DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Parts 1 and 23

[Docket No. FAA–2009–0738; Notice No. 09–09]

RIN 2120–AJ22

Certification of Turbojets

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Notice of proposed rulemaking (NPRM).

SUMMARY: This action proposes to enhance safety by amending the applicable standards for part 23 turbojet-powered airplanes—which are commonly referred to as ''turbojets''—to reflect the current needs of industry, accommodate future trends, address emerging technologies, and provide for future airplane operations. This action is necessary to eliminate the current workload of processing exemptions, special conditions, and equivalent levels of safety findings necessary to certificate light part 23 turbojets. The intended effect of the proposed changes would: Standardize and simplify the certification of part 23 turbojets; clarify areas of frequent non-standardization and misinterpretation, particularly for electronic equipment and system certification; and codify existing certification requirements in special conditions for new turbojets that incorporate new technologies.

DATES: Send your comments on or before November 16, 2009.

ADDRESSES: You may send comments identified by Docket Number FAA–2009–0738 using any of the following methods:

- *Federal eRulemaking Portal:* Go to *http://www.regulations.gov* and follow the online instructions for sending your comments electronically.
- *Mail:* Send comments to Docket Operations, M–30, U.S. Department of Transportation, 1200 New Jersey Avenue, SE., Room W12–140, West Building Ground Floor, Washington, DC 20590–0001.
- *Hand Delivery or Courier:* Bring comments to Docket Operations in Room W12–140 of the West Building Ground Floor at 1200 New Jersey Avenue, SE., Washington, DC, between 9 a.m. and 5 p.m., Monday through Friday, except Federal holidays.
- *Fax:* Fax comments to Docket Operations at 202–493–2251.

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

Privacy: We will post all comments we receive, without change, to *http://www.regulations.gov*, including any personal information you provide. Using the search function of our docket Web site, anyone can find and read the electronic form of all comments received into any of our dockets, including the name of the individual sending the comment (or signing the comment for an association, business, labor union, etc.). You may review DOT's complete Privacy Act Statement in the **Federal Register** published on April 11, 2000 (65 FR 19477–78) or you may visit *http://DocketsInfo.dot.gov.*

Docket: To read background documents or comments received, go to *http://www.regulations.gov* at any time and follow the online instructions for accessing the docket. Or, go to Docket Operations in Room W12–140 of the West Building Ground Floor at 1200 New Jersey Avenue, SE., Washington, DC, between 9 a.m. and 5 p.m., Monday through Friday, except Federal holidays.

FOR FURTHER INFORMATION CONTACT: For technical questions concerning this proposed rule, contact Pat Mullen, Regulations and Policy, ACE–111, Federal Aviation Administration, 901 Locust St., Kansas City, MO 64106; *telephone:* (816) 329–4111; facsimile (816) 329–4090; *e-mail: pat.mullen@faa.gov.* For legal questions concerning this proposed rule, contact Mary Ellen Loftus, ACE–7, Federal Aviation Administration, 901 Locust St., Kansas City, MO 64106; *telephone:* (816) 329–3764; *e-mail: mary.ellen.loftus@faa.gov.*

SUPPLEMENTARY INFORMATION: Later in this preamble under the Additional Information section, we discuss how you can comment on this proposal and how we will handle your comments. Included in this discussion is related information about the docket, privacy, and the handling of proprietary or confidential business information. We also discuss how you can get a copy of this proposal and related rulemaking documents.

Authority for This Rulemaking

The FAA's authority to issue rules on aviation safety is found in Title 49 of the United States Code. Subtitle I, Section 106 describes the authority of the FAA Administrator. Subtitle VII, Aviation Programs describes in more detail the scope of the agency's authority.

This rulemaking is promulgated under the authority described in Subtitle VII, Part A, Subpart III, Section 44701. Under that section, the FAA is charged with promoting safe flight of civil airplanes in air commerce by prescribing minimum standards required in the interest of safety for the design and performance of airplanes. This regulation is within the scope of that authority because it prescribes new safety standards for the design of normal, utility, acrobatic, and commuter category airplanes.

Table of Contents

I. Background

A. Historical Certification Requirements Overview

Title 14 Code of Federal Regulations (14 CFR) part 23 provides the airworthiness standards for Normal, Utility, Acrobatic, and Commuter Category Airplanes. The first application for the certification of a turbojet airplane under part 23 occurred in the 1970s before many of the current turbine requirements were added to part 23. Prior to this, turbojet powered airplanes were certificated to the standards under part 25. Part 25 provides the airworthiness standards for Transport category airplanes. A turbojet is a jet engine that develops thrust using a turbine compressor which is propelled by high speed exhaust gases expelled as a jet. The FAA implemented many of the certification requirements for early part 23 turbojets through special conditions based on 14 CFR part 25 (pre-amendment 25–42, (43 FR 2320)) requirements. Almost all special conditions applied to turbojets were for part 23, subpart B, Flight, and subpart G, Operating Limitations and Information.

Special conditions for part 23 certification increased performance requirements for emerging turbojets similar to those covered by early part 25 standards. The FAA established these special conditions to ensure a minimum one-engine inoperative (OEI) performance level that would be included in the airplane's limitations, thereby guaranteeing single-engine climb performance. The level of safety provided by the special conditions was purposely higher for the early turbojets than for propeller-driven airplanes in the same weight band because the manufacturers and the FAA wanted part 23 turbojets to be similar to part 25 business jets. Special conditions also addressed the following safety concerns: (1) The lack of turbine requirements in part 23, (2) the sensitivity of turbine engines to altitude and temperature effects, and (3) the high takeoff and landing speeds associated with turbojets that typically required long takeoff and landing distances, as compared to the performance of reciprocating, multiengine airplanes of that era.

In the mid-1990s, the FAA hosted a meeting for flight test pilot representatives from the Aircraft Certification Offices. The purpose of that meeting was to discuss how emerging 600 to 1,200 pound thrust engines were being developed and how the FAA would certificate future turbojet programs. The participants considered the prospect for small single- and multi-engine turbojets. At that time, the FAA assumed that any new part 23 turbojet would have similar characteristics to any existing small part 25 turbojet. However, using the preliminary design estimates from several new turbojets, FAA flight test personnel realized these assumptions were outdated. Therefore, the FAA needed to reevaluate its certification standards for turbojets against existing light-weight airplanes.

The meeting participants did not want to discourage development of small part 23 turbojets by applying significantly higher standards than for an equivalent propeller airplane. Therefore, the participants decided the best approach for future turbojet certification programs was to apply the existing part 23 weight differentiator of 6,000 pounds in establishing requirements.

B. Aviation Rulemaking Committee (ARC) Recommendations

On February 3, 2003, we published a notice announcing the creation of the part 125/135 Aviation Rulemaking Committee.[1] Part 125 addresses the certification and operations of airplanes having a seating capacity of 20 or more passengers or a maximum payload capacity of 6,000 pounds or more. Part 135 addresses the operating requirements for commuter and on-demand operations and rules governing persons on board such aircraft. Since some part 23 airplanes operate under parts 125 or 135, the ARC provided recommendations to the FAA for safety standards applicable for part 23 turbojet airplanes to reflect the current industry, industry trends, emerging technologies and operations under parts 125 and 135, and associated regulations. The ARC also reviewed the existing part 23 certification requirements and the accident history of light piston-powered, multiengine airplanes up through small turbojets used privately and for business. In addition, the ARC reviewed the special conditions applied to part 23 turbojets. The ARC completed its work in 2005 and submitted its recommendations to the FAA. Those documents may be reviewed in the docket for this proposed rule. The ARC recommended modifying forty-one 14 CFR part 23 sections as a result of its review of these areas.

As stated earlier, the FAA's intent is to codify standards consistent with the level of safety currently required through special conditions. We compared the special conditions applied to part 23 turbojets, as well as several additional proposed part 23 changes, with the ARC's recommendations. With few exceptions, the ARC recommendations validated the FAA's long-held approach to certification of part 23 turbojets.

The ARC did not want to impose commuter category takeoff speeds for turbojets above 6,000 pounds, nor did the ARC want to impose more stringent requirements for one-engine inoperative (OEI) climb performance than those established for similar-sized piston-powered and turboprop multiengine airplanes. The FAA ultimately accepted thirty-nine of the forty-one ARC recommendations and developed this proposed rulemaking in accordance with them. The two recommendations we disagreed with would have lowered the standards previously applied through special conditions.

C. Proposed Regulatory Requirements Overview

The FAA currently issues type certificates (TCs) to part 23 turbojets using extensive special conditions, exemptions, and equivalent levels of safety (ELOS). Until recently, this practice of using special conditions, exemptions, and ELOS did not represent a significant workload because there were relatively few part 23 turbojet programs. However, in the past five years, the number of new part 23 turbojet type certification programs has increased more than 100 percent over the program numbers of the past three decades. The need to incorporate special conditions, exemptions, and ELOS into part 23 stems from this rise in the number of new turbojet programs and the expected growth in the number of future programs. Codifying special conditions would standardize and clarify the requirements for manufacturers during the design phase of turbojets. Doing so would prevent instances where manufacturers design turbojets and later have to demonstrate compliance with special conditions that may require redesign. Codifying special conditions, exemptions, and ELOS would also eliminate the manufacturers' and the FAA's workload associated with processing these documents and could reduce potential delays to project schedules. Many of the proposed changes in this notice would codify certification requirements and practices currently accomplished through use of special conditions, exemptions, and ELOS.

We propose changes to part 1 definitions to clarify new requirements proposed for part 23. In addition, we propose changes to part 23 in the areas of:

- Airplane categories to allow commuter category certification of multiengine turbojets;
- Flight requirements, including standards for performance, stability, stalls, and other flight characteristics;
- Structure requirements, including standards for emergency landing conditions and fatigue evaluation;
- Design and construction requirements, including standards for flutter, takeoff warning system, brakes, personnel and cargo accommodations, pressurization, and fire protection;
- Powerplant requirements, including standards for engines, powerplant controls and accessories, and powerplant fire protection;
- Equipment requirements, including general equipment standards and standards for instruments installation, electrical systems and equipment, and oxygen systems; and
- Operating limitations and information, including standards for airspeed limitations, kinds of operation, markings and placards, and airplane flight manual and approved manual material.

II. Discussion of the Proposed Regulatory Amendments

1. Part 1: Definitions Clarifying Power and Engine Terms

We propose to amend part 1 definitions for "rated takeoff power," "rated takeoff thrust," "turbine engine," "turbojet engine," and "turboprop engine." Defining engine-specific terms would clarify the new requirements proposed for part 23. The need to define some of these terms was also shown by the following communications between the FAA and members of industry. These communications were based on the existing part 1 definitions for "rated takeoff power" and "rated takeoff thrust", which limit the use of these

[1] 68 FR 5488

power and thrust ratings to no more than five minutes for takeoff operation.

In 1990, the Airline Transport Association (ATA) sent a letter to the FAA asking the FAA to allow 10-minute OEI takeoff approval. At some airports (mostly foreign), the climb gradient capability needed to clear distant obstacles after takeoff requires more time at takeoff thrust than 5 minutes. Using only 5 minutes of takeoff thrust to clear distant obstacles limits the maximum allowable airplane takeoff weight. The availability of takeoff thrust or power for use up to 10 minutes, granted by some foreign authorities, enabled some foreign operators to dispatch at an increased gross weight over that allowed for U.S. operators. U.S. operators asked for equal treatment in similar circumstances. The FAA has approved these requests when they have been properly substantiated. This policy would also apply to operators of part 23 turbojet-powered airplanes in order to achieve a climb gradient necessary to clear obstacles.

2. Expanding Commuter Category to Include Turbojets

Currently, we limit commuter category airplane requirements to propeller-driven, multiengine airplanes. The FAA has issued exemptions to allow turbojets weighing more than 12,500 pounds to be certificated under part 23. The proposal to change § 23.3 would codify the current FAA practice of certificating multiengine turbojets weighing up to and including 19,000 pounds under part 23 in the commuter category.

3. Performance, Flight Characteristics, and Other Design Considerations

a. Performance

We propose to extend the commuter category performance requirements to multiengine turbojets weighing more than 6,000 pounds. This proposal codifies requirements that we currently impose by special conditions for these airplanes. Amendment 23–45 (58 FR 42136) requires all turbine-powered airplanes weighing 6,000 pounds or less to meet many of the same performance standards for reciprocating-powered airplanes weighing more than 6,000 pounds. The FAA has determined that turbojets should meet a higher level of safety than reciprocating-powered airplanes in the same weight band. By requiring turbojets over 6,000 pounds to meet the higher commuter category certification requirements, the FAA would remain consistent in establishing more stringent requirements for turbojet airplanes than for reciprocating airplanes.

The ARC recommended no changes to performance requirements in §§ 23.51, 23.53, 23.55, 23.57, 23.59 and 23.61. The ARC pointed out that applying the commuter category takeoff performance requirements to multiengine turbojets weighing more than 6,000 pounds would include restrictions that could become a takeoff weight limitation for operations. The ARC stated that these requirements are too restrictive for part 91 operations. However, existing multiengine turbojets weighing more than 6,000 pounds are required to meet these standards through special conditions, and we have seen negligible operational impact. We have no rationale or basis to support a reduced level of safety for part 23 turbojets.

The ARC also reviewed FAA and Flight Safety Foundation accident studies for engine failure on takeoff. The ARC determined that existing normal category part 23 turboprops operated under part 135 have an acceptable safety record when compared to turbojets. Furthermore, turboprops in the accident studies were not certificated with any of the commuter category performance requirements for climb gradients.

The ARC believed the safety record of the turboprops had more to do with the inherent reliability of turbine engines rather than the higher climb gradient. An ARC member suggested the higher OEI climb gradients originated in part 25 during the large piston transport airplane engine era. Back then, the large piston engines were prone to failure on takeoff or initial climb, and the requirements for OEI climb gradients were necessary for safety.

The ARC further believed raising the OEI climb performance requirements for most multiengine airplanes was appropriate. However, the ARC debated the appropriate OEI climb gradients for turbine-powered airplanes over 6,000 pounds. Based on the reliability of turbine engines, the ARC only recommended raising the climb performance to 1 percent. This matched the ARC's recommendation of 1 percent for turbojets under 6,000 pounds. The ARC's recommendation, however, would reduce the OEI climb performance that is currently required through special conditions from 2 to 1 percent for turbojet-powered airplanes over 6,000 pounds.

