, or a maximum type certificated payload capacity of 7500 pounds or more. The SFAR would also apply to applicants for type certificates, amendments to a type certificate, and supplemental type certificates affecting the fuel tank systems for those airplanes identified above if the application was filed before the effective date of the proposed SFAR and the certificate was not issued before the effective date of the SFAR. The FAA has determined that turbine-powered airplanes, regardless of whether they are turboprops or turbojets, should be subject to the rule, because the potential for ignition sources in fuel tank systems is unrelated to the engine design. This would result in the coverage of the large transport category airplanes where the safety benefits and public interest are greatest. This action would affect approximately 6,000 U.S. registered airplanes in part 91, 121, 125, and 129 operations.

The date January 1, 1958, was chosen so that only turbine-powered airplanes, except for a few 1953–1958 vintage Convair 340s and 440s converted from reciprocating power, would be included. No reciprocating-powered transport category airplanes are known to be used currently in passenger service, and the few remaining in cargo service would be excluded. Compliance is not proposed for those older airplanes because their advanced age and small numbers would likely make compliance impractical from an economic standpoint. This is consistent with similar exclusions made for those airplanes from other requirements applicable to existing airplanes, such as the regulations adopted for flammability of seat cushions (49 FR 43188, October 24, 1984); flammability of cabin interior components (51 FR 26206, July 21, 1986); cargo compartment liners (54 FR 7384, February 17, 1989); access to passenger emergency exits (57 FR 19244, May 4, 1992); and Class D cargo or baggage compartments (63 FR 8032, February 17, 1998).

In order to achieve the benefits of this rulemaking for large transport airplanes as quickly as possible, the FAA has decided to proceed with this rulemaking with the applicability of the SFAR limited to airplanes with a maximum certificated passenger capacity of at least 30 or at least 7,500 pounds payload. Compliance is not proposed for smaller airplanes because it is not clear at this time that the possible benefits for those airplanes would be commensurate with the costs involved. However, the FAA intends to undertake a full regulatory evaluation of applying these requirements to small transport category and commuter category airplanes to determine the merits of subsequently extending the rule to airplanes with a passenger capacity of fewer than 30 and less than 7,500 pounds payload. Therefore, the FAA specifically requests comments as to the feasibility of requiring holders of type certificates issued prior to January 1, 1958, or for airplanes having a passenger capacity of fewer than 30 and less than 7,500 pounds payload, to comply and the safety benefits likely to be realized.

Supplemental Type Certificates (STC)

The FAA considers that this rule should apply to STC holders as well, because a significant number of STCs effect changes to fuel tank systems, and the objectives of this proposed rule would not be achieved unless these systems are also reviewed and their safety ensured. The service experience noted in the background of this proposed rule indicates modifications to airplane fuel tank systems incorporated by STCs may affect the safety of the fuel tank system.

Modifications that could affect the fuel tank system include those that could result in an ignition source in the fuel tank. Examples include installation of auxiliary fuel tanks and installation of, or modification to, other systems such as the fuel quantity indication system, the fuel pump system (including electrical power supply), airplane refueling system, any electrical wiring routed within or adjacent to the fuel tank, and fuel level sensors or float switches. Modifications to systems or components located outside the fuel tank system may also affect fuel tank safety. For example, installation of electrical wiring for other systems that was inappropriately routed with FQIS wiring could violate the wiring separation requirements of the type design. Therefore, the FAA intends that a fuel tank system safety review be conducted for any modification to the airplane that may affect the safety of the fuel tank system. The level of evaluation that is intended would be dependent upon the type of modification. In most cases a simple qualitative evaluation of the modification in relation to the fuel tank system, and a statement that the change has no effect on the fuel tank system, would be all that is necessary. In other cases where the initial qualitative assessment shows that the modification may affect the fuel tank system, a more detailed safety review would be required.

Design approvals for modification to airplane fuel tank systems approved by STCs require the applicant to have knowledge of the airplane fuel tank system in which the modification is installed. The majority of these approvals are held by the original airframe manufacturers or airplane modifiers that specialize in fuel tank system modifications, such as installation of auxiliary fuel tanks. Therefore, the FAA expects that the data needed to complete the safety review proposed in this notice would be available to the STC holder.

Compliance

This notice proposes a 12-month compliance time from the effective date of the final rule, or within 12 months after the issuance of a certificate for which application was filed before the effective date of this SFAR, whichever is later, for design approval holders to conduct the safety review and develop the compliance documentation and any required maintenance and inspection instructions. The FAA would expect each design approval holder to work with the cognizant FAA Aircraft Certification Office (ACO) and Aircraft Evaluation Group (AEG) to develop a plan to complete the safety review and develop the required maintenance and inspection instructions within the 12 month period. The plan should include periodic reviews with the ACO and AEG of the ongoing safety review and the associated maintenance and inspection instructions.

During the proposed 12-month compliance period, the FAA is committed to working with the affected design approval holders to assist them in complying with the requirements of this proposed SFAR. However, failure to comply within the specified time would constitute a violation of the proposed requirements and may subject the violator to certificate action to amend, suspend, or revoke the affected certificate in accordance with 49 U.S.C. § 44709. It may also subject the violator to a civil penalty of not more than $1,100 per day until the SFAR is complied with, in accordance with 49 U.S.C. § 46301.

Proposed Operating Requirements

This proposed rule would require that affected operators incorporate FAA-approved fuel tank system maintenance and inspection instructions in their maintenance or inspection program within 18 months of the effective date of the proposed rule. If the design approval holder has complied with the SFAR and developed an FAA-approved program, the operator could incorporate that program to meet the proposed requirement. The operator would also have the option of developing its own program independently, and would be ultimately responsible for having an FAA-approved program, regardless of the action taken by the design approval holder.

The proposed rule would prohibit the operation of certain transport category airplanes operated under parts 91, 121, 125, and 129 beyond a specified compliance time, unless the operator of those airplanes has incorporated FAA-approved fuel tank maintenance and inspection instructions in its maintenance or inspection program, as applicable. The proposed regulation would require that the maintenance and inspection instructions be approved by the Administrator; for the purposes of this rule, the Administrator is considered to be the manager of the cognizant FAA ACO.

The operator would need to consider the following:

1. The fuel tank system maintenance and inspection instructions that would be incorporated into the operator's existing maintenance or inspection program would need to be approved by the FAA ACO having cognizance over the TC of the airplane. If the operator can establish that the existing maintenance and inspection instructions fulfill the requirements of this proposed rule, then the ACO may approve the operator's existing maintenance and inspection instructions without change.

2. The means by which the FAA-approved fuel tank system maintenance and inspection instructions would be incorporated into a certificate holder's FAA-approved maintenance or inspection program would be subject to approval by the certificate holder's principal maintenance inspector (PMI) or other cognizant airworthiness inspector. The FAA intends that any escalation to the FAA-approved inspection intervals would require the operator to receive FAA approval of the amended program. Any request for escalation to the FAA approved inspection intervals would need to include data to substantiate that the proposed interval will provide the level of safety intended by the original approval. If inspection results and service experience indicate that additional or more frequent inspections are necessary, the FAA may issue AD's to mandate such changes to the inspection program.

3. This rule would not impose any new reporting requirements; however, normal reporting required under 14 CFR §§ 121.703 and 125.409 would still apply.

4. This rule would not impose any new FAA recordkeeping requirements. However, as with all maintenance, the current operating regulations (e.g., 14 CFR §§ 121.380 and 91.417) already impose recordkeeping requirements that would apply to the actions required by this proposed rule. When incorporating the fuel tank system maintenance and inspection instructions into its

approved maintenance or inspection program, each operator should address the means by which it will comply with these recordkeeping requirements. That means of compliance, along with the remainder of the program, would be subject to approval by the cognizant PMI or other cognizant airworthiness inspector.