Existing multiengine turbojets weighing more than 6,000 pounds are required through special conditions to meet the commuter category performance requirements (2 percent climb gradient) for OEI. We propose to maintain the 2 percent OEI climb gradient currently applied through special conditions for multiengine turbojets over 6,000 pounds. This climb gradient requirement is safe and prudent, and it is not reasonable to reduce the level of safety that already exists with part 23 turbojets.

Although special conditions have required 2 percent OEI climb gradient for multiengine turbojets over 6,000 pounds, there was no data to support whether small turbojets under 6,000 pounds could meet the higher 2 percent climb gradient while maintaining reasonable utility. If our rule changes to §§ 23.63 and 23.67 negatively impacted their utility (i.e., weight-carrying ability), the rule might give the piston-powered, multiengine airplanes a distinct market advantage. Accident studies show that turbojets are generally safer than piston-powered airplanes. Therefore, we wanted to compromise by proposing a requirement that would provide an adequate minimum safety standard and encourage production of more turbojets. One multiengine turbojet in this weight band has been operated as an air taxi, and the FAA expects this type of operation to grow. While this particular jet is capable of higher climb performance, we propose only to increase the OEI climb performance requirement to 1.2 percent because other jets in this weight band may not be capable of the higher 2 percent climb performance. Based on accident data, 1.2 percent provides an adequate minimum safety standard.

Historically, piston-powered, multiengine airplanes were allowed a lower climb requirement because they would not have any weight-carrying utility if forced to meet the same requirements of the larger airplanes. We are continuing this philosophy in this proposal. (*See* summary in the table below.)

TABLE 1—ONE-ENGINE INOPERATIVE CLIMB REQUIREMENTS TO 400 FEET ABOVE GROUND LEVEL (AGL)

Multiengine type/airplane weight band	Current rule	ARC recommendation (percent)	FAA proposal (percent)
Pistons >6,000 lbs.	Measurably positive	1.0	1.0
Turboprops ≤6,000 lbs.	Measurably positive	1.0	1.0
Turboprops >6,000 lbs.	Measurably positive	1.0	1.0
Turbojets ≤6,000 lbs.	Measurably positive	1.0	1.2
Turbojets >6,000 lbs.	2.0 percent imposed through special conditions	1.0	2.0

In addition to the proposed changes in takeoff and climb performance requirements described above, we also propose changes to other performance rules. Currently, part 23 reflects the traditional small airplane definition of landing configuration stall speed (V_{SO}). However, certification personnel have interpreted V_{SO} in part 23 as being the same as that in part 25. This interpretation has resulted in an unnecessary burden to the applicant. We are revising the part 23 requirement so that it is distinct from the part 25 requirement and to retain the original definition of the term. We are proposing to revise paragraphs (a) and (c) of § 23.49 to clarify the section. We are also proposing to correct the title of this section in the CFR to ''Stalling speed'' instead of ''Stalling period.''

V_{SO}, by definition, is the stall speed in the maximum landing flap configuration and is not applicable to other flap configurations. (V speeds are defined in part 1. To simplify the understanding of the proposed rule, we are adding this information here.) Current § 23.73 references V_{SO}. The reference to V_{SO} in this paragraph is an error and should be changed to reference the stall speed for a specified flap configuration (V_{S1}). The reference landing approach speed (V_{REF}) should be based on 1.3 times the V_{S1}. We propose to amend the standards to address airplanes certificated under part 23 that may have more than one landing flap setting. We also propose to apply the commuter category requirements for V_{REF} to multiengine turbojets over 6,000 pounds maximum weight. In addition, we propose to apply the commuter category requirements for balked landings in § 23.77 to all multiengine turbine-powered airplanes over 6,000 pounds, consistent with current special conditions for multiengine turbojets and turbine-powered airplanes over 6,000 pounds.

b. Flight Characteristics

The FAA proposes to define ''maximum allowable speed'' and to clarify the specific speed limitations, which include specific criteria for V_{FC}, V_{LE}, or V_{FC}/M_{FC} as appropriate. The proposal for § 23.177 would codify special conditions that include specific speed limitations. Furthermore, we are adding a new paragraph to § 23.175(b) to define the V_{FC}/M_{FC} (maximum speed for stability characteristics) term in part 23. This definition was inadvertently omitted in the last revision to part 23.

The FAA proposes to amend the combined lateral-directional dynamic stability damping requirements for airplanes that operate above 18,000 feet. The existing stability damping requirements, which apply at all certificated altitudes, were developed when small airplanes typically operated under 18,000 feet and were not equipped with yaw dampers. The existing requirement remains appropriate for low altitude operations, such as for approaches, but it is not appropriate for larger airplanes that typically use yaw dampers and fly at altitudes well above 18,000 feet. The FAA has issued exemptions for most turbojets certificated under part 23 because it is appropriate for high-altitude, high-speed operations. The proposed changes to § 23.181 would reduce the stability damping requirement at 18,000 feet and above. If adopted, this amendment would reduce the number of exemptions processed by the FAA by codifying what is allowed as an acceptable means of compliance.

The FAA proposes to amend the existing stall requirements in §§ 23.201 and 23.203 to include language from the turbojet special conditions. We propose clarifying the requirements for wings-level and accelerated turning stalls. We also propose changing the roll-off requirements for wings-level, high-altitude stalls.

The FAA proposes additional high-speed and high-altitude requirements to §§ 23.251 and 23.253 to address the new generation of high performance part 23 airplanes. The FAA also proposes to extend provisions from part 25, §§ 25.251(d) and (e), to part 23. However, we would limit the requirements to airplanes that fly over 25,000 feet and have a Mach dive speed (M_D) faster than Mach 0.6 (M 0.6) to be consistent with part 25 requirements. The FAA also proposes the use of V_{DF}/M_{DF}, which is demonstrated flight dive speed (V_{DF}) or Mach (M_{DF}) as referenced in the part 23 turbojet special conditions.

Furthermore, we propose adding requirements in a new § 23.255 that would be based on § 25.255 and would address potential high-speed Mach effects for airplanes with M_D greater than M 0.6. The FAA's approach would only apply the part 25-based requirements to airplanes that incorporate a trimmable horizontal stabilizer, which is consistent with the ARC's recommendation. The ARC's recommendation was based on the positive service history with the existing fleet of part 23 and part 25 turbojets designed with conventional horizontal tails that use trimmable elevators. The industry manufacturers have designed airplanes that have experienced upset incidents involving out-of-trim conditions with a trimmable horizontal stabilizer. Service experience shows that out-of-trim conditions can occur in flight for various reasons, and the control and maneuvering characteristics of the airplane may be critical in recovering from upsets. The proposed language would require exploring the airplane's high-speed control and maneuvering characteristics.

c. Other Design Considerations

We propose to revise language in § 23.703 in the introductory text and paragraph (b) to add takeoff warning system requirements to all airplanes over 6,000 pounds and all turbojets. The definition of an unsafe condition, in this case, is the inability to rotate or prevent an immediate stall after rotation. High temporary control forces that can be quickly ''trimmed out'' would not necessarily be considered unsafe.

We have proposed the commuter category, rejected takeoff requirements for all multiengine turbojets over 6,000 pounds. The higher takeoff speeds and distances for these airplanes make the ability to stop in a specified distance a safety issue. Additional braking considerations accompany the rejected takeoff requirements. Therefore, we propose to apply the requirements for brakes in § 23.735 to all multiengine turbojets over 6,000 pounds, as well as to all commuter category airplanes.

4. Structural Considerations for Crashworthiness and High-Altitude Operations

The FAA proposes to codify into § 23.561 the recent turbojet special conditions that were not available during the ARC's effort. This proposal applies to single-engine turbojets with centerline engines embedded in the fuselage. Part 23 did not encompass embedded centerline engine installations, except for in-line propeller-pusher types. In light of several new turbojet designs, it is prudent to require greater engine retention strength for engines mounted aft of the cabin. This is especially true for engines mounted inside the fuselage behind the passengers. The proposed requirement would reduce the potential for the engine to separate from its mounts under forward-acting crash loads and subsequently intrude into the cabin. We recently applied this proposed requirement to a single-engine turbojet through special conditions.

The ARC did not consider emergency landing dynamic conditions in § 23.562. We recognize, however, that § 23.562 should be applicable to all turbojets, including those operating in the commuter category. All manufacturers of recently certificated commuter category turbojets have agreed to comply with § 23.562. The FAA proposes to amend § 23.562 to include all commuter category turbojets. This proposal would adopt current industry practice and ensure a consistent level of safety for all turbojets.

At one time, the FAA proposed to apply the requirements for emergency landing dynamic conditions to all commuter category airplanes.[2] Subsequently, we published new certification and operations requirements for commuter operations.[3] These actions required certain commuter operators that previously conducted operations under part 135 to conduct those operations under part 121. This rule, in effect, eliminated the use of new part 23 airplanes with 10 seats or more in scheduled service. This action negated any projected benefits supporting the addition of emergency landing dynamic conditions to commuter category airplanes.

The commuter operators affected were those conducting scheduled passenger-carrying operations in airplanes that have passenger-seating configurations of 10 to 30 seats (excluding any crewmember seat) and those conducting scheduled passenger-carrying operations in turbojet airplanes regardless of seating configuration. The action increased safety in scheduled passenger-carrying operations and clarified, updated, and consolidated the certification and operations requirements for persons who transport passengers or property by air for compensation or hire.

In terms of overall configuration, commuter category turbojets have little resemblance to their propeller-driven counterparts. During an emergency landing, most commuter category turbojets will have more structure underneath the cabin floor available to absorb energy than traditional propeller-driven airplanes. This capability, along with the differences in the overall airplane configuration of turbojets, would suggest the test conditions specified in the current rule should be applicable to all turbojets. However, commuter category airplanes cannot exceed a maximum takeoff weight of 19,000 pounds. With this limitation, the amount of crushable, energy absorbing structure is small when compared to most part 25 airplanes. For this reason, we propose to require the dynamic test conditions specified in part 23 rather than those in § 25.562.

We also propose to modify the seating head injury criteria (HIC) calculation in the proposed rule to be consistent with the HIC definition in part 25. This proposal addresses the concern that the HIC definition in part 23 would lead to a HIC calculation only for the total time of the head impact, which would not necessarily maximize HIC.

In the event of a ditching, the proposed change in § 23.807 would provide an alternative to meeting the current requirement for an emergency exit, above the waterline, on both sides of the cabin for multiengine airplanes. Proposed section 23.807 would allow the placement of a water barrier in the doorway before the door would be opened as a means to comply with the above waterline exit requirement. This barrier would be used to slow the inflow of water. The FAA has approved the use of this barrier as an alternative to the above waterline exit for several airplanes by issuing an ELOS finding.

Several new part 23 turbojet programs include approval for operations at altitudes above 40,000 feet. Additionally, the FAA has issued special conditions for operations up to 49,000 feet. We propose rule changes for structures and the cabin environment to ensure structural integrity of the airplane at higher altitudes. We also propose rule changes to prevent exposure of the occupants to cabin pressure altitudes that could cause them physiological injury or prevent the flight crew from safely flying and landing the airplane.

We propose to amend § 23.831 to add new paragraphs (c) and (d), which include standards appropriate for airplanes operating at high altitudes beyond those included in part 23. The proposed changes are intended to ensure flight deck and cabin environments do not result in the crew's mental errors or physical exhaustion that would prevent the crew from successfully completing assigned tasks for continued safe flight and landing. An applicant may demonstrate compliance with paragraph (d) of this requirement if the applicant can show that the flight deck crew's performance is not degraded.

The cabin environment must be conservatively specified such that no occupant would incur any permanent physiological harm after depressurization. The environmental and physiological performance limits used for demonstrating compliance must originate from recognized and cognizant authorities as accepted by the regulatory authority reviewing the compliance finding.

As part of the certification process, we would consider the entire flight profile of the airplane during the depressurization event. The profile would include cruise and transient conditions during descent, approach, landing, and rollout to a stop on the runway. We would not include taxiing as a compliance consideration because the airplane would be on the ground and could be evacuated, or flight deck windows and cabin doors could be opened for ventilation. The condition of the airplane from the beginning of the event to the end of the landing roll is accounted for when assessing the safe exit of an airplane.

We chose the words ''* * * shall not adversely affect crew performance * * *'' to mean the crew can be expected to reliably perform either their published or trained duties, or both, to complete a safe flight and landing. We have measured this in the past by a person's ability to track and perform tasks. The event should not result in expecting the crew to perform tasks beyond the procedures defined by the manufacturer or required by existing regulations. We use the phrase ''No occupant shall sustain permanent physiological harm'' to mean the occupants who may have required some

[2] 58 FR 38028.

[3] 60 FR 65832 and 61 FR 2608.

form of assistance, once treated, must be expected to return to their normal activities.

To show compliance to the proposed rule, the applicant should consider what would happen to the airplane and systems during depressurization. The applicant may also consider operational provisions, which provide for or mitigate the resulting environmental effects to airplane occupants. If the manufacturer provides an approved procedure(s) for depressurization, the flight deck and cabin crew may configure the airplane to moderate either temperature or humidity extremes, or both, on the flight deck and in the cabin. This configuration may include turning off non-critical electrical equipment and opening the flight deck door, or opening the flight deck window(s).

As with § 23.831, we find it necessary to amend the standards in § 23.841 to prevent exposure of the occupants to cabin pressure altitudes that could keep the flight crew from safely flying and landing the airplane or cause permanent physiological injury to the occupants. The intent of the proposed changes to § 23.841 is to provide airworthiness standards that allow subsonic, pressurized turbojets to operate at their maximum achievable altitudes—the highest altitude an applicant can choose to demonstrate the effects to several occupant related items after decompression. The applicant must show that: (1) The flight crew would remain alert and be able to fly the airplane, (2) the cabin occupants would be protected from the effects of hypoxia (*i.e.*, deprivation of adequate oxygen supply), and (3) if some occupants do not receive supplemental oxygen, they would be protected against permanent physiological harm.

Existing rules require the cabin pressure control system maintain the cabin at an altitude of not more than 15,000 feet if any probable failure or malfunction in the pressurization system occurs. Cabin pressure control systems on part 23 airplanes frequently exhibit a slight overshoot above 15,000 feet cabin altitude before stabilizing below 15,000 feet. Existing technology for cabin pressure control systems on part 23 airplanes cannot prevent this momentary overshoot, which prevents strict compliance with the rule. We have granted ELOS findings for this characteristic because physiological data shows the brief duration of the overshoot would have no significant effect on an airplane's occupants.

Special conditions issued for part 23 turbojets are similar and, for operating altitudes above 41,000 feet, equivalent to the requirements in § 25.841 adopted in Amendment 25–87 (61 FR 28684). That amendment revised § 25.841(a) to include requirements for pressurized cabins that were previously covered only in special conditions. The special conditions required consideration of specific failures. The FAA incorporated reliability, probability, and damage tolerance concepts addressing other failures and methods of analysis into part 25 after the issuance of the special conditions. Sections 23.571, 23.573, and 23.574 address damage tolerance requirements. We propose to require the use of these additional methods of analysis as part of this rulemaking.

This proposal also specifies a more performance-based criterion, such that failures cannot adversely affect crew performance nor result in permanent physiological harm to passengers.

(**Note:** There is a different standard for the crew than the passengers.)

Part 23 requires a warning of an excessive cabin altitude at 10,000 feet. Those regulations do not adequately address airfield operation above 10,000 feet. Rather than disable the cabin altitude warning to prevent nuisance warnings, we have issued ELOS findings that allow the warning altitude setting to be shifted above the maximum approved field elevation, not to exceed 15,000 feet. We propose to revise § 23.841 to incorporate language from existing ELOSs into the regulation.

Currently, we address oxygen systems for airplanes operating above 41,000 feet using special conditions derived from part 25. A large number of new turbojets and high-performance airplanes entering part 23 certification will operate at higher altitudes than previously envisioned for part 23 airplanes. We are proposing revisions to §§ 23.1443, 23.1445, and 23.1447 to establish requirements for oxygen systems. These new requirements would eliminate the need for special conditions for airplanes operating above 40,000 feet.

5. General Fire Protection and Flammability Standards for Insulation Materials

When we initially introduced powerplant fire protection provisions in part 23, we did not foresee turbojet engines embedded in the fuselage, nor in pylons on the aft fuselage, for airplanes certificated to part 23 standards. We propose to add fire protection requirements for turbojets in §§ 23.1193, 23.1195, 23.1197, 23.1199, and 23.1201. Part 23 has historically addressed fire protection through prevention, identification, and containment. Manufacturers have provided prevention through minimizing the potential for ignition of flammable fluids and vapors. Also historically, pilots had been able to see the engines and identify the fire or use the incorporated fire detection systems, or both. The ability to see the engine provided for the rapid detection of a fire, which led to a fire being rapidly extinguished. However, engine(s) embedded in the fuselage or in pylons on the aft fuselage do not allow the pilot to see a fire.

Isolating designated fire zones, through flammable fluid shutoff valves and firewalls, provides for containment of a fire. Containing fires ensures that components of the engine control system function effectively to permit a safe shutdown of the engine. We have only required a demonstration of containment for 15 minutes. If a fire occurs in a traditional part 23 airplane, the corrective action is to land as soon as possible. For a small, simple airplane originally envisioned by part 23, it is possible to descend the airplane to a suitable landing site within 15 minutes. If the isolation means do not extinguish the fire, the occupants can safely exit the airplane before the fire breaches the firewall.

Simple and traditional airplanes normally have the engine located away from critical flight control systems and the primary structure. This location has ensured that throughout the fire event, the pilot can continue safe flight and control of the airplane and predict the effects of a fire. Other design features of simple and traditional airplanes (*e.g.*, low stall speeds and short landing distances) ensure that even if an off-field landing occurs, the potential for a catastrophic outcome is minimized.

Specifically for airplanes equipped with embedded engines, the consequences of a fire in an engine embedded in the fuselage are more varied, adverse, and difficult to predict than the engine fire for a typical part 23 airplane. Engine(s) embedded in the fuselage offer minimal opportunity to actually see a fire. The ability to extinguish an engine fire becomes extremely critical due to this location. With the engine(s) embedded in the fuselage, an engine fire could affect both the airplane's fuselage and the empennage structure, which includes the pitch and yaw controls. A sustained fire could result in damage to this primary structure and loss of airplane control before a pilot could make an emergency landing. For embedded engine installations, we also propose requiring a two-shot fire-extinguishing system because the metallic components in the fire zone can become hot enough to reignite flammable fumes after someone extinguishes the first fire.

We propose to upgrade flammability standards for thermal and acoustic insulation materials used in part 23 airplanes. The current standards do not realistically address situations where thermal or acoustic insulation materials may contribute to propagating a fire. The changes we propose are based on the requirements in § 25.856(a), which were adopted following accidents involving part 25 airplanes, such as the Swissair MD–11. We believe the proposed standards would enhance safety by reducing the incidence and severity of cabin fires, particularly those in inaccessible areas where thermal and acoustic insulation materials are installed.

The proposed standards include new flammability tests and criteria that address flame propagation, which would apply to thermal/acoustic insulation material installed in the fuselage of part 23 airplanes. Certification tests would consist of samples of thermal/acoustic insulation that would be exposed to a radiant heat source and a propane burner flame for 15 seconds. The insulation must not propagate flame more than 2 inches away from the burner. The flame time after removal of the burner must not exceed 3 seconds on any specimen. (*See* proposed Part II, Appendix F to part 23 for more details.)

Current flammability requirements focus almost exclusively on materials located in occupied compartments (§ 23.853) and cargo compartments (§ 23.855). The potential for an in-flight fire is not limited to those specific compartments. Thermal/acoustic insulation can be installed throughout the fuselage in other areas, such as electrical/electronic compartments or surrounding air ducts, where the potential also exists for materials to spread fire. Proposed § 23.856 accounts for insulation installed within a specific compartment in areas the regulations might not otherwise cover. Proposed § 23.856 would be applicable to all part 23 airplanes, regardless of size or passenger capacity. Advisory material describing test sample configurations to address design details (*e.g.*, tapes and hook-and-loop fasteners) is available in DOT/FAA/AR–00/12, Aircraft Materials Fire Test Handbook, dated April 2000. A copy of the handbook has been placed in the docket for this rulemaking.

Insulation is usually constructed in what is commonly referred to as a ''blanket.'' Insulation blankets typically consist of two things: (1) A batting of a material generically referred to as fiberglass (*i.e.*, glass fiber or glass wool), and (2) a film covering to contain the batting and to resist moisture penetration, usually metalized or non-metalized polyethylene terephthalate (PET), or metalized polyvinyl fluoride (PVF). Polyimide, a heat-resistant fiber used in insulation and adhesive, is another film used on certain airplanes. Regardless of the film type used, there are variations associated with its assembly for manufacture that result in performance differences from a fire safety standpoint. These variations include the density of the film, the type and fineness of the scrim bonded to the film, and the adhesive used to bond the scrim to the film. The scrim resembles a screen, and the mesh can vary in fineness. The scrim is usually constructed of either nylon or polyester and is bonded to the backside of the film to add shape and strength to the surface area. The adhesive used to bond the scrim to the film also varies. However, the type of adhesive used is important because fire retardant is frequently concentrated in the adhesive of the assembled sheet.

6. Powerplant and Operational Considerations

Current § 23.777 standardizes the height and location of powerplant controls because pilots may become confused and use the wrong controls on propeller-driven airplanes. This requirement, however, does not include single-power levers (which are typical for electronically-controlled engines). The FAA currently makes an ELOS finding for each airplane program that includes a single-power lever. We propose to revise paragraph (d) in § 23.777 to incorporate the ELOS language.

We propose to revise § 23.903, paragraph (b)(2), to add requirements for fuselage-embedded, turbofan engine installations. These types of engine installations may have a negative impact on passenger safety because passengers occupy an area directly ahead of the turbojet engine fan disk. Certain turbofan engine designs have failure conditions that allow the fan disk to exit the front of the engine. This failure condition occurs if engines have bearing/shaft configurations that would allow the disk to separate from the engine and travel forward. If the engine has demonstrated this failure mode or if an analysis shows such a failure is conceivable, then the requirements of this section would apply. This requirement would be applicable to engines embedded in the airplane's fuselage where it could move forward into areas occupied by passengers or crew when a disk fails.

In addition to the changes described above, we also propose requiring that electronic engine control systems meet the equipment, systems, and installation standards of § 23.1309. We have applied this requirement to all digital engine controls in part 23 airplanes by special condition. The proposed rule change for § 23.1141 would largely eliminate the need to issue special conditions on future certification programs.

The ARC believed few single-engine airplane manufacturers have analyzed the criticality of their control system to meet the requirements of this proposed rule. The fundamental rule change recommended by the ARC for § 23.1141 was not intended to invalidate or overrule the 14 CFR part 33 certification requirements. The proposed change for § 23.1141 is intended for consideration of the airframe/engine interface and how that interface protects against high intensity radiated fields (HIRF) and lightning.

Over the years, airplane engines, including turbines, generated their own ignition system electrical power separate from the airplane's electrical generation system. Even with a complete electrical failure of the primary electrical systems, the engines would still run and be fully functional. However, all new engines are not designed with self-electrical-generation capability. Some new engines rely on the airplane's electrical system to continue running and to be fully functional. Revising § 23.1165(f) would ensure that when approved engines are installed on part 23 airframes, the engine ignition system is identified as an essential load. This would ensure that those engines have power during emergencies.[4]

7. Avionics, Systems, and Equipment Changes

Updated system requirements should reduce the regulatory burden on the applicant by clarifying and expanding the applicability of §§ 23.1301 and 23.1309 to specific systems and functions. Most new part 23 airplane manufacturers are installing electronic primary flight displays (PFD) and multifunction displays (MFD) that replace conventional electromechanical and mechanical instruments. These new systems also offer more capability, reliability, and features that improve safety.

[4] Under the proposed changes, we would certificate new engines, which include electronic ignition systems and engines with electronic controls necessary for the engine's operation, through the Engine and Propeller Directorate.

We propose changes that would address displays, software, hardware, and power requirements. Besides advanced avionics and integrated systems, we propose to update the certification requirements to consider other advanced technologies (*e.g.*, digital engine controls). We intend to apply lessons learned from recent small turbojet certification programs to update requirements for intended function and system safety.

The ARC did not make a specific recommendation for § 23.1301. However, the FAA seeks to clarify the intent of this section because it is frequently misinterpreted and misapplied. Clarifying the intent of § 23.1301 would improve standardization for systems and equipment certification, particularly for non-required equipment and non-essential functions embedded within complex avionic systems. Our intent is for the applicant to define proper functionality and to propose a means of compliance acceptable to the Administrator. We expect applicants to coordinate or negotiate deviations from established means of compliance with the Administrator as early as possible to minimize delay to project schedules.

We propose to remove § 23.1301(d), which currently states that equipment must ''function properly when installed.'' The proposed change would limit the scope of the rule since it would apply only to equipment required for type certification or operation. We propose a related change to clarify similar language in § 23.1309 for proper functionality of installed equipment.

The ARC did not make a specific recommendation for § 23.1303. However, the FAA seeks to clarify the intent of this rule to accommodate new technology and eliminate the need to issue an ELOS for part 23 airplanes. We propose to amend § 23.1303(c) by changing the current requirement from ''A direction indicator (non-stabilized magnetic compass)'' to ''A magnetic direction indicator.'' Section 23.1303 does not include a direction indicator, other than the typical non-stabilized compass for part 23 airplanes. As new technology becomes more affordable for part 23 airplanes, many electronic flight instrument systems will use magnetically stabilized direction indicators (or electric compass systems) to measure and indicate the airplane heading to provide better performance.

Current regulations require powerplant displays, referred to as ''indicators'' in § 23.1305, to provide trend or rate-of-change information. Advisory Circular (AC) 23.1311–1B, Installation of Electronic Displays in Part 23 Airplanes, dated June 14, 2005, currently provides a basis for an ELOS finding for digital engine display parameters.[5] The proposed rule changes to §§ 23.1303, 23.1305, and 23.1311 would largely eliminate the need to issue ELOS findings for these systems and help standardize certification of new technology.

The ARC also did not make a specific recommendation for § 23.1307. However, the FAA seeks to clarify language so applicants understand they may need additional equipment to operate their airplane. Part 23 is a minimum performance standard, and it may not include all the required equipment for commercial operations under 14 CFR part 135. We propose to include parts 91 and 135 operations as examples to use when deciding which equipment is necessary for an airplane to operate at the maximum altitude.

a. System SafetyAssessment Requirements

We originally designed the system safety assessment requirements of § 23.1309 to address certification of electronic systems driven by microprocessors and other complex systems. However, the requirements of § 23.1309 are being applied to conventional mechanical and electromechanical systems with well-established design and certification processes. This was not our intent, and we propose to revise § 23.1309 to clarify the intended application of the rule.

Proposed changes for § 23.1309 also clarify the intent for certification of electronic engine controls. The current section excludes systems certificated with the engine. Therefore, we use special conditions for all electronic engine control installation approvals to capture the evaluation requirements of § 23.1309. We applied special conditions to the interface of the electronic engine control system and the airplane. We also applied special conditions to verify that the installation does not invalidate the assumptions made during part 33 certification of the engine. This proposal would address electronic engine controls and eliminate the need for special conditions to apply § 23.1309 to electronic engine control systems.

Proposed § 23.1309(a) would have requirements for two different types of equipment and systems installed in the airplane. Proposed § 23.1309(a)(1) would cover the equipment and systems that have no negative safety effect and those installed to meet a regulatory requirement. Such systems and equipment are required to ''perform as intended under the airplane operating and environmental conditions.'' Proposed § 23.1309(a)(2) would require the applicant to show that all equipment and systems (including approved ''amenities,'' such as a coffee pot and entertainment systems) have no safety effect on the operation of the airplane. The phrase ''improper functioning'' identifies equipment and system failures that have a potentially negative effect on airplane safety. Therefore, we must consider their potential failure condition(s). Using § 23.1309, we must analyze any installed equipment or system that has potential failure condition(s) that are catastrophic, hazardous, major, or minor to determine their impact on the safe operation of the airplane.

We propose to clarify the certification requirements, environmental qualification test requirements, and our intent for determining proper ''intended function'' of non-required systems and equipment that do not have a safety effect on the airplane. A problem with the current requirements for airplane manufacturers arises when certification authorities question installation of non-required systems and equipment that do not perform following their specifications and, therefore, are ''not functioning properly when installed.'' Usually, normal installation practices can be based on a relatively simple qualitative installation evaluation. If the possible safety impacts (including failure modes or effects) are questionable, or isolation between systems is provided by complex means, more formal structured evaluation methods or a design change may be necessary. We do not require these types of equipment and systems to function properly when installed. However, we would require them to function when they are tested to verify that they do not interfere with the operation of other airplane equipment and systems and do not pose a hazard in and of themselves.