5. The maintenance and inspection instructions developed by the TC holder under the proposed rule generally would not apply to fuel tank systems modified by an STC, including any auxiliary fuel tank installations or other modifications. The operator, however, would still be responsible to incorporate specific maintenance and inspection instructions applicable to the entire fuel tank system that meet the requirements of this proposed rulemaking. This means that the operator should evaluate the fuel tank systems and any alterations to the fuel tank system and then develop, submit, and gain FAA approval of the maintenance and inspection instructions to evaluate repairs to such fuel tank systems.

The FAA recognizes that operators may not have the resources to develop maintenance or inspection instructions for the airplane fuel tank system. The proposed rule would therefore require the TC and STC holders to develop fuel tank system maintenance and inspection instructions that may be used by operators. If however, the STC holder is out of business or otherwise unavailable, the operator would independently have to acquire the FAA-approved inspection instructions. To keep the airplanes in service, operators, either individually or as a group, could hire the necessary expertise to develop and gain approval of maintenance and inspection instructions. Guidance on how to comply with this aspect of the proposed rule would be provided in the planned revision to AC 25.981–1A.

After the PMI having oversight responsibilities is satisfied that the operator's continued airworthiness maintenance or inspection program contains all of the elements of the FAA-approved fuel tank system maintenance and inspection instructions, the airworthiness inspector would approve the maintenance or inspection program revision. This approval would have the effect of requiring compliance with the maintenance and inspection instructions.

Applicability of the Proposed Operating Requirements

This proposed rule would prohibit the operation of certain transport category airplanes operated under 14 CFR parts 91, 121, 125, and 129 beyond a specified compliance time, unless the operator of those airplanes has incorporated FAA-approved specific maintenance and inspection instructions applicable to the fuel tank system in its approved maintenance or inspection program, as applicable. The operational applicability was established so that all airplane types affected by the SFAR, regardless of type of operation, would be subject to FAA approved fuel tank system maintenance and inspection procedures. As discussed earlier, this proposed rulemaking would include each turbine-powered transport category airplane model, provided its TC was issued after January 1, 1958, and it has a maximum type certificated passenger capacity of 30 or more, or a maximum type certificated payload capacity of 7,500 pounds or more.

Field Approvals

A significant number of changes to other transport category airplane fuel tank systems have been incorporated through field approvals issued to the operators of those airplanes. These changes may also significantly affect the safety of the fuel tank system. The operator of any airplane with such changes would be required to develop the fuel tank system maintenance and inspection program instructions and submit it to the FAA for approval, together with the necessary substantiation of compliance with the design review requirements of the SFAR.

Compliance

This notice proposes an 18 month compliance time from the effective date of the final rule for operators to incorporate FAA-approved long term fuel tank system maintenance and inspection instructions into their approved program. The FAA would expect each operator to work with the airplane TC holder or STC holder to develop a plan to implement the required maintenance and inspection instructions within the 18 month period. The plan should include periodic reviews with the cognizant ACO and AEG that would approve the associated maintenance and inspection instructions.

Proposed Changes to Part 25

Currently, § 25.981 defines limits on surface temperatures within transport airplane fuel tank systems. In order to address future airplane designs, the FAA proposes to revise § 25.981 to address both prevention of ignition sources in fuel tanks and reduction in the time fuel tanks contain flammable vapors. The first proposal would explicitly include a requirement for effectively precluding ignition sources within the fuel tank systems of transport category airplanes. The second proposal would require minimizing the formation of flammable vapors in the fuel tanks.

Fuel Tank Ignition Source Proposal

The title of § 25.981 would be changed from ''Fuel tank temperature'' to ''Fuel tank ignition prevention.'' The FAA proposes to retain the substance of existing paragraph (a), which requires the applicant to determine the highest temperature that allows a safe margin below the lowest expected auto ignition temperature of the fuel; and the existing paragraph (b), which requires precluding the temperature in the fuel tank from exceeding the temperature determined under paragraph (a). These requirements are redesignated as (a)(1) and (2) respectively.

Compliance with these paragraphs requires the determination of the fuel flammability characteristics of the fuels approved for use. Fuels approved for use on transport category airplanes have differing flammability characteristics. The fuel with the lowest autoignition temperature is JET A (kerosene), which has an autoignition temperature of approximately 450 °F at sea level. The autoignition temperature of JP–4 is approximately 470 °F at sea level. Under the same atmospheric conditions the autoignition temperature of gasoline is approximately 800 °F. The autoignition temperature of these fuels increases at increasing altitudes (lower pressures). For the purposes of this rule the lowest temperature at which autoignition can occur for the most critical fuel approved for use should be determined. The FAA intends that a temperature providing a safe margin is at least 50 °F below the lowest expected autoignition temperature of the fuel throughout the altitude and temperature envelopes approved for the airplane type for which approval is requested.

This proposal would also add a new paragraph (a)(3) to require that a safety analysis be performed to demonstrate that the presence of an ignition source in the fuel tank system could not result from any single failure, from any single failure in combination with any latent failure condition not shown to be extremely remote, or from any combination of failures not shown to be extremely improbable.

These new requirements define three scenarios that must be addressed in order to show compliance with the proposed paragraph (a)(3). The first scenario is that any single failure, regardless of the probability of occurrence of the failure, must not cause an ignition source. The second scenario is that any single failure, regardless of the probability occurrence, in combination with any latent failure condition not shown to be at least extremely remote (i.e., not shown to be extremely remote or extremely improbable), must not cause an ignition source. The third scenario is that any combination of failures not shown to be extremely improbable must not cause an ignition source.

For the purpose of this proposed rule, ''extremely remote'' failure conditions are those not anticipated to occur to each airplane during its total life, but which may occur a few times when considering the total operational life of all airplanes of the type. This definition is consistent with that proposed by the Aviation Rulemaking Advisory Committee (ARAC) for a revision to FAA AC 25.1309–1A and that currently used by the Joint Aviation Authorities (JAA) in AMJ 25.1309. ''Extremely improbable'' failure conditions are those so unlikely that they are not anticipated to occur during the entire operational life of all airplanes of one type. This definition is consistent with the definition provided in FAA AC 25.1309–1A and retained in the draft revision to AC 25.1309–1A proposed by the ARAC.

The severity of the external environmental conditions that should be considered when demonstrating compliance with this proposed rule are those established by certification regulations and special conditions (e.g., HIRF), regardless of the associated probability. The proposed regulation would also require that the effects of manufacturing variability, aging, wear, and likely damage be taken into account when demonstrating compliance.

The proposed requirements are consistent with the general powerplant installation failure analysis requirements of § 25.901(c) and the systems failure analysis requirements of § 25.1309 as they have been applied to powerplant installations. This proposal is needed because the general requirements of §§ 25.901 and 25.1309 have not been consistently applied and documented when showing that ignition sources are precluded from transport category airplane fuel tanks. Compliance with the proposed revision to § 25.981 would require analysis of the airplane fuel tank system using analytical methods and documentation currently used by the aviation industry in demonstrating compliance with §§ 25.901 and 25.1309. In order to eliminate any ambiguity as to the necessary methods of compliance, the proposed rule explicitly requires that the existence of latent failures be assumed unless they are extremely remote, which is currently required under § 25.901, but not under § 25.1309. The analysis should be conducted assuming design deficiencies listed in the background section of this notice, and any other failure modes identified within the fuel tank system functional hazard assessment.

Based upon the evaluations required by paragraph (a), a new requirement would be added to paragraph (b) to require that critical design configuration control limitations, inspections, or other procedures be established as necessary to prevent development of ignition sources within the fuel tank system, and that they be included in the Airworthiness Limitations section of the ICA required by § 25.1529. This requirement would be similar to that contained in § 25.571 for airplane structure. Appendix H to part 25 would also be revised to add a requirement to provide any mandatory fuel tank system inspections or maintenance actions in the limitations section of the ICA.