Also under proposed changes to § 23.1309(a), we would replace the conditional qualifiers of ''under any foreseeable operating condition,'' contained in the current § 23.1309(b)(1), with ''under the airplane operating and environmental conditions.'' Our intent with this proposal is for the applicant to take two actions. First, the applicant must consider the full normal operating envelope of the airplane, as defined by the airplane flight manual (AFM), with any modification to that envelope associated with abnormal or emergency procedures and any anticipated crew

[5] A copy of the advisory circular is available on the Internet at *http://www.faa.gov/regulations_policies/.*

action. Second, the applicant must consider the anticipated external and internal airplane environmental conditions, as well as any additional conditions where equipment and systems are assumed to ''perform as intended.'' We propose to make this change in response to an observation that although certain operating conditions are foreseeable, achieving normal performance when they exist is not always possible (*e.g.*, you may foresee ash clouds from volcanic eruptions, but airplanes with current technology cannot safely fly in such clouds).

The FAA currently accepts equipment that is susceptible to failures if these failures do not contribute significantly to the existing risks (*e.g.*, some degradation in functionality and capability is routinely allowed during some environmental qualifications, such as HIRF and lightning testing). System lightning protection specifically allows the loss of function and capability of some electrical/electronic systems when the airplane is exposed to lightning, if ''these functions can be recovered in a timely manner.''

Proposed § 23.1309(a)(3) is applicable for all functional reliability, flight testing, or flight evaluations. This proposed change clarifies the FAA's expectations for functional testing during certification of complex systems, but it is not meant to increase the testing burden on the applicant. The FAA's intent is to prohibit certification of systems with known defects in required functions that could impact safety. For example, it would not be acceptable for an integrated avionics system to be approved until known functional defects in required functions are corrected. The system would not be allowed to exhibit unintended or improper functionality for flight critical functions. The rate of occurrence of failures, malfunctions, and design errors must be appropriate for the failure condition(s) of the type of system and airplane.

Proposed § 23.1309(b) would codify a long-established means of compliance with current § 23.1309(b) and update failure condition(s) terminology used in related system safety assessment documents developed by industry working groups (*e.g.*, RTCA and the Society of Automotive Engineers (SAE)). This means of compliance identifies four classes of airplanes as defined in Appendix K of this proposal and applies appropriate probability values and development assurance levels for each class. The original text of § 23.1309(b)(4) has been retained and appears as § 23.1309(b)(5) in this revision. The proposed changes to § 23.1309(c) and (d) are meant to define the proper scope and intent for applying § 23.1309 depth of analysis for system safety assessments to all systems.

With proposed § 23.1309(f), we would make § 23.1309 compatible with the current § 23.1322 (''Warning, caution, and advisory lights'') that distinguishes between caution, warning, and advisory lights installed on the flight deck. Rather than only providing a warning to the flight crew, which is required by the current rule, proposed § 23.1309(f) would require that information concerning an unsafe system operating condition(s) be provided to the flight crew.

A warning indication would still be required if immediate action by a flight crewmember were required. The particular method of indication would depend on the urgency and need for flight crew awareness or action that is necessary for the particular failure. Inherent airplane characteristics may be used in lieu of dedicated indications and annunciations that can be shown to be timely and effective. The use of periodic maintenance or flight crew checks to detect significant latent failures when they occur should not be used in lieu of practical and reliable failure monitoring and indications.

Proposed § 23.1309(f) would clarify the current rule by specifying that the design of systems and controls, including indications and annunciations, must reduce crew errors that could create more hazards. The additional hazards to be minimized would be those that are caused by inappropriate actions made by a crewmember in response to the failure, or those that could occur after a failure. Any procedures for the flight crew to follow after the occurrence of a failure indication or annunciation would be described in the approved Airplane Flight Manual (AFM), AFM revision, or AFM supplement, unless they are accepted as part of normal aviation abilities.

Current § 23.1309 (c) and (d) are not directly related to the other safety and analysis requirements of § 23.1309. The ARC considered it appropriate to state the requirements separately for clarity. We agree with this suggested change and propose to add a new § 23.1310 to accommodate the change. The requirements as originally stated in current § 23.1309 would not change, except for a new section number.

We propose several changes to § 23.1311(a)(5) for plain language purposes. In proposed § 23.1311(a)(5), we replace the phrase ''individual electronic display indicators'' with ''electronic display parameters.'' The term ''indicator'' has a long-standing definition based on conventional, mechanical indicators; therefore, the term has caused confusion. These electronic display parameters could be integrated on one electronic display that is independent of the primary flight display. In proposed § 23.1311(a)(6), we add the phrase ''that provide a quick-glance sense of rate and, when appropriate, trend information'' to clarify ''sensory cues.''

We propose to add the term ''when appropriate'' to eliminate the requirement to display trend information when it would otherwise provide intuitive information to the pilot. For example, the trend for fuel burn is always negative. We propose to remove the remainder of section (a)(6), ''* * * that are equivalent to those in the instrument being replaced by the electronic display indicator'' to prevent confusion since most instruments will be electronic. In proposed § 23.1311(a)(7), we have added the word ''equivalent'' to make acceptable instrument markings on electronic displays that are equivalent to those instrument markings on conventional mechanical and electromechanical instruments.

In proposed § 23.1311(b), we replace the phrase ''remain available to the crew, without need for immediate action'' with ''be available within one second to the crew with a single pilot action or by automatic means.'' The proposed language allows an applicant to take credit for reversionary or secondary flight displays on a multi-function flight display (MFD) that provides a secondary means of primary flight information (PFI). This is acceptable if the display can ''be available within one second to the crew with a single pilot action or by automatic means.'' MFD's may also display PFI as needed to ensure continuity of operations. The display of PFI on reversionary (secondary) displays must be arranged in the basic T-configuration. Also, such displays must be legible and usable from the pilot's position with minimal head movement to meet the requirements of § 23.1321.

There are three acceptable methods for meeting the requirements of § 23.1311(b)—(1) Dedicated standby instruments, (2) dual primary flight displays (PFDs), or (3) reversionary displays that display independent attitude. The standby instruments, or another independent PFD, would ensure that primary flight information is available to the pilot during all phases of flight and system failures. The electronic display systems with dual PFDs should incorporate dual, independently-powered sensors that would provide primary flight parameters (*e.g.*, attitude heading reference system (AHRS) with comparators and dual air data computer (ADC)). A reversionary configuration would have a single pilot action that would force MFD displays into reversionary mode operation by a single pilot action within one second or less. However, the PFI must be displayed in substantially the same format and size in the reversionary mode as it is in normal mode. The single pilot action should be easily recognized, readily accessible, and have the control within the pilot's primary field of view.

The reversionary method could include an automatic reversionary display with a single pilot action. If PFI on another display is not provided, we would require automatic switching to ensure PFI is available to the pilot. This automatic reversionary capability would cover most possible malfunctions. While a total loss of the display may not be reliably detected automatically, such a failure condition would be obvious to the pilot. Malfunctions that result in automatic switching would be extensive enough to ensure PFI is available at the reliability level required by § 23.1309. If such a malfunction occurs, a single pilot action would provide a full display of the essential information on the remaining display within one second. All modes, sources, frequencies, and flight plan data would be exactly as they were on the PFD before the failure.

Another reversionary method would include a means to access the reversionary mode manually through a single pilot action. Manual activation of the reversionary mode on the MFD through single action by the pilot would be acceptable when procedures to activate the PFI are accomplished before entering critical phases of flight. The PFI would display continuously on the reversionary display during critical phases of flight (*e.g.*, takeoff, landing, and missed or final approach).

To meet the proposed turbojet performance requirements in subpart B, the pilot would need accurate speed indicators while accelerating on the runway. We propose to revise § 23.1323(e) to add the requirement to calibrate the airspeed system down to 0.8 of the minimum value of V_1. Also, we propose to adopt the language used in part 25 for this same requirement because it is more in line with operating new part 23 turbojets.

The proposed changes to § 23.1331 would apply to instruments that rely on a power source to provide required flight information for instrument flight rules (IFR) operations. Consequently, this section would apply to all flight instruments, such as those required by parts 23, 91, 121, and 135. Airplanes limited by type design to visual flight rules (VFR) operations would not have to comply with the requirements of proposed § 23.1331(c).

Each independent power source must provide sufficient power for normal operations throughout the approved flight envelope of the airplane and for any operations approved for the airplane. Section 23.1331(c) would not require the installation of dual alternators or vacuum systems on single-engine airplanes. One option would include a dedicated battery that meets the requirements of § 23.1353(h) for electrical instrument loads essential to continued safe flight and landing. Another option would include separately powered instruments for primary and standby use. The last option would include performing a system safety analysis, per § 23.1309, to identify the procedures necessary to verify the charge state of any airplane starting battery that is used to power a stand-by system.

The ARC did not make a specific recommendation for § 23.1353. However, we propose to add additional battery endurance requirements depending on the airplane's altitude performance. Proposed § 23.1353 addresses the power needs of new all-electrical instruments, navigation and communications equipment, and engine controls.

When § 23.1353(h) was adopted, part 23 airplanes were mostly mechanical. We did not envision all-electric, or almost all-electric, airplanes. Current § 23.1353(h) requires 30 minutes of sufficient electrical power for a reduced or emergency group of equipment and instrumentation. We considered 30 minutes adequate to reach VFR conditions to continue flying to an adequate airport and to accomplish a safe landing for traditional part 23 airplanes. We did not envision integrated electric cockpits when we developed § 23.1353(h). New part 23 airplanes are being certificated with all-electrical instruments, including the standby instruments. This reliance on electric power increases the importance of ensuring adequate battery power until the pilot can descend and make a safe landing.

Most new engines utilize electronic engine controls. These engine controls may rely on the airplane's electrical system for power and to control fuel and ignition. Large engines typically installed on part 25 airplanes have a dedicated power source running off the engine; as long as the engine is running, the electronic engine control has power. Some of the smaller, simpler engines emerging in part 23 airplanes may not have these dedicated power sources and may rely on the airplane's electrical system to keep functioning.

We believe that most new turbine-powered airplanes, and some turbocharged, piston-powered airplanes, will operate at high altitudes under IFR. Under these conditions, 30 minutes may not be adequate for battery power because of the time it would take to descend from maximum altitude to find visual meteorological conditions (VMC) and land, or to perform an instrument approach for a landing. For these reasons, proposed § 23.1353(h) would extend the battery time requirement to 60 minutes for airplanes approved with a maximum altitude above 25,000 feet.

Many new single-engine airplanes are intended for use in part 135 passenger service. Proposed § 23.1353(h) provides consistency with the operating requirements for single-engine IFR in § 135.163(i). That section requires a 60-minute battery to power all emergency equipment, as specified by the manufacturer, to allow continued safe flight and landing.

b. Allowable Qualitative Failure Condition Probabilities

We propose to add Appendix K to show the appropriate airplane systems probability standards, failure conditions, and related development assurance for four certification classes of airplanes designed to part 23 standards. Proposed Appendix K includes development assurance levels that correlate to the software levels in RTCA/DO–178B and the complex design assurance levels in RTCA/DO–254. We provided quantitative values in Appendix K to indicate the order of probability range for each certification class and failure condition.

As used in § 23.1309, the FAA proposes the following definitions for terms used in Appendix K:

i. *Extremely remote failure conditions:* Those failure conditions 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 this type. For quantitative assessments, refer to the probability values shown for hazardous failure conditions in Appendix K.

ii. *Extremely improbable failure conditions:* For commuter category airplanes, those failure conditions so unlikely that they are not anticipated to occur during the entire operational life of all airplanes of one type. For other classes of airplanes, the likelihood of occurrence may be greater. For quantitative assessments, refer to the probability values shown for catastrophic failure conditions in Appendix K.

iii. *Probable failure conditions:* Those failure conditions anticipated to occur one or more times during the entire operational life of each airplane. These failure conditions may be determined on the basis of past service experience with similar components in comparable airplane applications. For quantitative assessments, refer to the probability values shown for minor failure conditions in Appendix K.

iv. *Remote failure conditions:* Those failure conditions that are unlikely to occur to each airplane during its total life but that may occur several times when considering the total operational life of a number of airplanes of this type. For quantitative assessments, refer to the probability values shown for major failure conditions in Appendix K.

v. *Design appraisal:* A qualitative appraisal of the integrity and safety of the system design. An effective appraisal requires experienced judgment.

vi. *Development assurance level:* All planned and systematic actions used to substantiate, to an adequate level of confidence, that errors in requirements, design, and implementation have been identified and corrected such that the system satisfies the applicable certification basis. (The development assurance levels in Appendix K are intended to correlate to software levels in RTCA/DO–178B and complex hardware design assurance levels in RTCA/DO–254 for the system or item.)

vii. *Simple and conventional systems:* A system is considered ''simple'' or ''conventional'' if its function, the technological means to implement its function, and its intended usage are all the same as, or closely similar to, that of previously approved systems commonly used. The systems that have established an adequate service history and the means of compliance for approval are generally accepted as ''simple'' or ''conventional.'' Simple systems do not contain software or complex hardware requiring compliance by documents. These documents are the developmental assurance levels assigned in RTCA/DO–178A/B, Software Considerations in Airborne Systems and Equipment Certification, or RTCA/DO–254, Design Assurance Guidance for Airborne Electronic Hardware documents or later versions.

For simple and conventional installations, it may be possible to assess a hazardous or catastrophic failure condition(s) as being extremely remote or extremely improbable, respectively, based on an FAA approved qualitative analysis. The basis for the assessment would be the degree of redundancy, the established independence and isolation of the channels, and the reliability record of the technology involved. Satisfactory service experience on similar systems commonly used in many airplanes may be sufficient when a close similarity is established regarding both the system design and operating conditions.

viii. *Installation appraisal:* A qualitative appraisal of the integrity and safety of the installation. Any deviations from normal industry-accepted installation practices should be evaluated.