Critical design configuration control limitations include any information necessary to maintain those design features that have been defined in the original type design as needed to preclude development of ignition sources. This information is essential to ensure that maintenance, repairs or alterations do not unintentionally violate the integrity of the original fuel tank system type design. An example of a critical design configuration control limitation for current designs discussed previously would be maintaining wire separation between FQIS wiring and other high power electrical circuits. The original design approval holder must define a method of ensuring that this essential information will be evident to those that may perform and approve such repairs and alterations. Placards, decals or other visible means must be placed in areas of the airplane where these actions may degrade the integrity of the design configuration. In addition, this information should be communicated by statements in appropriate manuals, such as Wiring Diagram Manuals.

Flammability Proposal

The FAA agrees with the intent of the recommended regulatory text recommended by the ARAC. However, due to the short timeframe that the ARAC was provided to complete the tasking, sufficient detailed economic evaluation was not completed to determine if practical means, such as ground based inerting, were available to reduce the exposure below the specific value of 7 percent of the operational time included in the ARAC proposal. In addition the 7 percent level of flammability proposed by the FTHWG does not minimize flammability on certain applications, while in other applications, such as very short haul operations, it may not be practical to achieve. Therefore, the FAA is proposing a more objective regulation that is intended to minimize exposure to operation with flammable conditions in the fuel tanks.

As discussed previously, the ARAC has submitted a recommendation to the FAA that the FAA continue to evaluate means for minimizing the development of flammable vapors within the fuel tanks. Development of a definitive standard to address this recommendation will require a significant research effort that will likely take some time to complete. In the meantime, however, the FAA is aware that historically certain design methods have been found acceptable that, when compared to readily available alternative methods, increase the likelihood that flammable vapors will develop in the fuel tanks. For example, in some designs, including the Boeing 747, air conditioning packs have been located immediately below a fuel tank without provisions to reduce transfer of heat from the packs to the tank.

Therefore, in order to preclude the future use of such design practices, this proposal would revise § 25.981 to add a requirement that fuel tank installations be designed to minimize the development of flammable vapors in the fuel tanks. Alternatively, if an applicant concludes that such minimization is not advantageous, it may propose means to mitigate the effects of an ignition of fuel vapors in the fuel tanks. For example, such means might include installation of fire suppressing polyurethane foam or installation of an explosion suppression system.

This proposal is not intended to prevent the development of flammable vapors in fuel tanks because total prevention has currently not been found to be feasible. Rather, it is intended as an interim measure to preclude, in new designs, the use of design methods that result in a relatively high likelihood that flammable vapors will develop in fuel tanks when other practicable design methods are available that can reduce the likelihood of such development. For example, the proposal would not prohibit installation of fuel tanks in the cargo compartment, placing heat exchangers in fuel tanks, or locating a fuel tank in the center wing. The proposal would, however, require that practical means, such as transferring heat from the fuel tank (e.g., use of ventilation or cooling air), be incorporated into the airplane design if heat sources were placed in or near the fuel tanks that significantly increased the formation of flammable fuel vapors in the tank, or if the tank is located in an area of the airplane where little or no cooling occurs. The intent of the proposal is to require that fuel tanks are not heated, and cool at a rate equivalent to that of a wing tank in the transport airplane being evaluated. This may require incorporating design features to increase or provide ventilation means for fuel tanks located in the center wing box, horizontal stabilizer, or auxiliary fuel tanks located in the cargo compartment. 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.

Applicability of Proposed Part 25 Change

The proposed amendments to part 25 would apply to all transport category airplane models for which an application for type certification is made after the effective date of the rule, regardless of passenger capacity or size. In addition, as currently required by the provisions of § 21.50, applicants for any future changes to existing part 25 type certificated airplanes, including STCs, that could introduce an ignition source in the fuel tank system would be required to provide any necessary Instructions for Continued Airworthiness, as required by § 25.1529 and the proposed change to the Airworthiness Limitations section, paragraph H25.4 of Appendix H. In cases where it is determined that the existing ICA are adequate for the continued airworthiness of the altered product, then it should be noted on the STC, PMA supplement, or major alteration approval.

FAA Advisory Material

In addition to the amendments proposed in this notice, the FAA is developing a proposed revision to AC 25.981–1A, ''Guidelines for Substantiating Compliance With the Fuel Tank Temperature Requirements.'' The proposed revision will include consideration of failure conditions that could result in sources of ignition of vapors within fuel tanks. The revised AC will provide guidance on how to substantiate that ignition sources will not be present in airplane fuel tank systems following failures or malfunctions of airplane components or systems. This AC will also include guidance for developing any limitations for the ICA that may be generated by the fuel tank system safety assessment. Public comments concerning the proposed AC will be requested by separate notice published in the **Federal Register**.

Future Regulatory Actions

The ARAC report discussed earlier does not recommend specific actions to eliminate or significantly reduce the flammability of fuel tanks in current production and the existing fleet of transport airplanes. The report, however, recommends that the FAA continue to investigate means to achieve a cost-effective reduction in flammability exposure for these airplanes. The FAA has reviewed the report and established research programs to support the further evaluation needed to establish the practicality of methods for achieving reduced flammability exposure for newly manufactured and the existing fleet of transport airplanes. The FAA intends to initiate rulemaking to address these airplanes if practical means are established.

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

Proposed 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 Office of Management and Budget directs agencies to assess the effects of regulatory changes on international trade. And 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, the FAA has determined that this proposed rulemaking: (1) would generate benefits that justify its costs as required by Executive Order 12866 and would be a ''significant regulatory action'' as defined in DOT's Regulatory Policies and Procedures; (2) would have a significant economic impact on a substantial number of small entities; (3) would have minimal effects on international trade; and (4) would not contain a significant intergovernmental or private sector mandate. These analyses, available in the docket, are summarized as follows.

Affected Industries

Based on 1996 data, the proposal would affect 6,006 airplanes, of which 5,700 airplanes are operated by 114 air carriers under part 121 service, 193 airplanes are operated by 7 carriers that operate under both part 121 and part 135, 22 airplanes are operated by 10 carriers under part 125 service, and 91 airplanes are operated by 23 carriers operating U.S.-registered airplanes under part 129. At this time, the FAA does not have information on airplanes operating under part 91 that would be affected by the proposed rulemaking; however, the FAA believes that very few airplanes operating under part 91 would be affected by the proposal.

The proposed rule would also affect 12 manufacturers holding 35 type certificates (TCs) and 26 manufacturers and airlines holding 168 supplemental type certificates (STCs). The proposed rule would also affect manufacturers of future, new part 25 type certificated airplane models and holders of future, new part 25 supplemental type certificates for new fuel tank systems. At this time, the FAA cannot predict the number of new airplane models. Based on the past 10 years average, the FAA anticipates that about 17 new fuel tank system STCs would be granted annually. The FAA requests comments on these estimates and requests that commenters provide clear supporting additional information.

Benefits

In order to quantify the benefits from preventing future fuel tank explosions, the FAA assumes that the potential U.S. fuel tank explosion rate due to an unknown internal fuel tank ignition source is similar to the worldwide fleet explosion rate over the past 10 years. On that basis, the FAA estimates that if no preventative actions were to be taken, between one and two (the expected value would be 1.25) fuel tank explosions would be expected to occur during the next 10 years in U.S. operations.

By way of illustrating the potential effectiveness of an enhanced fuel tank system inspection program, on May 14, 1998, the FAA issued AD T98–11–52 requiring the inspection of fuel boost pump wires in the center wing tank of all Boeing 737's with more than 30,000 hours. Of the 599 airplanes inspected as of June 30, 1998, 273 wire bundles had noticeable chafing to wire insulation, 33 had significant (greater than 50 percent) insulation chafing, 8 had arcing on the cable but not through the conduit, while 2 had arcing through the conduit into the fuel tank.