8. Placards, Speeds, Operating Limitations, and Information

Currently, § 23.853(d)(2) requires placards for commuter category airplanes to have red letters at least ½ inch high on a white background at least 1 inch high. The letter size is not a requirement for the part 23 normal category or for the part 25 transport category airplanes. We propose removing the letter size requirement from this section. We also propose removing the ashtray requirement from this section since smoking is no longer allowed in parts 121 and 135 operations. We propose to amend paragraph (d)(2) of this section to read ''Lavatories must have 'No Smoking' or 'No Smoking in Lavatory' placards located conspicuously on each side of the entry door.''

Proposed § 23.629 would allow the use of V_{DF} in place of V_D for flight testing turbojets. In addition, the proposed amendment for § 23.1505 would require airspeed limits based on a combination of analytical (V_D/M_D) and demonstrated (V_{DF}/M_{DF}) dive speeds for turbojets. Proposed § 23.1505(c) would include specific turbojet speed designations.

The ARC did not make a specific recommendation regarding § 23.1525. However, we propose to clarify language so applicants understand that additional equipment may be needed to operate their airplane. Part 23 is a minimum performance standard, and it may not include all the required equipment for operations under part 135. We propose to include parts 91 and 135 operations as examples of the kinds of operation authorized.

Proposed § 23.1545 limits the white flap arc to reciprocating engine airplanes. This change reflects standard practice for turbojets and is included in all part 23 turbojet special conditions.

Proposed § 23.1555(d)(3) would require fuel systems with a calibrated fuel quantity indication system to comply with § 23.1337(b)(1) while removing current placard requirements. Most modern turbine-powered airplanes have a calibrated fuel quantity indicating system that is density compensated and accurately indicates the actual usable fuel quantity in each tank. When using these types of fuel indicating systems, we consider the placards required by §§ 23.1555(d)(1) and (2) redundant. The placards or markings required by §§ 23.1555(d)(1) and (2) indicate the maximum capacity of the tank. For these reasons, we propose to remove the placard requirement for these accurate fuel quantity indicating systems.

The placard requirements of §§ 23.1559, 23.1563 and 23.1567 have been a source of confusion to both FAA and industry personnel relative to placard lighting. We are proposing changes to these three rules to clarify the intent of these requirements. The requirements specified on the placard in § 23.1559 are relative to preflight planning, and this placard is not normally referenced in flight. As long as the placard is ''in clear view of the pilot'' and the pilot can view it at night using a flashlight or other means, the intent of the rule is met. The requirement has been confusing for certification offices and this proposal makes the placard lighting intent clear. We propose to add a new paragraph § 23.1559(d), which states ''The placard required by this section need not be lighted.''

With modern flight display equipment, the necessary information may now be available on that equipment and is automatically illuminated as part of the display. Therefore, we also propose to update § 23.1563 to clarify requirements for night lighting of the placard. Maneuvering speed is applicable to operations that may involve intentional large control input and is therefore not applicable to normal night operations. Most modern airplanes have means for the landing gear speed to be displayed in the airspeed indicator or on lighted portions of the landing gear control. They have the means for the airspeed indicator to display low speed awareness or other airspeed reference information to provide safety above V_{MC}. Lighting this placard is unnecessary for safety and provides another source of unwanted lighting reflections in the cockpit.

The requirements specified in § 23.1567 for the limitation placard relate to acrobatic maneuvers and spin information related to preflight planning. Since these maneuvers are not normally conducted during night operations, the placard information is not required for night flight. If the placard is ''in clear view of the pilot'' and the pilot can view the placard at night using a flashlight or other means, it meets the intent of the rule. The proposed change to § 23.1567 clarifies our intent of this rule relative to lighting.

We propose to incorporate the existing special conditions into the AFM requirements in §§ 23.1583, 23.1585, and 23.1587. These are necessary to be consistent with the performance requirements proposed in subpart B. These requirements include the ARC recommended, single-engine climb performance increase for turboprops.

III. Regulatory Notices and Analyses

Paperwork Reduction Act

According to the 1995 amendments to the Paperwork Reduction Act (5 CFR 1320.8(b)(2)(vi)), an agency may not collect or sponsor the collection of information, nor may it impose an information collection requirement unless it displays a currently valid OMB control number. The OMB control number for this information collection will be published in the **Federal Register,** after the Office of Management and Budget approval.

International Compatibility

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

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

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 (Pub. L. 96–354) requires agencies to analyze the economic impact of regulatory changes on small entities. Third, the Trade Agreements Act (Pub. L. 96–39) prohibits agencies from setting standards that create unnecessary obstacles to the foreign commerce of the United States. In developing U.S. standards, this Trade Act requires agencies to consider international standards and, where appropriate, that they be the basis of U.S. standards. Fourth, the Unfunded Mandates Reform Act of 1995 (Pub. L. 104–4) requires agencies to prepare a written assessment of the costs, benefits, and other effects of proposed or final rules that include a Federal mandate likely to result in the expenditure by State, local, or tribal governments, in the aggregate, or by the private sector, of $100 million or more annually (adjusted for inflation with base year of 1995). This portion of the preamble summarizes the FAA's analysis of the economic impacts of this proposed rule. We suggest readers seeking greater detail read the full regulatory evaluation, a copy of which we have placed in the docket for this rulemaking.

In conducting these analyses, FAA has determined that this proposed rule: (1) Has benefits that justify its costs, (2) is not an economically ''significant regulatory action'' as defined in section 3(f) of Executive Order 12866, (3) the Office of Management and Budget has determined this proposal is ''significant''; (4) would not have a significant economic impact on a substantial number of small entities; (5) would not create unnecessary obstacles to the foreign commerce of the United States; and (6) would not impose an unfunded mandate on state, local, or tribal governments, or on the private sector by exceeding the threshold identified above. These analyses are summarized below.

Total Benefits and Costs of This Rule

The estimated base case cost of this proposed rule is about $472,000 ($443,000 in 7 percent present value terms). The estimated safety benefits would be to avoid 14 accidents and are valued at about $82.7 million. The estimated base case efficiency benefits to streamline the part 23 certification process are valued at about $1.6 million. The total base case benefit is equal to the sum of the safety and efficiency benefits and is valued at about $84.2 million.

Who Is Potentially Affected by This Rule

This proposed rulemaking will affect manufacturers and operators of part 23 reciprocal engine, turboprop and turbojet airplanes.

Assumptions

The proposed rule makes the following assumptions:

1. The base year is 2008.
2. The average retirement age of a U.S. operated part 23 airplane is 32 years.
3. The average part 23 airplane production life cycle is 24 years.
4. The analysis period extends for 56 (32 + 24) years.
5. U.S companies would manufacture 75 percent of the turbojets forecasted by the FAA.
6. All business and commercial part 23 airplanes would operate in commuter service.
7. The value of a fatality avoided is $5.8 million.

Benefits of This Rule

For part 23 airplanes, we estimated that the proposed changes would avoid about 14 accidents over the 24-year operating lives of 37,657 new-production airplanes. The resulting benefits include averted fatalities and injuries, loss of airplanes, investigation cost, and collateral damages for the accidents. The safety benefits for averting the 14 accidents are about $82.7 million ($17.8 million in 7 percent present value terms).

Other benefits of this proposal include FAA and industry paperwork and certification time saved by standardizing and streamlining the certification of part 23 airplanes. The base case efficiency benefits for standardizing and streamlining the certification process is valued at $1.6 million.

The total base case benefit is equal to the sum of the safety and efficiency benefits and is about $84.2 million ($19.3 million in 7 percent present value terms).

Costs of This Rule

Constant-dollar (2008$) unit costs per aircraft by 14 CFR Part 23 could be as high as: $165 for turboprop airplanes and $6,550 for turbojet airplanes. Total incremental costs equal the constant-dollar unit costs multiplied by the number of aircraft produced over 10 years. The base case costs of this rule are about $472,000 ($443,000 in 7 percent present value terms) and the high case costs of this rule are about $11.1 million ($5.0 million in 7 percent present value terms).

Alternatives Considered

Alternative 1—The FAA would continue to issue special exemptions, exceptions and equivalent levels of safety to certificate part 23 airplanes. As that would perpetuate ''rulemaking by exemption,'' we choose not to continue with the status quo.

Alternative 2—The FAA continue to enforce the current regulations that affect single engine climb performance.

The FAA rejected this alternative because the accident rate on twin piston engine and turboprop airplanes identified a safety issue that had to be addressed.

Regulatory Flexibility Determination

The Regulatory Flexibility Act of 1980 (Pub. L. 96–354) (RFA) establishes ''as a principle of regulatory issuance that agencies shall endeavor, consistent with the objectives of the rule and of applicable statutes, to fit regulatory and informational requirements to the scale of the businesses, organizations, and governmental jurisdictions subject to regulation. To achieve this principle, agencies are required to solicit and consider flexible regulatory proposals and to explain the rationale for their actions to assure that such proposals are given serious consideration.'' The RFA covers a wide-range of small entities, including small businesses, not-for-profit organizations, and small governmental jurisdictions.

Agencies must perform a review to determine whether a rule will have a significant economic impact on a substantial number of small entities. If the agency determines that it will, the agency must prepare a regulatory flexibility analysis as described in the RFA. However, if an agency determines that a rule is not expected to have a significant economic impact on a substantial number of small entities, section 605(b) of the RFA provides that the head of the agency may so certify and a regulatory flexibility analysis is not required. The certification must include a statement providing the factual basis for this determination, and the reasoning should be clear.

The FAA believes that this proposed rule would not have a significant impact on a substantial number of entities. The purpose of this analysis is to provide the reasoning underlying the FAA determination.

First, we will discuss the reasons why the FAA is considering this action. We will follow with a discussion of the objective of, and legal basis for, the proposed rule. Next we explain there are no relevant federal rules which may overlap, duplicate, or conflict with the proposed rule. Lastly, we will describe and provide an estimate of the number of small entities affected by the proposed rule and why the FAA believes this proposed rule would not result in a significant economic impact on a substantial number of small entities.

We now discuss the reasons why the FAA is considering this action.

The FAA proposes this action to amend safety and applicability standards of the part 23 turbojet industry to reflect the current needs of the industry, accommodate future trends, address emerging technologies, and provide for future aircraft operations. This proposal primarily standardizes and streamlines the certification of part 23 turbojet airplanes. The intent of the proposed changes to parts 1 and 23 are necessary to eliminate the current workload of exemptions, special conditions, and equivalent levels of safety determinations necessary to certificate part 23 turbojets. These proposed part 23 changes will also clarify areas of frequent non-standardization and misinterpretation and provide appropriate safety and applicability standards that reflect the current state of the industry, emerging technologies and new types of operations for all part 23 airplanes; including turbojet, turboprop and reciprocating engine airplanes.

The FAA currently issues type certificates (TCs) for part 23 turbojets using extensive special conditions. Issuance of TCs has not been significant until now because there were few part 23 turbojet programs. However, in the past five years, the number of new turbojet certification programs in part 23 has increased more than 100 percent over the past three decades.

The need to incorporate these special conditions into part 23 stems from both the existing number of new jet programs and the expected future jet programs. Codifying these special conditions will allow manufacturers to know the requirements during their design phase instead of designing the turbojet and then having to apply for special conditions that may ultimately require a redesign. Codifying will also reduce the manufacturers and FAA's paper process required to TC an airplane and reduces the potential for program delays. These proposed changes would also clarify areas of frequent non-standardization and misinterpretation, particularly for electronic equipment and system certification.

The revisions include general definitions, error correction, and specific requirements for performance and handling characteristics to ensure safe operation of part 23 transport category airplanes. The proposed revisions would apply to all future new part 23 turbojet, turboprop and reciprocating engine airplane certifications.

We now discuss the legal basis for, and objective of, the proposed rule. Next, we discuss if there are relevant federal rules, which may overlap, duplicate, or conflict with the proposed rule.

The FAA's authority to issue rules on aviation safety is found in Title 49 of the United States Code. Subtitle I, Section 106 describes the authority of the FAA Administrator. Subtitle VII, Aviation Programs, describes in more detail the scope of the agency's authority.

This rulemaking is promulgated under the authority described in Subtitle VII, Part A, Subpart III, Section 44701. Under that section, the FAA is charged with promoting safe flight of civil aircraft in air commerce by prescribing minimum standards required in the interest of safety for the design and performance of aircraft. This regulation is within the scope of that authority because it prescribes new safety standards for the design of part 23 normal, utility, acrobatic, and commuter category airplanes.

Accordingly, this proposed rule will amend Title 14 of the Code of Federal Regulations to address deficiencies in current regulations regarding the certification of part 23 light jets, turboprops and reciprocating engine airplanes. The proposed rule would clarify areas of frequent non-standardization and misinterpretation and codify certification requirements that currently exist in special conditions.

The FAA is unaware the proposed rule will overlap, duplicate, or conflict with existing Federal Rules.

We now discuss our methodology to determine the number of small entities for which the proposed rule will apply.

Under the RFA, the FAA must determine whether a proposed rule significantly affects a substantial number of small entities. This determination is typically based on small entity size and cost thresholds that vary depending on the affected industry.

Using the size standards from the Small Business Administration for Air Transportation and Aircraft Manufacturing, we defined companies as small entities if they have fewer than 1,500 employees.[6]

There are 11 U.S. aircraft manufacturers currently producing part 23 airplanes and could be affected by this proposal. These manufacturers are American Champion, Cessna, Cirrus, Eclipse, Hawker Beechcraft, Liberty, Maule, Mooney, Piper, Quest, and Sino Swearingen.

Using information provided by the World Aviation Directory, Internet filings and industry contacts, manufacturers that are subsidiary

[6] 13 CFR 121.201, Size Standards Used to Define Small Business Concerns, Sector 48–49 Transportation, Subsector 481 Air Transportation.

businesses of larger businesses, manufacturers that are foreign owned, and businesses with more than 1,500 employees were eliminated from the list of entities. Cessna and Hawker Beechcraft are businesses with more than 1,500 employees and Cirrus and Liberty are foreign owned. We found no source of employment or revenue data for American Champion. For the remaining businesses, we obtained company revenue and employment from the above sources.

The base year for the proposed rule is 2008. Although the FAA forecasts traffic and air carrier fleets, we can not determine the number of new entrants nor who will be in business in the future. Therefore we use current U.S. manufacturer's revenue and employment in order to determine the number of operators this proposal would affect.

The methodology discussed above resulted in the following six U.S. part 23 aircraft manufacturers, with less than 1,500 employees, shown in Table RF1.