In light of the findings from these inspections, the FAA believes that better fuel tank system inspections would be a significant factor in discovering potential fuel tank ignition sources. The FAA anticipates that compliance with the proposal would prevent between 75 percent and 90 percent of the potential future fuel tank explosions from unknown ignition sources.

Using a value of $2.7 million to prevent a fatality, a value of the destroyed airplane of $20 million, an average of $30 million for an FAA investigation of an explosion, and assuming the proposal would prevent between 75 percent and 90 percent of these potential fuel tank explosions from an unknown ignition source, the potential present value of the expected benefits discounted over 10 years at 7 percent would be between $260 million and $520 million.

In addition, the proposed part 25 change would reduce the length of time that an explosive atmosphere would exist in the fuel tank during certain operations for new part 25 type certificated airplanes and for new fuel tank system STCs. At this time, the FAA cannot quantify these potential benefits, but they are not expected to be considerable in the immediate future. The FAA expects that these benefits would increase over time as new part 25 type certificated airplanes replace the older part 25 type certificated airplanes in the fleet.

Compliance Costs

The proposal consists of three parts. The first two are separate but interrelated parts, each of which would impose costs on the industry. The first is the proposed SFAR. The second is the proposed operational rules changes from the recommendations following the SFAR. The third part is the proposed part 25 change.

The compliance costs for the proposed SFAR would be due to the requirement for the design approval holder to complete a comprehensive fuel tank system design assessment and to provide recommendations for the inspections and model-specific service instructions within one year from the SFAR's effective date. The assessment may identify conditions that would be addressed by specific service bulletins or unsafe conditions that would result in FAA issuance of an airworthiness directive (AD). However, those future costs would be the result of compliance with the service bulletin or the AD and are not costs of compliance with the proposed rulemaking. Those costs would be estimated for each individual AD, when proposed. In addition, the compliance costs do not include the compliance costs from an existing fuel tank AD.

The compliance costs for the proposed operational rule changes would be due to the requirement for the air carrier to incorporate these recommendations into its fuel tank system inspection and maintenance program within 18 months from the proposal's effective date. These compliance costs do not include the costs to repair and replace equipment and wiring that is found to need repair or replacement during the inspection. Although these costs are likely to be substantial, they are attributable to existing FAA regulations that require such repairs and replacements be made to assure the airplane's continued airworthiness.

The FAA anticipates that the proposed part 25 change would have a minimal effect on the cost of future type certificated airplanes because compliance with the proposed change would be done during the design phase of the airplane model before any new airplanes would be manufactured.

In addition, the FAA determines, after discussion with industry representatives, that the proposed part 25 changes would have a minimal impact on future fuel tank system STCs because current industry design practices could be adapted to allow compliance with the proposed requirement.

Costs of Fuel Tank System Design Assessments—New SFAR

The FAA has determined that 35 TCs and 68 fuel tank system STCs (many of the 168 STCs duplicate other STCs) would need a fuel tank system design assessment. Depending upon the complexity of the fuel tank system and the number of tanks, the FAA has estimated that a fuel tank system design assessment would take between 0.5 to 2 engineer years for a TC holder and an average of 0.25 engineer years for an STC holder. The FAA estimates that developing manual revisions and service bulletins would take between 0.25 to 1 engineer years for a TC holder and an average of 0.1 engineer years for an STC holder. In addition, the FAA and the TC or STC holder would each spend between 1 day and 5 days to review, revise, and approve the assessment and the changes to the manual.

Using a total engineer compensation rate (salary and fringe benefits plus a mark-up for hours spent by management, legal, etc. on the assessment) of $100 an hour, the FAA estimates that the one-time fuel tank system design assessment would cost TC holders a total of $9.5 million, it would cost STC holders a total of $4.9 million, and it would cost the FAA about $220,000.

The FAA requests comments on the assumptions and the methodology and also requests that commenters provide additional data.

Costs of Fuel Tank System Inspections—Operational Rule Changes

Methodology: The costs to air carriers of complying with the operational requirements proposed for Parts 91, 121, 125, and 129 would be the additional (incremental) labor hours and additional airplane out-of-service time to perform the enhanced fuel tank system maintenance and inspections. However, the costs of the fuel tank system inspections that have been required by recent ADs are not included as a cost of complying with the proposed operational amendments.

The FAA intends that any additional fuel tank system inspection and maintenance actions resulting from the SFAR review would occur during an airplane's regularly scheduled major maintenance checks. From a safety standpoint, repeated entry increases the risk of damage to the airplane. Thus, the proposal would not require air carriers to alter their maintenance schedules, and the FAA anticipates that few or no airplanes would be taken out of service solely to comply with the proposal unless an immediate safety concern is identified. In that case, corrective action would be mandated by an AD.

The FAA anticipates that the proposal would require additional time out of service and man-hours to complete a fuel tank system inspection and equipment and wiring testing.

The FAA-estimated number of additional hours (for both man-hours and time out of service) to perform each of the various inspections is derived primarily from the available service bulletins and from discussions with airline maintenance engineers. For those turbojet models that have not been the subject of a fuel tank system inspection service bulletin, the FAA adopted the estimated hours from existing service bulletins of similar types of turbojet models. Although there have been no fuel tank system inspection service bulletins for turboprops, the FAA received information concerning the estimated fuel tank system inspection time for a turboprop from commuter airline maintenance personnel. Based on this information and an FAA analysis that turboprop fuel tanks are smaller and have less equipment than turbojet fuel tanks, the FAA estimates that a turboprop fuel tank system inspection would take between one-third to one-half of the time it would take for the turbojet fuel tank system inspections defined in available bulletins.

The FAA requests comments on these estimates and that commenters provide supporting data.

Estimated Compliance Costs: The following cost and hour estimates are summaries of the Regulatory Evaluation of the proposal. The detailed estimated compliance costs, including all assumptions and the spreadsheet used for the calculations, are in that document, which is available in the docket.

The incremental cost of complying with the operational proposals would consist of the following four components: (1) the labor hours to incorporate the recommendations into the inspections manual; (2) the labor hours needed to perform the fuel tank system inspection; (3) the cost of the additional downtime required to complete the inspection; and (4) the increased documentation and reporting of the inspection and subsequent findings.

The FAA estimates that it would take an average of 5 engineer days to incorporate the recommendations into the inspections manual, for a cost of about $4,000 per airplane model per operator, with a total cost of about $1.16 million.

The FAA estimates that the increased number of labor hours per airplane resulting from the enhanced fuel tank system inspection and maintenance would range from 19 hours to 110 hours in the first three years, and would decline to 9 hours to 60 hours beginning in the fourth year. Using a total compensation rate (wages plus fringe benefits) of $70 an hour for maintenance personnel, the FAA estimates that the annual per airplane costs of compliance would range from $1,330 to $7,700 in each of the first 3 years and from $630 to $4,200 in each year thereafter.

The FAA estimates that the total annual inspection costs would be about $21.1 million during the first year, increasing by 4.3 percent per year from the projected increase in airline operations until the fourth year, when it would decline to about $10.1 million increasing by 4.3 percent each year thereafter. The present value of the total operational cost, discounted at 7 percent over 10 years, would be about $100 million.

As noted earlier, equipment costs would not be attributed to the proposal but rather to the existing FAA airworthiness requirements. For example, inspecting fuel boost pump wiring may involve its disassembly and then reinstallation. Regardless of the wiring's condition, the cost of complying with the proposal would include reinstallation time. However, if the inspection or testing revealed the need for new wiring, the new wiring cost is not attributed to the proposal.

The proposal would increase out-of-service time because only a limited number of maintenance employees can work inside of a fuel tank at any point in time, and thereby would not allow air carriers the flexibility to perform the fuel tank system inspections during regularly scheduled major maintenance checks. Thus, the time to open the tank, drain the fuel, vent the tank, and close the tank are not costs attributed to the proposal because those activities are necessary to complete a scheduled maintenance check. On that basis, the FAA estimates that this annual increase in out-of-service time would be between 11.5 hours and 32 hours per airplane for each of the first 3 years and then decline to 10 to 25 hours per airplane in each year thereafter.

The economic cost of out-of-service time is lost net revenue, which is computed using the Office of Management and Budget (OMB) determination that the average annual risk-free productive rate of return on capital is 7 percent of the average value of that airplane model. Thus, out-of-service lost net revenue per fuel tank system inspection ranges from $50 to $9,750 per airplane, depending upon the airplane model. Assuming one major inspection per year, the total annual out-of-service lost net revenue would be about $6.4 million during the first year, increasing by 4.3 percent per year until the fourth year when it would decline to about $2.95 million but increase by 4.3 percent each year thereafter. The present value of this total lost net revenue, discounted at 7 percent over 10 years, would be about $35.6 million.

The FAA estimates that the increased annual documentation and reporting time would be one hour of recordkeeping for every 8 hours of labor time in the first three years, and one hour of recordkeeping for every 10 hours of labor time in every year thereafter. Thus, the per airplane annual documentation cost would be between $150 and $850 in the first three years becoming $100 to $540 each year thereafter.

To estimate the total documentation cost, it is noted that there is a voluntary industry program to inspect certain airplane model fuel tanks and report the findings and corrective actions taken to the manufacturer. The reporting costs of compliance associated with the proposal would not include these airplanes. On that basis, the FAA estimates that the present value of the total recordkeeping cost discounted at 7 percent for 10 years would be about $17.4 million.

Costs of Future Fuel Tank System Design Changes—Revised Part 25

The FAA anticipates that these discounted costs would be minimal for new type certificated airplanes because these design costs would be incurred in the future by airplane models yet to be designed. After consultation with industry, the FAA also anticipates that these discounted costs would be minimal for future fuel tank system design supplemental type certificates because the existing systems would largely be in compliance. The FAA requests comments and supporting data on these determinations.

Total Costs of Proposed SFAR and Proposed Operational Rules Changes

Thus, the FAA estimates that the present value of the total cost of complying with the proposed SFAR and the proposed operational rules changes discounted over 10 years at 7 percent would be about $170 million.

Benefit-Cost Comparison of the Proposed Part 25 Change

Although the FAA does not have quantified costs and benefits from the proposed part 25 changes at this time, the FAA believes that the future benefits would likely be greater than the future costs. The FAA requests comments and additional data on this determination.

Benefit-Cost Comparison of the Proposed SFAR and the Proposed Operational Rules Changes

In comparing the estimated benefits and costs, the FAA determines that using the lowest expected benefit estimate, the expected present value of the benefits ($260 million) would be about 50 percent greater than the present value of the total compliance costs ($170 million). Thus, the FAA concludes that the proposed SFAR and the proposed operational rules changes would be cost-beneficial.

Regulatory Flexibility Determination

The Regulatory Flexibility Act of 1980 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 Act requires agencies to solicit and consider flexible regulatory proposals and to explain the rationale for their actions. The Act 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 determination finds that it will, the agency must prepare a Regulatory Flexibility Analysis (RFA) as described in the Act.

However, if an agency determines that a proposed or final rule is not expected to have a significant economic impact on a substantial number of small entities, section 605(b) of the 1980 Act provides that the head of the agency may so certify, and an RFA is not required. The certification must include a statement providing the factual basis for this determination, and the reasoning should be clear. Recently, the Office of Advocacy of the Small Business Administration (SBA) published new guidance for Federal agencies in responding to the requirements of the Regulatory Flexibility Act, as amended.

Application of that guidance to the proposed part 25 change would only affect future airplane manufacturers; and currently all manufacturers of part 25 type certificated airplanes are considered to be large manufacturers. Although the proposed changes to part 25 would also affect future fuel tank system STCs, industry sources indicate that current industry designs would meet the proposed requirement. Thus, the FAA certifies that the proposed part 25 change would not have a significant economic impact on a substantial number of small airplane manufacturing entities.

However, application of that guidance to the proposed SFAR and to the proposed operational rule changes indicates that it would have a significant economic impact on a substantial number of small air carrier entities that have one to nineteen airplanes. Accordingly, a complete preliminary regulatory flexibility analysis was conducted for those two elements of the proposal and is summarized as follows.

1. *Reasons why the FAA is considering the proposed rule.* This proposed action is being considered in order to prevent airplane explosions and the resultant loss of life (as evidenced by TWA Flight 800). Existing fuel tank system inspection programs may not provide comprehensive, systematic prevention and control of ignition sources in airplane fuel tanks.

2. *The objectives and legal basis for the proposal.* The objective of the proposal is to ensure the continuing airworthiness of airplanes certificated with 30 or more passengers or with a payload of 7,500 pounds or more. The design approval holder [including type certificates (TC) and supplemental type certificates (STC)] would be required to perform a design fuel tank system assessment and provide recommendations and instructions concerning fuel tank system inspections and equipment and wiring testing to the operators of those airplanes, as well as to create service bulletins and provide data to the FAA to support any needed ADs. An operator working under part 91, under part 121, under part 125, and all U.S.-registered airplanes used in scheduled passenger carrying operations under part 129, would be required to incorporate these recommendations or other approved instructions into the inspection manual and to perform these inspections and tests. The legal basis for the proposal is found in 49 U.S.C. 44901 *et seq.* As a matter of policy, the FAA must, as its highest priority (49 U.S.C. 40101(d)), maintain and enhance safety and security in air commerce.

3. *All relevant federal rules that may duplicate, overlap, or conflict with the proposal.* The FAA is unaware of any federal rules that would duplicate, overlap, or conflict with the proposal.

4. *A description and an estimate of the number of small entities to which the proposal would apply.* The proposal would apply to the operators of all airplanes certificated with 30 or more passengers or a 7,500 pound or more payload operated under part 91, part 121, part 125, and all U.S.-registered airplanes operated under part 129. Standard industrial classification (SIC) coding does not exactly coincide with the subsets of operators who could be affected by the proposal. Nevertheless, using data from the SBA, the distributions of employment size and estimated receipts for all scheduled air transportation firms (SIC Code 4512), given in Table 1 below, are representative of the operators who would be affected by the proposal.

5. *The projected reporting, recordkeeping, and other compliance requirements of the proposal.* The proposal would not impose any incremental recordkeeping authority. Existing 14 CFR part 43, in part, already prescribes the content, form, and disposition of maintenance, preventive maintenance, rebuilding, and alteration records for any aircraft having a U.S. airworthiness certificate or any foreign registered aircraft used in common carriage under part 121. The FAA recognizes, however, that the proposal would necessitate additional inspection and testing work, and consequently would also require the completion of the additional recordkeeping associated with that additional work.

The FAA estimates that each 8 additional hours of actual inspection and testing required under the proposal would require one additional hour for reporting and recordkeeping (7.5 recordkeeping minutes per inspection hour). This recordkeeping would be performed by the holder of an FAA-approved repairman or maintenance certificate. The projected recordkeeping and reporting costs of the proposal are included as part of the overall costs computed in the evaluation and included below in the Regulatory Flexibility Cost Analysis.

TABLE 1.

Operator Category (No. of employ-ees)	Number of firms	Estimated re-ceipts (in $1,000)
0–4	153	193,166
5–9	57	145,131
10–19	56	198,105
20–99	107	1,347,711
101–499	74	3,137,624
500+	73	112,163,942
Total	520	117,185,679

Table 2 categorizes the estimated number of operators by number of airplanes that would be affected by the proposal and provides an estimate of the total number of affected airplanes in that operator category. Based on existing operator/airplane distributions, the FAA estimates that 131 U.S. operators would be subject to the proposal. (Note that this excludes the 19 non-U.S. owners of U.S.-registered airplanes that would be affected by the proposal. It should also be noted that Table 2 excludes Boeing 747 models, and, therefore, operators who exclusively fly Boeing 747s.)