TABLE RF1

Company	Employees	Annual revenue
Quest	60	$4,600,000
Maule	86	5,700,000
Piper	100	7,600,000
Mooney	400	42,083,000
Sino Swearingen	400	25,300,000
Eclipse	1,000	36,700,000

The majority of this proposal affects the certification of turbojets and has a minor affect on the certification of turboprop and reciprocating engine airplanes by clarifying frequent non-standardization and misinterpretations of the current part 23 rules.

From the list of part 23 small entity U.S. airplane manufacturers above, only Eclipse and Sino Swearingen produce turbojet airplanes and Piper and Quest produce turboprop airplanes. The remaining part 23 small entity U.S. airplane manufacturers produce reciprocating engine airplanes.

In the regulatory evaluation, we estimated that operators of newly certificated part 23 airplanes would incur additional fuel costs. Additionally, operators could incur costs from added weight and a reduced payload capacity. The U.S. Census Bureau data on the Small Business Administration's Web site shows an estimate of the total number of small business entities who could be affected if they purchase newly certificated part 23 airplanes.[7] The U.S. Census Bureau data lists 39,754 small entities in the Non-scheduled Air Transportation Industry that employ less than 500 employees. Many of these non-scheduled businesses are in part 25. Other small businesses may own aircraft and not be included in the U.S. Census Bureau Non-scheduled Air Transportation Industry category. The estimate of the affect of this proposal on the total number of small entities that operate part 23 airplanes is developed below.

We now discuss our methodology to estimate the costs of this proposal to the small entities part 23 airplane manufacturers and operators. We will also discuss why the FAA believes this proposed rule would not result in a significant economic impact to part 23 airplane manufacturers and operators.

In 2003, we published a notice (68 FR 5488) creating the part 125/135 Aviation Rulemaking Committee (ARC). FAA and the part 23 industry have worked together to develop common certification part 23 airplane requirements proposed in this rulemaking. We contacted the part 23 aircraft manufacturers, the ARC, and General Aviation Manufacturers Association (GAMA) (an industry association for part 23 aircraft manufacturers) for specific cost estimates for each proposed section change for this rule. Not every party we contacted responded to our request for costs. Many of the ARC members, from the domestic and international manufacturing community, collaborated and filed a joint cost estimate for this proposed rule. We are basing our cost estimates for this proposed rule from these part 23 U.S. aircraft manufacturers, ARC members and GAMA.

The part 23 U.S. airplane manufacturers, ARC members, and industry association informed us that this proposed rulemaking would add manufacturer certification costs for fire extinguishing systems, climb, and take-off warning systems. Industry informed us that this proposal would save the manufacturers design time for the certification of cockpit controls. Industry has also informed us that every other proposed section of this rule is either clarifying, error correcting, or would only add minimal to no costs.

The proposed rule adds certification requirements for the following part 23 airplane categories:

1. All turbojet airplanes,
2. All turbojet airplanes with a MTOW less than 6,000 pounds,
3. All turboprop airplanes,
4. All reciprocal engine airplanes, and
5. All reciprocal twin engine airplanes with a MTOW greater than 6,000 pounds.

In some cases the proposed regulations only affect part 23 airplanes operated in revenue service. Any part 23 airplane could be used as a business airplane to haul passengers and cargo in commercial service. We estimated the business versus personal use of a part 23 airplane by analyzing the number of all US-operated airplanes from Table 3.1 of the *2006 General Aviation and Part 135 Activity Survey.* Table 3.1 shows the breakout of the 2006 General Aviation fleet by business, corporate, instructional, aerial applications, aerial observations, aerial other, external load, other work, sight see, air medical, other, part 135 Air Taxi, Air Tours, and Air Medical airplane usage. For the purpose of estimating the cost of this proposal, we assume all business part 23 airplane operators from Table 3.1 of the *2006 General Aviation and Part 135 Activity Survey* would operate in Commuter service. Table RF2 shows these results.

[7] *http://www.sba.gov/advo/research/us05_n6.pdf.*

TABLE RF2—2006 GENERAL AVIATION AND PART 135 ACTIVITY SURVEY—TABLE 3.1

Aircraft type	Total active	Personal	% Personal	% Business
Piston	163,743	118,618	72.44	27.56
Turboprop	8,063	1,177	14.60	85.40
Turbojet	10,379	750	7.23	92.77

Table RF3 shows the results of the proposed sections that add (or subtract) incremental costs by increasing design or flight testing times, adds weight, or reducing payload.

TABLE RF3

		Certification		Flight Operation		Part 23 Airplane Categories Affected					
Part 23 Section	Section title	Design hours	Flight test hours	Additional weight	Payload reduction	Turbojet	Turbojet <6,000 # MTOW	Turbo-prop	Recip-rocal engine	Twin reciprocal engine >6,000 # MTOW	Category
23.1193(g), 23.1195(a), 23.1197, 23.1199, 23.1201.	Cowling and Nacelle, Fire Extinguisher Systems, Fire Extinguishing Agents, Extinguishing Agent Containers, Fire Extinguishing System Materials.	....	50	25	....	....	....	X	....	....	Commuter.
23.63, 23.67, 23.77.	Climb: General, Climb—One Engine, Balked Landing.	....	....	....	10%	....	X	X	....	X	All.
23.703	Take-Off Warning System.	1,000	25	....	....	....	X	X	....	X	All.
23.777	Cockpit Controls	−25	....	....	....	X	....	X	X	....	All.

We estimated part 23 airplane manufacturer fixed (added certification plus flight test hours) and operator variable (added fuel burn plus 10 percent reduction in payload) costs and applied our estimated costs to expected fleet delivered in compliance with this proposal. The total cost of this rule is the sum of the fixed certification cost plus the airplane fuel-burn variable cost multiplied by the expected fleet delivered over the analysis period.

The total fixed certification compliance cost equals the average compliance cost multiplied by the expected number of certifications of newly delivered part 23 turbojet, turboprop and reciprocating engine airplane. In the regulatory evaluation we estimated a base case and high case range for the certification costs. This range was based on the estimated number of new turbojet certifications. In the base case, we estimated five new turbojet certifications in the analysis interval. In the high case, we estimated eight new turbojet certifications. We will use the high cost case scenario for this analysis.

We estimated the certification costs for fire extinguishing systems, climb, and take-off warning systems. Based on the hours provided by the part 23 U.S. airplane manufacturers, ARC members and industry association and the *Economic Values For FAA Investment and Regulatory Decisions, A Guide* for the hourly rates.[8] Table RF4 shows the incremental certification costs estimate we calculated.

TABLE RF4—HIGH COST SCENARIO FOR PART 23 MANUFACTURERS

Costs	Recip	Commuter TP	TJ < 6,000
Design	$0	$152,020	$94,496
Design	(9,501)	(3,801)	(22,803)
Flight Test	0	114,400	93,489
Total High Cost	(9,501)	262,620	165,181
# Certifications	5	4	12
Cost per Cert	(1,900)	65,655	13,765

We applied the estimated incremental certification costs to the each of the small part 23 airplane manufacturing average number of historical certifications over a ten-year period. We then divided the small part 23 airplane

[8] *http://www.faa.gov/regulations_policies/policy_guidance/benefit_cost/media/050404%20Critical%20Values%20Dec%2031%20Report%2007Jan05.pdf.*

manufacturer's annual revenue by the incremental costs. Table RF5 shows these results.

TABLE RF5

Company	Employees	Annual revenue	Average # certs 10 years	Airplane certificated	Estimated cert cost	Percent
Quest	60	$4,600,000	1.00	Turboprop	$65,655	1.43
Maule	86	5,700,000	0.20	Recip	−380	−0.01
Piper	100	7,600,000	1.00 (Recip) + 33 (TP).	Recip + Turboprop	65,022	0.86
Mooney	400	42,083,000	0.17	Recip	−317	0.00
Sino Swearingen	400	25,300,000	1.00	Turbojet	13,765	0.05
Eclipse	1,000	36,700,00	1.00	Turbojet	13,765	0.04

We estimated that the incremental fixed certification cost this proposed rule would be less than one percent in five of the six small entity part 23 airplane manufacturers, and less than 1.5 percent in the remaining one. We do not believe these are significant economic costs. Further, we believe that the manufacturers of the part 23 airplanes would have additional costs savings associated with the proposal standardizes and streamlining the certification process. Additional costs savings of the proposed changes to parts 1 and 23 would be to eliminate the current workload of exemptions, special conditions, and equivalent levels of safety necessary to certificate part 23 turbojets and by clarifying frequent non-standardization and misinterpretations of current part 23 rules.

To estimate the incremental variable costs to a part 23 operator, we multiplied the annual per-unit fuel burn cost by the expected fleet delivered over the analysis interval.

In the regulatory evaluation, we estimated a minimal base and high case cost for the 10 percent loss in capacity occurs the operators may incur. The base case was a no cost scenario because the average GA airplane has about 3.7 seats and flies about half full.[9] The cargo load factor for all cargo carriers is 60 percent.[10] Therefore, we conclude that the 10 percent reduction in payload caused by the proposed sections on climb and balked landings could have a minimum cost impact on part 23 airplanes for the base case. For the high case we realize that a percentage of the part 23 airplanes, in commuter service, could have a load factor over 90 percent on some of their flights. Although we believe any capacity affected would be distributed over other flights in the operator's network, we estimate the cost of a 10 percent payload capacity reduction. Table RF6 shows the results of our calculations.

TABLE RF6

	Recip	TurboProp	Commuter TP	Total TJ	TJ<6,000
Base Case Cost	$0	$0	$8,430	$0	$0
High Case Cost	$0	$0	$1,413,692	$0	$3,086,919
Number of A/P	23,160	1,248	1,066	11,040	1,143
Base Case Cost / A/P	$0	$0	$8	$0	$0
High Case Cost / A/P	$0	$0	$1,326	$0	$2,700
A/P Value	$431,681	$3,389,054	$3,389,054	$6,300,000	$6,300,000
% Base of Value	0.00%	0.00%	0.00%	0.00%	0.00%
% High of Value	0.00%	0.00%	0.04%	0.00%	0.04%

For this proposal, our high case estimate for small business part 23 operators of turboprop airplanes would pay an additional $1,326 to operate a newly certificated airplane. Operators of newly certificated and delivered part 23 turbojet airplanes with a maximum take off weight less than 6,000 pounds would pay an additional $2,700 to operate a newly certificated airplane. Operators would not incur these costs unless they purchase a newly certificated part 23 airplane.

We do not believe that these proposals costs would be a significant impact to small entity operators because, even for the high-cost case, the compliance costs of this proposal to operators would only be 0.04 percent for a turboprop and 0.04 percent for a turbojet with a maximum take-off weight less than 6,000 pounds, of the price of a newly certificated airplane.

Therefore the FAA certifies that this proposed rule would not have a significant economic impact on a substantial number of small entities. The FAA solicits comments regarding this determination.

International Trade Impact Assessment

The Trade Agreements Act of 1979 (Pub. L. 96–39) prohibits Federal agencies from establishing any standards or engaging in related activities that create unnecessary obstacles to the foreign commerce of the United States. Legitimate domestic objectives, such as safety, are not considered unnecessary obstacles. The statute also requires consideration of international standards and, where appropriate, that they be the basis for U.S. standards. The FAA has assessed the potential effect of this final rule and has no basis for believing the rule will impose substantially different costs on domestic and international entities. Thus the FAA believes the rule has a neutral trade impact.

Unfunded Mandates Assessment

Title II of the Unfunded Mandates Reform Act of 1995 (Pub. L. 104–4) requires each Federal agency to prepare

[9] Table 3.15 of the *Economic Values For FAA Investment and Regulatory Decisions, A Guide*

[10] *Ibid.*

a written statement assessing the effects of any Federal mandate in a proposed or final agency rule that may result in an expenditure of $100 million or more (in 1995 dollars) in any one year by State, local, and tribal governments, in the aggregate, or by the private sector; such a mandate is deemed to be a ''significant regulatory action.'' The FAA currently uses an inflation-adjusted value of $136.1 million in lieu of $100 million. This proposed rule does not contain such a mandate; therefore, the requirements of Title II of the Act do not apply.

Executive Order 13132, Federalism

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

Regulations Affecting Intrastate Aviation in Alaska

Section 1205 of the FAA Reauthorization Act of 1996 (110 Stat. 3213) requires the Administrator, when modifying regulations in Title 14, Code of Federal Regulations 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 appropriate regulatory distinctions. Because this proposed rule would apply to the certification of future designs of transport category airplanes and their subsequent operation, it could, if adopted, affect intrastate aviation in Alaska. The FAA, therefore, specifically requests comments on whether there is justification for applying the proposed rule differently in intrastate operations in Alaska.

Environmental Analysis

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

Regulations That Significantly Affect Energy Supply, Distribution, or Use

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

Additional Information

Comments Invited

The FAA invites interested persons to participate in this rulemaking by submitting written comments, data, or views. We also invite comments relating to the economic, environmental, energy, or federalism impacts that might result from adopting the proposals in this document. The most helpful comments reference a specific portion of the proposal, explain the reason for any recommended change, and include supporting data. To ensure the docket does not contain duplicate comments, please send only one copy of written comments, or if you are filing comments electronically, please submit your comments only one time.

We will file in the docket all comments we receive, as well as a report summarizing each substantive public contact with FAA personnel concerning this proposed rulemaking. Before acting on this proposal, we will consider all comments we receive on or before the closing date for comments. We will consider comments filed after the comment period has closed if it is possible to do so without incurring expense or delay. We may change this proposal in light of the comments we receive.

Proprietary or Confidential Business Information

Do not file in the docket information that you consider to be proprietary or confidential business information. Send or deliver this information directly to the person identified in the **FOR FURTHER INFORMATION CONTACT** section of this document. You must mark the information that you consider proprietary or confidential. If you send the information on a disk or CD ROM, mark the outside of the disk or CD ROM, and also identify electronically within the disk or CD ROM the specific information that is proprietary or confidential.

Under 14 CFR 11.35(b), when we are aware of proprietary information filed with a comment, we do not place it in the docket. We hold it in a separate file to which the public does not have access, and we place a note in the docket that we have received it. If we receive a request to examine or copy this information, we treat it as any other request under the Freedom of Information Act (5 U.S.C. 552). We process such a request under the DOT procedures found in 49 CFR part 7.