TABLE 2.

Operator category	No. of operators	Total No. of airplanes
0–4	48	93
5–9	17	108
10–19	22	271
20–29	13	277
30–39	4	145
40–49	5	220
Total 0–50	109	1,114
50+	22	4,594
U.S. Total	131	5,708
Non-U.S.	23	62
Total	154	5,770

6. *Regulatory Flexibility Cost Analysis.* The proposal would consist of two actions affecting small business expenses. The first action, the proposed SFAR, would require all design approval TC holders and fuel tank system STC holders: (1) to complete a fuel tank system design assessment and to generate future service bulletins and provide data to the FAA; and (2) to provide operators with recommendations for fuel tank system inspections, testing, and maintenance. The second action, the proposed operational rules changes, would require that operators incorporate these recommendations for an enhanced fuel tank system inspection and equipment and wiring testing into the inspection and maintenance manuals. This proposal would apply to both existing and future production airplanes and to future TCs and STCs. This Regulatory Flexibility Cost Analysis focuses on the costs to operators of existing and future production airplanes, because almost 99 percent of the estimated costs of the proposal would be incurred by operators of those airplanes.

Table 3 summarizes the results for the total annualized compliance costs for U.S. operators only and also provides the estimated cost per operator and per airplane by each operator size category.

TABLE 3.

Operator category (No. of airplanes)	Total costs	Per operator cost	Per airplane cost
0–4	$293,000	$6,100	$3,150
5–9	275,000	16,175	2,550
10–19	1,123,000	51,050	4,150
20–29	784,000	60,300	2,825
30–39	234,000	58,500	1,600
40–49	262,000	52,400	1,200
Total 0–4	2,971,000	27,250	2,675
50+	17,820,000	810,000	3,775
Total	20,791,000	158,700	3,650

7. *Affordability Analysis.* Although the FAA lacks financial data for most of the smallest operators, if the average operating revenues, calculated to be about $1.25 million for the category of 0 to 4 employees from Table 1, are compared to the average annualized compliance costs from Table 3 (an admittedly crude method), it appears that the average operator would pay no more than 0.5 percent of operating revenues, based on an average annual risk-free return of 7 percent of the value of the airplane, to comply with the proposal. On that basis, most small entities would be able to offset the incremental compliance costs. Nevertheless, it is likely that there would be some of the very small operators (those with 1 to 9 affected airplanes) that may have difficulties in offsetting these incremental costs. However, due to the unavailability of current financial data from the Department of Transportation on these smallest operators, the FAA cannot more definitively determine the potential impact on these smallest affected operators. The FAA solicits comments on these costs and requests that all comments be accompanied with clear supporting data.

8. *Disproportionality analysis.* The principle factors determining the compliance cost for an operator would be the type of airplane model in the operator's fleet and the number of airplanes that would be affected by the proposal. As noted in the compliance cost section, the cost to inspect the fuel tank system of larger transport category airplane models would be 3 to 4 times more than the cost for a small transport category turboprop. Consequently, as seen in Table 3, the average per airplane compliance cost for operators with more than 50 airplanes is generally higher than the average cost per airplane for operators with fewer than 50 airplanes. This is due to the predominance of turboprops in the 30–50 airplane fleets, which would have the lowest compliance costs. However the per airplane cost for operators with 1 to 29 airplanes is higher than for the 30 to 50 airplane operators. Many of the smallest operators with fewer airplanes are cargo

operators utilizing larger and older turbojets, and they have fewer airplanes available to average the fixed costs associated with compliance with the proposal. Nevertheless, in general, the average compliance cost per airplane is relatively consistent for operators with fewer than 50 affected airplanes. Further, the compliance cost relative to these airplanes operating revenues would be relatively small. As a result, the FAA does not believe that small entities, as a group, would be disadvantaged relative to large air carriers due solely to the slight disproportionate cost effects from compliance with the proposal.

9. *Competitiveness Analysis.* The proposal would likely impose significant costs on some of the smallest air carriers (those with 1 to 19 airplanes) and, as a consequence, may affect the relative position of these carriers in their markets. However, most of these smallest air carriers operate in ''niche'' markets in which the competition that occurs arises from other small operators using largely similar equipment and often competing on the basis of service rather than on the basis of price. In such markets, the number of competitors is very limited. For example, Atlas Air specializes in supplying international air cargo by using large all-cargo airplanes to carry bulky cargo, like oil rig equipment. Similarly, Northern Air Cargo specializes in mail and air cargo to rural Alaska.

The FAA believes that most of the markets served by these smallest air carriers are low-volume niche markets that larger air carriers have in many cases abandoned, because the larger air carriers' fleets have been designed for high-volume markets. Further, larger air carriers would not be interested in servicing most of these markets because they cannot compete on a cost basis. Thus, these smallest operators would be able to avoid direct competition with larger air carriers. As a result, to the extent that there would be adverse competitiveness effects, they would likely be minimal and they would occur with other similar-sized (1 to 19) air carriers. On that basis, the FAA concludes that small air carriers would not lose market share to larger air carriers.

The proposal would not impose significant compliance costs on a substantial number of small operators that have 20 or more airplanes that would be affected by the proposal. These operators include large regionals, medium regionals, commuter airlines, and air cargo carriers. To some extent, these operators avoid direct competition with major carriers. However, in those markets where there is competition between the small entities and the larger air carriers, the proposal would have minimal competitive impact, because the per airplane compliance cost for a given airplane model would be roughly the same for a large and a small operator.

10. *Business Closure Analysis.* The FAA is unable to determine with certainty the extent to which small entities that would be significantly affected by the proposal would have to close their operations. Many of the very small operations (1 to 4 airplanes) operate very close to the margin, as evidenced by the constant exit from and entry into air carrier service of these types of air carriers. Consequently, in the absence of financial data, it is difficult to determine the extent to which the proposal would make the difference in an entity's remaining in business.

11. *Description of Alternatives.* In the general course of promulgating the proposed rule, the FAA has considered four approaches. The three alternatives to the proposed rule are described below. In formulating the alternatives, the FAA focused on its responsibility for aviation safety and its particular obligation under 49 U.S.C. 44717 to ensure the continuing airworthiness of airplanes. The three primary alternatives to the proposal considered by the FAA varied with respect to the number of airplanes to be included in the proposal. The proposed rule would limit the potential impact on airplanes most likely to be used by small entities, while meeting the Agency's safety responsibility.

Alternative 1: Require all airplanes in commercial service with more than 10 seats to be covered by the proposal.

Alternative 1 would require all airplanes operating under part 91, 121, 125, and 129 to comply with the proposal. This would also include operators supplying on-demand service under part 135. The FAA estimates that about 45 additional airplane models, about 2,360 additional airplanes, and about 550 additional operators would be covered by this proposed alternative. The airplane operation is not the principal business for many of these additional operators. In estimating these potential compliance costs, the FAA assumes that, due to their small fuel tanks and relative straightforward fuel systems, these airplanes would need one-half of the time reported for the smallest part 25 turboprop to complete the fuel tank system design assessment. In addition, the FAA assumes that it would also take one-quarter of the time reported for the smallest part 25 turboprop to complete the enhanced fuel tank system inspection and maintenance and wiring testing. Further, the FAA assumes that the out-of-service time would be one-half of the labor time to complete the inspection and testing. However, there would be no out-of-service time for part 135 on-demand airplanes because those operators would normally schedule maintenance when there was no activity. For the other operators, the FAA estimates the value of the average airplane would be about $750,000.

The FAA estimates that the total additional compliance costs of including these operators (including the fuel tank system design assessment cost) would be about $7.4 million in the first-year, becoming about $1.1 million in the fourth year. The total compliance cost, discounted over 10 years at 7 percent, would be about $17.1 million. The annualized cost, discounted over 10 years at 7 percent, would be about $2.4 million.

This proposed alternative would not significantly increase the expected quantitative benefits because there have been no in-flight fuel tank explosions of these airplanes. In light of the absence of a fuel tank explosion accident history, the FAA does not believe at this time that the increased cost from including these smaller airplanes would be met with a commensurate level of benefits.

The FAA requests comments on these estimates and requests commenters to provide supporting data for the comments.

Alternative 2: Require all airplanes in commercial service with 30 or more seats (the proposed rule), plus all airplanes with 10 or more seats in scheduled commercial service, to be covered by the proposal.

Alternative 2 would add the requirement for all airplanes with 10 or more seats in scheduled commercial service operating under part 91, part 121, part 125, and part 129 to comply with the proposal. The FAA estimates that 30 additional airplane models, 724 additional airplanes, and about 84 additional operators would be covered by this proposed alternative. However, 35 of the 84 additional operators would already have airplanes that would be covered by the proposal. In estimating these potential compliance costs, the FAA makes the same assumptions that were described under Alternative 1.

On that basis, the FAA estimates that the additional compliance costs of including these operators (including the fuel tank system design assessment cost) would be about $2.7 million in the first-year and about $340,000 in the fourth year. The total compliance cost, discounted over 10 years at 7 percent, would be about $5.7 million. The annualized cost, discounted over 10 years at 7 percent, would be about $806,000. However, as also described under Alternative 1, this proposed alternative would not significantly increase the expected quantitative benefits because there have been no in-flight fuel tank explosions of these airplanes.

The FAA requests comments on these estimates and requests commenters to provide supporting data for the comments.

Alternative 3: Require that only turbojet airplanes in commercial service be covered by the proposal.

This alternative would allow 1,034 turboprop airplanes certificated under part 25 to be exempt from the proposal's requirements. By doing so, it would reduce the first year cost of compliance to all of these exempted airplanes by about $1.8 million, becoming about $545,000 in the fourth year. The total compliance cost savings, discounted over 10 years at 7 percent, would be about $8.3 million. The total annualized cost savings, discounted over 10 years at 7 percent, would be about $1.2 million.

Although there have been no in-flight fuel tank explosions associated with these part 25 turboprop airplane models, the FAA believes that the underlying fuel tank system risk is similar to those of the larger turbojets. On that basis, as the FAA's estimated overall benefits are larger than its estimated overall costs, by extrapolation, removing 20 percent of the population at risk from the proposed rule would remove 20 percent of both the benefits and costs. As the benefits are estimated to be greater than the costs, the result would be a reduction in the net dollar benefits and higher safety risk. Finally, these airplanes are part 25 certificated and the FAA considers that the same level of safety should be applied to all part 25 certificated airplanes. Thus, as a result of performing the regulatory flexibility analysis and addressing the concerns of the SBA, the FAA believes that, in comparison to the two higher cost alternatives and the one lower cost alternative evaluated by the FAA, the proposal would provide the necessary level of safety in the most cost-effective manner.

12. *Special Considerations.* As seen in Table 3, on a proportional basis the proposal would have a slightly greater impact on larger air carriers. The per airplane annualized cost for a large operator with 50 or more airplanes would be $3,775, where it would be about $2,675 for a smaller operator. However, this difference is relatively small, and the FAA concludes that the proposal would not alter the competitiveness of small air carriers relative to larger air carriers.

13. *Conclusion.* For a small operator with an airplane worth $5 million, an annualized cost of $2,675 would be equal to about three days of lost net revenue, based on an average annual risk-free productive rate of return on capital of 7 percent. However, the FAA also considers that even for small operators of these affected airplanes, the safety benefits would be greater than the compliance costs. The FAA requests comments on this analysis and requests commenters to supply supporting data for the comments.

International Trade Impact Assessment

Consistent with the Administration's belief in the general superiority, desirability, and efficacy of free trade, it is the policy of the Administrator to remove or diminish, to the extent feasible, barriers to international trade, including both barriers affecting the export of American goods and services to foreign countries and those affecting the import of foreign goods and services into the United States.

In accordance with that policy, the FAA is committed to develop as much as possible its aviation standards and practices in harmony with its trading partners. Significant cost savings can result from this, both to American companies doing business in foreign markets, and foreign companies doing business in the United States.

This proposed rule would have little or no impact on international trade. The proposed part 25 change would equally affect all future part 25 airplanes, wherever manufactured, that would be registered in the United States. Although the proposed operational rules changes would affect only U.S. registered airplanes, the net effect is expected to be small and the European Joint Aviation Authorities may consider similar regulations.

Unfunded Mandates Assessment

Title II of the Unfunded Mandates Reform Act of 1995 (the Act), enacted as Public Law 104–4 on March 22, 1995, requires each Federal agency, to the extent permitted by law, to prepare a written assessment of the effects of any Federal mandate in a proposed or final agency rule that may result in the expenditure by State, local, and tribal governments, in the aggregate, or by the private sector, of $100 million or more (adjusted annually for inflation) in any one year. Section 204(a) of the Act, 2 U.S.C. 1534(a), requires the Federal agency to develop an effective process to permit timely input by elected officers (or their designees) of State, local, and tribal governments on a proposed ''significant intergovernmental mandate.'' A ''significant intergovernmental mandate'' under the Act is any provision in a Federal agency regulation that will impose an enforceable duty upon State, local, and tribal governments, in the aggregate, of $100 million (adjusted annually for inflation) in any one year. Section 203 of the Act, 2 U.S.C. 1533, which supplements section 204(a), provides that before establishing any regulatory requirements that might significantly or uniquely affect small governments, the agency shall have developed a plan that, among other things, provides for notice to potentially affected small governments, if any, and for a meaningful and timely opportunity to provide input in the development of regulatory proposals.

The FAA determines that this proposed rule would not contain a significant intergovernmental or private sector mandate as defined by the Act.

Federalism Implications

The regulations proposed herein will not have substantial direct effects on the States, or on the relationship between the national government and the States, or on the distribution of power and responsibility among the various levels of the government. Therefore, in accordance with Executive Order 12612, it is determined that this proposed rule would not have significant federalism implications to warrant the preparation of a Federalism Assessment.

International Civil Aviation Organization (ICAO) and Joint Aviation Regulations

In keeping with U.S. obligations under the Convention on International Civil Aviation, it is FAA policy to comply with ICAO Standards and Recommended Practices to the maximum extent practicable. The FAA has determined that this proposed rule would not conflict with any international agreement of the United States.

Paperwork Reduction Act

There are no new requirements for information collection associated with this proposed rule that would require approval from the Office of Management and Budget pursuant to the Paperwork Reduction Act of 1995 (44 U.S.C. 3507(d)).

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 a 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 operation of certain transport category airplanes under parts 91, 121, 125, and 129 of Title 14, 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 to intrastate operations in Alaska.

List of Subjects

14 CFR Parts 21, 25, 91, 125 and 129

Aircraft, Aviation safety, Reporting and recordkeeping requirements.

14 CFR Part 121

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

The Proposed Amendment

In consideration of the foregoing, the Federal Aviation Administration proposes to amend parts 21, 25, 91, 121, 125, and 129 of Title 14, Code of Federal Regulations, as follows:

PART 21—CERTIFICATION PROCEDURES FOR PRODUCTS AND PARTS

1. The authority citation for part 21 continues to read as follows:

Authority: 42 U.S.C. 7572; 40105; 40113; 44701–44702, 44707. 44709, 44711, 44713, 44715, 45303.