Availability of Rulemaking Documents

You can get an electronic copy of rulemaking documents using the Internet by—

1. Searching the Federal eRulemaking Portal (*http://www.regulations.gov*);
2. Visiting the FAA's Regulations and Policies web page at *http://www.faa.gov/regulations_policies/;* or
3. Accessing the Government Printing Office's Web page at *http://www.gpoaccess.gov/fr/index.html.*

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

You may access all documents the FAA considered in developing this proposed rule, including economic analyses and technical reports, from the Internet through the Federal eRulemaking Portal referenced in paragraph (1).

List of Subjects

14 CFR Part 1

Air transportation.

14 CFR Part 23

Aviation Safety, Signs, Symbols, Aircraft.

The Proposed Amendments

In consideration of the foregoing, the Federal Aviation Administration proposes to amend Chapter I of Title 14, Code of Federal Regulations, as follows:

PART 1—DEFINITIONS AND ABBREVIATIONS

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

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

2. Revise the definitions of ''Rated takeoff power'' and ''Rated takeoff thrust'' and add the definitions of ''Turbine engine'', ''Turbojet engine'', and ''Turboprop engine'' in alphabetical order in § 1.1 to read as follows:

§ 1.1 General definitions.

* * * * *

Rated takeoff power, with respect to reciprocating, turbopropeller, and turboshaft engine type certification, means the approved brake horsepower that is developed statically under standard sea level conditions, within the engine operating limitations established under part 33 of this chapter, and limited in use—

(1) To periods of not more than 5 minutes for takeoff operations with reciprocating, turbopropeller, and turboshaft engines; and

(2) When specifically requested by the engine manufacturer, to periods of not more than 10 minutes for one-engine-inoperative takeoff operations with turbopropeller engines.

Rated takeoff thrust, with respect to turbojet engine type certification, means the approved turbojet thrust that is developed statically under standard sea level conditions, without fluid injection and without the burning of fuel in a separate combustion chamber, within the engine operating limitations established under part 33 of this chapter, and limited in use—

(1) To periods of not more than 5 minutes for takeoff operations; and

(2) When specifically requested by the engine manufacturer, to periods of not more than 10 minutes for one-engine-inoperative takeoff operations.

* * * * *

Turbine engine, with respect to part 23 airplane type certification, consists of an air compressor, a combustion section, and a turbine. Thrust is produced by increasing the velocity of the air flowing through the engine.

Turbojet engine, with respect to part 23 airplane type certification, is a turbine engine which produces its thrust entirely by accelerating the air through the engine.

Turboprop engine, with respect to part 23 airplane type certification, is a turbine engine which drives a propeller through a reduction gearing arrangement. Most of the energy in the exhaust gases is converted into torque, rather than using its acceleration to drive the airplane.

* * * * *

PART 23—AIRWORTHINESS STANDARDS: NORMAL, UTILITY, ACROBATIC, AND COMMUTER CATEGORY AIRPLANES

3. The authority citation for part 23 continues to read as follows:

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

4. Amend § 23.3 by revising the first sentence in paragraph (d) to read as follows:

§ 23.3 Airplane categories.

* * * * *

(d) The commuter category is limited to multiengine airplanes that have a seating configuration, excluding pilot seats, of 19 or less, and a maximum certificated takeoff weight of 19,000 pounds or less. * * *

* * * * *

5. Amend § 23.45 by revising the introductory text of paragraph (h) to read as follows:

§ 23.45 General.

* * * * *

(h) For multiengine turbojet powered airplanes over 6,000 pounds in the normal, utility, and acrobatic category and commuter category airplanes the following also apply:

* * * * *

6. Amend § 23.49 by revising the section heading and the introductory text of paragraphs (a) and (c) to read as follows:

§ 23.49 Stalling speed.

(a) V_{SO} (maximum landing flap configuration) and V_{S1} are the stalling speeds or the minimum steady flight speeds, in knots (CAS), at which the airplane is controllable with—

* * *

(c) Except as provided in paragraph (d) of this section, V_{SO} at maximum weight may not exceed 61 knots for—

* * * * *

7. Amend § 23.51 by revising paragraph (b)(1) introductory text and paragraph (c) introductory text to read as follows:

§ 23.51 Takeoff speeds.

* * * * *

(b) * * *

(1) For multiengine airplanes, the highest of—

* * *

(c) For normal, utility, and acrobatic category multiengine turbojet airplanes of more than 6,000 pounds maximum weight and commuter category airplanes, the following apply:

* * * * *

8. Amend § 23.53 by revising paragraph (c) to read as follows:

§ 23.53 Takeoff performance.

* * * * *

(c) For normal, utility, and acrobatic category multiengine turbojet airplanes of more than 6,000 pounds maximum weight and commuter category airplanes, takeoff performance, as required by §§ 23.55 through 23.59, must be determined with the operating engine(s) within approved operating limitations.

9. Amend § 23.55 by revising the introductory text to read as follows:

§ 23.55 Accelerate-stop distance.

For normal, utility, and acrobatic category multiengine turbojet airplanes of more than 6,000 pounds maximum weight and commuter category airplanes, the accelerate-stop distance must be determined as follows:

* * * * *

10. Amend § 23.57 by revising the introductory text to read as follows:

§ 23.57 Takeoff path.

For normal, utility, and acrobatic category multiengine turbojet airplanes of more than 6,000 pounds maximum weight and commuter category airplanes, the takeoff path is as follows:

* * * * *

11. Amend § 23.59 by revising the introductory text to read as follows:

§ 23.59 Takeoff distance and takeoff run.

For normal, utility, and acrobatic category multiengine turbojet airplanes of more than 6,000 pounds maximum weight and commuter category airplanes, the takeoff distance and, at the option of the applicant, the takeoff run, must be determined.

* * * * *

12. Amend § 23.61 by revising the introductory text to read as follows:

§ 23.61 Takeoff flight path.

For normal, utility, and acrobatic category multiengine turbojet airplanes of more than 6,000 pounds maximum weight and commuter category airplanes, the takeoff flight path must be determined as follows:

* * * * *

13. Amend § 23.63 by revising the introductory text of paragraphs (c) and (d) to read as follows:

§ 23.63 Climb: General.

* * * * *

(c) For reciprocating engine-powered airplanes of more than 6,000 pounds maximum weight, single-engine turbines, and multiengine turbine airplanes of 6,000 pounds or less maximum weight in the normal, utility, and acrobatic category, compliance must be shown at weights as a function of airport altitude and ambient temperature, within the operational limits established for takeoff and landing, respectively, with—

* * * * *

(d) For multiengine turbine airplanes over 6,000 pounds maximum weight in the normal, utility, and acrobatic category and commuter category airplanes, compliance must be shown at weights as a function of airport altitude and ambient temperature within the operational limits established for takeoff and landing, respectively, with—

* * * * *

14. Amend § 23.67 by:

a. Revising paragraph (b) introductory text and (b)(1) introductory text;

b. Redesignating paragraph (c) as paragraph (d)

c. Revising newly redesignated paragraph (d) introductory text, paragraph (d)(2) introductory text, paragraph (d)(3) introductory text, and paragraph (d)(4) introductory text; and

d. Adding new paragraph (c).

The revisions and addition read as follows:

§ 23.67 Climb: One-engine inoperative.

* * * * *

(b) For normal, utility, and acrobatic category reciprocating engine-powered airplanes of more than 6,000 pounds maximum weight, and turbopropeller-powered airplanes in the normal, utility, and acrobatic category—

(1) The steady gradient of climb at an altitude of 400 feet above the takeoff may be no less than 1 percent with the—

* * * * *

(c) For normal, utility, and acrobatic category turbojet engine-powered airplanes of 6,000 pounds or less maximum weight—

(1) The steady gradient of climb at an altitude of 400 feet above the takeoff may be no less than 1.2 percent with the—

(i) Critical engine inoperative;

(ii) Remaining engine(s) at takeoff power;

(iii) Landing gear retracted;

(iv) Wing flaps in the takeoff position(s); and

(v) Climb speed equal to that achieved at 50 feet in the demonstration of § 23.53.

(2) The steady gradient of climb may not be less than 0.75 percent at an altitude of 1,500 feet above the takeoff surface, or landing surface, as appropriate, with the—

(i) Critical engine inoperative:

(ii) Remaining engine(s) at not more than maximum continuous power;

(iii) Landing gear retracted;

(iv) Wing flaps retracted; and

(v) Climb speed not less than 1.2 V_{S1}.

(d) For turbojet powered airplanes over 6,000 pounds maximum weight in the normal, utility and acrobatic category and commuter category airplanes, the following apply:

* * * * *

(2) *Takeoff; landing gear retracted.* The steady gradient of climb at an altitude of 400 feet above the takeoff surface must be at least 2.0 percent of two-engine airplanes, 2.3 percent for three-engine airplanes, and 2.6 percent for four-engine airplanes with—

* * * * *

(3) *Enroute.* The steady gradient of climb at an altitude of 1,500 feet above the takeoff or landing surface, as appropriate, must be at least 1.2 percent for two-engine airplanes, 1.5 percent for three-engine airplanes, and 1.7 percent for four-engine airplanes with—

* * * * *

(4) *Discontinued approach.* The steady gradient of climb at an altitude of 400 feet above the landing surface must be at least 2.1 percent for two-engine airplanes, 2.4 percent for three-engine airplanes, and 2.7 percent for four-engine airplanes, with—

* * * * *

15. Revise § 23.73 to read as follows:

§ 23.73 Reference landing approach speed.

(a) For normal, utility, and acrobatic category reciprocating engine-powered airplanes of 6,000 pounds or less maximum weight, the reference landing approach speed, V_{REF}, may not be less than the greater of V_{MC}, determined in § 23.149(b) with the wing flaps in the most extended takeoff position, and 1.3 V_{S1}.

(b) For normal, utility, and acrobatic category turbine powered airplanes of 6,000 pounds or less maximum weight, turboprops of more than 6,000 pounds maximum weight, and reciprocating engine-powered airplanes of more than 6,000 pounds maximum weight, the reference landing approach speed, V_{REF}, may not be less than the greater of V_{MC}, determined in § 23.149(c), and 1.3 V_{S1}.

(c) For normal, utility, and acrobatic category turbojet engine-powered airplanes of more than 6,000 pounds maximum weight and commuter category airplanes, the reference landing approach speed, V_{REF}, may not be less than the greater of 1.05 V_{MC}, determined in § 23.149(c), and 1.3 V_{S1}.

16. Amend § 23.77 by revising the introductory text of paragraphs (b) and (c) to read as follows:

§ 23.77 Balked landing.

* * * * *

(b) Each normal, utility, and acrobatic category reciprocating engine-powered and single engine turbine powered airplane of more than 6,000 pounds maximum weight, and multiengine turbine engine-powered airplane of 6,000 pounds or less maximum weight in the normal, utility, and acrobatic category must be able to maintain a steady gradient of climb of at least 2.5 percent with—

* * * * *

(c) Each normal, utility, and acrobatic multiengine turbine powered airplane over 6,000 pounds maximum weight and each commuter category airplane must be able to maintain a steady gradient of climb of at least 3.2 percent with—

* * * * *

17. Amend § 23.175 by adding a new paragraph (b)(3) to read as follows:

§ 23.175 Demonstration of static longitudinal stability.

* * * * *

(b) * * *

(3) *Maximum speed for stability characteristics, V_{FC}/M_{FC}.* V_{FC}/M_{FC} may not be less than a speed midway between V_{MO}/M_{MO} and V_{DF}/M_{DF} except that, for altitudes where Mach number is the limiting factor, M_{FC} need not exceed the Mach number at which effective speed warning occurs.

* * * * *

18. Amend § 23.177 by revising paragraphs (a), (b), and (d) to read as follows:

§ 23.177 Static directional and lateral stability.

(a)(1) The static directional stability, as shown by the tendency to recover from a wings level sideslip with the rudder free, must be positive for any landing gear and flap position appropriate to the takeoff, climb, cruise, approach, and landing configurations. This must be shown with symmetrical power up to maximum continuous power, and at speeds from 1.2 V_{S1} up to the landing gear or wing flap operating limit speeds, or V_{NO} or V_{FC}/M_{FC}, whichever is appropriate.

(2) The angle of sideslip for these tests must be appropriate to the type of airplane. The rudder pedal force may not reverse at larger angles of sideslip, up to that at which full rudder is used or a control force limit in § 23.143 is reached, whichever occurs first, and at speeds from 1.2 V_{S1} to V_O.

(b)(1) The static lateral stability, as shown by the tendency to raise the low wing in a sideslip with the aileron controls free, may not be negative for any landing gear and flap position appropriate to the takeoff, climb, cruise, approach, and landing configurations. This must be shown with symmetrical power from idle up to 75 percent of maximum continuous power at speeds from 1.2 V_{S1} in the takeoff configuration(s) and at speeds from 1.3 V_{S1} in other configurations, up to the maximum allowable airspeed for the configuration being investigated, (V_{FE},

V_{LE}, V_{NO}, V_{FC}/M_{FC}, whichever is appropriate) in the takeoff, climb, cruise, descent, and approach configurations. For the landing configuration, the power must be that necessary to maintain a 3-degree angle of descent in coordinated flight.

(2) The static lateral stability may not be negative at 1.2 V_{S1} in the takeoff configuration, or at 1.3 V_{S1} in other configurations.

(3) The angle of sideslip for these tests must be appropriate to the type of airplane, but in no case may the constant heading sideslip angle be less than that obtainable with a 10 degree bank or, if less, the maximum bank angle obtainable with full rudder deflection or 150 pound rudder force.

* * * * *

(d)(1) In straight, steady slips at 1.2 V_{S1} for any landing gear and flap position appropriate to the takeoff, climb, cruise, approach, and landing configurations, and for any symmetrical power conditions up to 50 percent of maximum continuous power, the aileron and rudder control movements and forces must increase steadily, but not necessarily in constant proportion, as the angle of sideslip is increased up to the maximum appropriate to the type of airplane.

(2) At larger slip angles, up to the angle at which the full rudder or aileron control is used or a control force limit contained in § 23.143 is reached, the aileron and rudder control movements and forces may not reverse as the angle of sideslip is increased.

(3) Rapid entry into, and recovery from, a maximum sideslip considered appropriate for the airplane may not result in uncontrollable flight characteristics.

19. Amend § 23.181 by revising paragraph (b) to read as follows:

§ 23.181 Dynamic stability.