2. In part 21, add SFAR No. XX to read as follows:

Special Federal Aviation Regulations

* * * * *

SFAR No. XX—Fuel Tank System Fault Tolerance Evaluation Requirements

1. *Applicability.* This SFAR applies to the holders of type certificates, and supplemental type certificates affecting the airplane fuel tank system, for turbine-powered transport category airplanes, provided the type certificate was issued after January 1, 1958, and the airplane has a maximum type certificated passenger capacity of 30 or more, or a maximum type certificated payload capacity of 7500 pounds or more. This SFAR also applies to applicants for type certificates, amendments to a type certificate, and supplemental type certificates affecting the fuel tank systems for those airplanes identified above, if the application was filed before the effective date of this SFAR and the certificate was not issued before the effective date of this SFAR.

2. *Compliance:* No later than [12 months after the effective date of the final rule], or within 12 months after the issuance of a certificate for which application was filed before [effective date of the final rule], whichever is later, each type certificate holder, or supplemental type certificate holder of a modification affecting the airplane fuel tank system, must accomplish the following:

(a) Conduct a safety review of the airplane fuel tank system to determine that the design meets the requirements of §§ 25.901 and 25.981(a) and (b) of this chapter. If the current design does not meet these requirements, develop all design changes necessary to the fuel tank system to meet these requirements.

(b) Develop all maintenance and inspection instructions necessary to maintain the design features required to preclude the existence or development of an ignition source within the fuel tank system of the airplane.

(c) Submit a report for approval of the Administrator that:

(1) Provides substantiation that the airplane fuel tank system design, including all necessary design changes, meets the requirements of §§ 25.901 and 25.981(a) and (b) of this chapter; and

(2) Contains all maintenance and inspection instructions necessary to maintain the design features required to preclude the existence or development of an ignition source within the fuel tank system throughout the full operational life of the airplane.

PART 25—AIRWORTHINESS STANDARDS: TRANSPORT CATEGORY AIRPLANES

3. The authority citation for part 25 continues to read:

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

4. Section 25.981 is revised to read as follows:

§ 25.981 Fuel tank ignition prevention.

(a) No ignition source may be present at each point in the fuel tank or fuel tank system where catastrophic failure could occur due to ignition of fuel or vapors. This must be shown by:

(1) Determining the highest temperature allowing a safe margin below the lowest expected autoignition temperature of the fuel in the fuel tanks.

(2) Demonstrating that no temperature at each place inside each fuel tank where fuel ignition is possible will exceed the temperature determined under paragraph (a)(1) of this section. This must be verified under all probable operating, failure and malfunction conditions of each component whose operation, failure or malfunction could increase the temperature inside the tank.

(3) Demonstrating that an ignition source could not result from each single failure, from each single failure in combination with each latent failure condition not shown to be extremely remote, and from all combinations of failures not shown to be extremely improbable. The effects of manufacturing variability, aging, wear, corrosion, and likely damage must be considered.

(b) Based on the evaluations required by this section, critical design configuration control limitations, inspections or other procedures must be established as necessary to prevent development of ignition sources within the fuel tank system and must be included in the Airworthiness Limitations section of the ICA required by § 25.1529. Placards, decals or other visible means must be placed in areas of the airplane where maintenance, repairs or alterations may violate the critical design configuration limitations.

(c) The fuel tank installation must include—

(1) Means to minimize the development of flammable vapors in the fuel tanks; 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.

5. Paragraph H25.4 of Appendix H is revised to read as follows:

Appendix H To Part 25—Instructions for Continued Airworthiness

H25.4 *Airworthiness Limitations section.*

(a) The Instructions for Continued Airworthiness must contain a section titled Airworthiness Limitations that is segregated and clearly distinguishable from the rest of the document. This section must set forth—

(1) Each mandatory replacement time, structural inspection interval, and related structural inspection procedures approved under § 25.571; and

(2) each mandatory replacement time, inspection interval, related inspection procedure, and all critical design configuration control limitations approved under § 25.981 for the fuel tank system.

(b) If the Instructions for Continued Airworthiness consist of multiple documents, the section required by this paragraph must be included in the principle manual. This section must contain a legible statement in a prominent location that reads: ''The Airworthiness Limitations section is FAA-approved and specifies maintenance required under §§ 43.16 and 91.403 of the Federal Aviation Regulations, unless an alternative program has been FAA approved.''

PART 91—GENERAL OPERATING AND FLIGHT RULES

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

Authority: 49 U.S.C. 1301(7), 1303, 1344, 1348, 1352 through 1355, 1401, 1421 through 1431, 1471, 1472, 1502, 1510, 1522, and 2121 through 2125; Articles 12, 29, 31, and 32(a) of the Convention on International Civil Aviation (61 Stat. 1180); 42 U.S.C. 4321 et. seq.; E.O. 11514; 49 U.S.C. 106(g) (Revised Pub. L. 97–449, January 21, 1983).

7. By adding a new § 91.410 to read as follows:

§ 91.410 Fuel tank system maintenance and inspection instructions.

After [18 months after the effective date of the final rule], no person may operate a turbine-powered transport category airplane with a type certificate issued after January 1, 1958, and a maximum type certificated passenger capacity of 30 or more, or a maximum type certificated payload capacity of 7,500 pounds or more, unless instructions for maintenance and inspection of the fuel tank system are incorporated into its inspection program. Those instructions must be approved by the Administrator. Thereafter, the approved instructions can be revised only with the approval of the Administrator.

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

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

Authority: 49 U.S.C. 106(g), 40113, 40119, 44101, 44701–44702, 44705, 44709–44711, 44713, 44716–44717, 44722, 44901, 44903–44904, 44912, 46105.

9. By adding a new § 121.370 to read as follows:

§ 121.370 Fuel tank system maintenance and inspection instructions.

After [18 months after the effective date of the final rule], no certificate holder may operate a turbine-powered transport category airplane with a type certificate issued after January 1, 1958, and a maximum type certificated passenger capacity of 30 or more, or a maximum type certificated payload capacity of 7500 pounds or more, unless instructions for maintenance and inspection of the fuel tank system are incorporated in its maintenance program. Those instructions must be approved by the Administrator. Thereafter, the approved instructions can be revised only with the approval of the Administrator.

PART 125—CERTIFICATION AND OPERATIONS: AIRPLANES HAVING A SEATING CAPACITY OF 20 OR MORE PASSENGERS OR A MAXIMUM PAYLOAD CAPACITY OF 6,000 POUNDS OR MORE

10. 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.

11. By adding a new § 125.248 to read as follows:

§ 125.248 Fuel tank system maintenance and inspection instructions.

After [18 months after the effective date of the final rule], no certificate holder may operate a turbine-powered transport category airplane with a type certificate issued after January 1, 1958, and a maximum type certificated passenger capacity of 30 or more, or a maximum type certificated payload capacity of 7500 pounds or more unless instructions for maintenance and inspection of the fuel tank system are incorporated in its inspection program. Those instructions must be approved by the Administrator. Thereafter, the approved instructions can be revised only with the approval of the Administrator.

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

12. The authority citation for part 129 continues to read:

Authority: 49 U.S.C. 106(g), 40104–40105, 40113, 40119, 44701–44702, 44712, 44716–44717, 44722, 44901–44904, 44906.

13. By amending § 129.14 by adding a new paragraph (c) to read as follows:

§ 129.14 Maintenance program and minimum equipment list requirements for U.S.-registered airplanes.

* * * * *

(c) For turbine-powered transport category airplanes with a type certificate issued after January 1, 1958, and a maximum type certificated passenger capacity of 30 or more, or a maximum type certificated payload capacity of 7500 pounds or more, no later than [18 months after the effective date of the final rule], the program required by paragraph (a) of this section must include instructions for maintenance and inspection of the fuel tank systems. Those instructions must be approved by the Administrator. Thereafter the approved instructions can be revised only with the approval of the Administrator.

Issued in Washington, D.C., on October 26, 1999.

Elizabeth Erickson,

Director, Aircraft Certification Service.

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