* * * * *

(b) Any combined lateral-directional oscillations (''Dutch roll'') occurring between the stalling speed and the maximum allowable speed appropriate to the configuration of the airplane with the primary controls in both free and fixed position, must be damped to 1/10 amplitude in:

(1) Seven (7) cycles below 18,000 feet, and

(2) Thirteen (13) cycles from 18,000 feet to the certified maximum altitude.

* * * * *

20. Amend § 23.201 by revising paragraphs (d) and (e) and by adding a new paragraph (f) to read as follows:

§ 23.201 Wings level stall.

* * * * *

(d) During the entry into and the recovery from the maneuver, it must be possible to prevent more than 15 degrees of roll or yaw by the normal use of controls except as provided for in paragraph (e) of this section.

(e) For airplanes approved with a maximum operating altitude above 25,000 feet, during the entry into and the recovery from stalls performed above 25,000 feet, it must be possible to prevent more than 25 degrees of roll or yaw by the normal use of controls.

(f) Compliance with the requirements of this section must be shown under the following conditions:

(1) *Wing flaps:* Retracted, fully extended, and each intermediate normal operating position, as appropriate for the phase of flight.

(2) *Landing gear:* Retracted and extended as appropriate for the altitude.

(3) *Cowl flaps:* Appropriate to configuration.

(4) *Spoilers/speedbrakes:* Retracted and extended unless they have little to no effect at low speeds.

(5) *Power:*

(i) Power/Thrust off; and

(ii) For reciprocating engine powered airplanes: 75 percent maximum continuous power. However, if the power-to-weight ratio at 75 percent of maximum continuous power results in nose-high attitudes exceeding 30 degrees, the test must be carried out with the power required for level flight in the landing configuration at maximum landing weight and a speed of 1.4 V_{SO}, except that the power may not be less than 50 percent of maximum continuous power; or

(iii) For turbine engine powered airplanes: The maximum engine thrust, except that it need not exceed the thrust necessary to maintain level flight at 1.6 V_{S1} (where V_{S1} corresponds to the stalling speed with flaps in the approach position, the landing gear retracted, and maximum landing weight).

(6) *Trim* at 1.5 V_{S1} or the minimum trim speed, whichever is higher.

(7) *Propeller:* Full increase r.p.m. position for the power off condition.

21. Amend § 23.203 by revising paragraph (c) to read as follows:

§ 23.203 Turning flight and accelerated turning stalls.

* * * * *

(c) Compliance with the requirements of this section must be shown under the following conditions:

(1) *Wings flaps:* Retracted, fully extended, and each intermediate normal operating position as appropriate for the phase of flight.

(2) *Landing gear:* Retracted and extended as appropriate for the altitude.

(3) *Cowl flaps:* Appropriate to configuration.

(4) *Spoilers/speedbrakes:* Retracted and extended unless they have little to no effect at low speeds.

(5) *Power:*

(i) Power/Thrust off; and

(ii) For reciprocating engine powered airplanes: 75 percent maximum continuous power. However, if the power-to-weight ratio at 75 percent of maximum continuous power results in nose-high attitudes exceeding 30 degrees, the test may be carried out with the power required for level flight in the landing configuration at maximum landing weight and a speed of 1.4 V_{SO}, except that the power may not be less than 50 percent of maximum continuous power; or

(iii) For turbine engine powered airplanes: The maximum engine thrust, except that it need not exceed the thrust necessary to maintain level flight at 1.6 V_{S1} (where V_{S1} corresponds to the stalling speed with flaps in the approach position, the landing gear retracted, and maximum landing weight).

(6) *Trim:* The airplane trimmed at 1.5 V_{S1}.

(7) *Propeller:* Full increase rpm position for the power off condition.

22. Revise § 23.251 to read as follows:

§ 23.251 Vibration and buffeting.

(a) There may be no vibration or buffeting severe enough to result in structural damage, and each part of the airplane must be free from excessive vibration, under any appropriate speed and power conditions up to V_D/M_D, or V_{DF}/M_{DF} for turbojets. In addition, there may be no buffeting in any normal flight condition, including configuration changes during cruise, severe enough to interfere with the satisfactory control of the airplane or cause excessive fatigue to the flight crew. Stall warning buffeting within these limits is allowable.

(b) There may be no perceptible buffeting condition in the cruise configuration in straight flight at any speed up to V_{MO}/M_{MO}, except stall buffeting, which is allowable.

(c) For airplanes with M_D greater than M 0.6 and a maximum operating altitude greater than 25,000 feet, the positive maneuvering load factors at which the onset of perceptible buffeting occurs must be determined with the airplane in the cruise configuration for the ranges of airspeed or Mach number, weight, and altitude for which the airplane is to be certificated. The envelopes of load factor, speed, altitude, and weight must provide a sufficient range of speeds and load factors for normal operations. Probable inadvertent excursions beyond the boundaries of the buffet onset envelopes may not result in unsafe conditions.

23. Amend § 23.253 by revising paragraphs (b)(1) and (b)(2), and by adding a new paragraph (b)(3) to read as follows:

§ 23.253 High speed characteristics.

* * * * *

(b) * * *

(1) Exceptional piloting strength or skill;

(2) Exceeding V_D/M_D, or V_{DF}/M_{DF} for turbojet, the maximum speed shown under § 23.251, or the structural limitations; and

(3) Buffeting that would impair the pilot's ability to read the instruments or to control the airplane for recovery.

* * * * *

24. Section 23.255 is added to subpart B to read as follows:

§ 23.255 Out of trim characteristics.

For airplanes with an M_D greater than M 0.6 and that incorporate a trimmable horizontal stabilizer, the following requirements for out-of-trim characteristics apply:

(a) From an initial condition with the airplane trimmed at cruise speeds up to V_{MO}/M_{MO}, the airplane must have satisfactory maneuvering stability and controllability with the degree of out-of-trim in both the airplane nose-up and nose-down directions, which results from the greater of the following:

(1) A three-second movement of the longitudinal trim system at its normal rate for the particular flight condition with no aerodynamic load (or an equivalent degree of trim for airplanes that do not have a power-operated trim system), except as limited by stops in the trim system, including those required by § 23.655(b) for adjustable stabilizers; or

(2) The maximum mis-trim that can be sustained by the autopilot while maintaining level flight in the high speed cruising condition.

(b) In the out-of-trim condition specified in paragraph (a) of this section, when the normal acceleration is varied from +l g to the positive and negative values specified in paragraph (c) of this section, the following apply:

(1) The stick force versus g curve must have a positive slope at any speed up to and including V_{FC}/M_{FC}; and

(2) At speeds between V_{FC}/M_{FC} and V_{DF}/M_{DF}, the direction of the primary longitudinal control force may not reverse.

(c) Except as provided in paragraphs (d) and (e) of this section, compliance with the provisions of paragraph (a) of this section must be demonstrated in flight over the acceleration range as follows:

(1) −1 g to +2.5g; or

(2) 0 g to 2.0g, and extrapolating by an acceptable method to −1g and +2.5g.

(d) If the procedure set forth in paragraph (c)(2) of this section is used to demonstrate compliance and marginal conditions exist during flight test with regard to reversal of primary longitudinal control force, flight tests must be accomplished from the normal acceleration at which a marginal condition is found to exist to the applicable limit specified in paragraph (b)(1) of this section.

(e) During flight tests required by paragraph (a) of this section, the limit maneuvering load factors, prescribed in §§ 23.333(b) and 23.337, need not be exceeded. In addition, the entry speeds for flight test demonstrations at normal acceleration values less than 1g must be limited to the extent necessary to accomplish a recovery without exceeding V_{DF}/M_{DF}.

(f) In the out-of-trim condition specified in paragraph (a) of this section, it must be possible from an overspeed condition at V_{DF}/M_{DF} to produce at least 1.5g for recovery by applying not more than 125 pounds of longitudinal control force using either the primary longitudinal control alone or the primary longitudinal control and the longitudinal trim system. If the longitudinal trim is used to assist in producing the required load factor, it must be shown at V_{DF}/M_{DF} that the longitudinal trim can be actuated in the airplane nose-up direction with the primary surface loaded to correspond to the least of the following airplane nose-up control forces:

(1) The maximum control forces expected in service, as specified in §§ 23.301 and 23.397.

(2) The control force required to produce 1.5g.

(3) The control force corresponding to buffeting or other phenomena of such intensity that it is a strong deterrent to further application of primary longitudinal control force.

25. Amend § 23.561 by adding new paragraphs (e)(1) and (e)(2) to read as follows:

§ 23.561 General.

* * * * *

(e) * * *

(1) For turbojet engines mounted inside the fuselage, aft of the cabin, it must be shown by test or analysis that the engine and attached accessories, and the engine mounting structure—

(i) Can withstand a forward acting static ultimate inertia load factor of 18.0g plus the maximum takeoff engine thrust; or

(ii) The airplane structure is designed to deflect the engine and its attached accessories away from the cabin should the engine mounts fail.

(2) [Reserved]

26. Amend § 23.562 by revising paragraphs (a) introductory text, (b) introductory text, and (c)(5)(ii) to read as follows:

§ 23.562 Emergency landing dynamic conditions.

(a) Each seat/restraint system for use in a normal, utility, or acrobatic category airplane, or in a commuter category turbojet powered airplane, must be designed to protect each occupant during an emergency landing when—

* * * * *

(b) Except for those seat/restraint systems that are required to meet paragraph (d) of this section, each seat/restraint system for crew or passenger occupancy in a normal, utility, or acrobatic category airplane, or in a commuter category turbojet powered airplane, must successfully complete dynamic tests or be demonstrated by rational analysis supported by dynamic tests, in accordance with each of the following conditions. These tests must be conducted with an occupant simulated by an anthropomorphic test dummy (ATD) defined by 49 CFR part 572, subpart B, or an FAA-approved equivalent, with a nominal weight of 170 pounds and seated in the normal upright position.

* * * * *

(c) * * *

(5) * * *

(ii) The value of HIC is defined as—

$$HIC = \left\{ (t_2 - t_1) \left[\frac{1}{(t_2 - t_1)} \int_{t1}^{t2} a(t)\,dt \right]^{2.5} \right\}_{Max}$$

Where:

t_1 is the initial integration time, expressed in seconds, t_2 is the final integration time, expressed in seconds, and a(t) is the total acceleration vs. time curve for the head expressed as a multiple of g (units of gravity).

* * * * *

27. Amend § 23.571 by adding a new paragraph (d) to read as follows:

§ 23.571 Metallic pressurized cabin structures.

* * * * *

(d) If certification for operation above 41,000 feet is requested, a damage tolerance evaluation of the fuselage pressure boundary per § 23.573(b) must be conducted and the evaluation must factor in the environmental requirements of § 23.841.

28. Amend § 23.573 by adding a new paragraph (c) to read as follows:

§ 23.573 Damage tolerance and fatigue evaluation of structure.

* * * * *

(c) If certification for operation above 41,000 feet is requested, the damage tolerance evaluation of this paragraph for the fuselage pressure boundary must factor in the requirements of § 23.841.

29. Amend § 23.574 by adding a new paragraph (c) to read as follows:

§ 23.574 Metallic damage tolerance and fatigue evaluation of commuter category airplanes.

* * * * *

(c) If certification for operation above 41,000 feet is requested, the damage tolerance evaluation of this paragraph for the fuselage pressure boundary must factor in the requirements of § 23.841.

30. Amend § 23.629 by revising paragraphs (b)(1), (b)(3), (b)(4), and (c) to read as follows:

§ 23.629 Flutter.

* * * * *

(b) * * *

(1) Proper and adequate attempts to induce flutter have been made within the speed range up to V_D/M_D;

* * * * *

(3) A proper margin of damping exists at V_D/M_D, or V_{DF}/M_{DF} for turbojet airplanes; and

(4) As V_D/M_D (or V_{DF}/M_{DF} for turbojet airplanes) is approached, there may not be a large or rapid reduction in damping.

(c) Any rational analysis used to predict freedom from flutter, control reversal and divergence must cover all speeds up to 1.2 V_D/M_D, or 1.2 V_{DF}/M_{DF} for turbojet airplanes.

* * * * *

31. Amend § 23.703 by revising the introductory text and paragraph (b) to read as follows:

§ 23.703 Takeoff warning system.

For all airplanes with a maximum weight more than 6,000 pounds and all turbojet airplanes, unless it can be shown that a lift or longitudinal trim device that affects the takeoff performance of the airplane would not give an unsafe takeoff configuration when selected out of an approved takeoff position, a takeoff warning system must be installed and meet the following requirements:

* * * * *

(b) For the purpose of this section, an unsafe takeoff configuration is the inability to rotate or the inability to prevent an immediate stall after rotation.

32. Amend § 23.735 by revising paragraph (e) to read as follows:

§ 23.735 Brakes.

* * * * *

(e) For airplanes required to meet § 23.55, the rejected takeoff brake kinetic energy capacity rating of each main wheel brake assembly may not be less than the kinetic energy absorption requirements determined under either of the following methods—

(1) The brake kinetic energy absorption requirements must be based on a conservative rational analysis of the sequence of events expected during a rejected takeoff at the design takeoff weight.

(2) Instead of a rational analysis, the kinetic energy absorption requirements for each main wheel brake assembly may be derived from the following formula—

$$KE = 0.0443\ WV^2/N$$

Where:

KE = Kinetic energy per wheel (ft.-lbs.);
W = Design takeoff weight (lbs.);
V = Ground speed, in knots, associated with the maximum value of V_1 selected in accordance with § 23.51(c)(1);
N = Number of main wheels with brakes.

33. Amend § 23.777 by revising paragraph (d) to read as follows:

§ 23.777 Cockpit controls.

* * * * *

(d) When separate and distinct control levers are co-located (such as located together on the pedestal), the control location order from left to right must be power (thrust) lever, propeller (rpm control), and mixture control (condition lever and fuel cut-off for turbine-powered airplanes). Power (thrust) levers must be at least one inch higher or longer than propeller (rpm control) or mixture controls to make them more prominent. Carburetor heat or alternate air control must be to the left of the throttle or at least eight inches from the mixture control when located other than on a pedestal. Carburetor heat or alternate air control, when located on a pedestal, must be aft or below the power (thrust) lever. Supercharger controls must be located below or aft of the propeller controls. Airplanes with tandem seating or single-place airplanes may utilize control locations on the left side of the cabin compartment; however, location order from left to right must be power (thrust) lever, propeller (rpm control), and mixture control.

* * * * *

34. Amend § 23.807 by adding a new paragraph (e)(3) to read as follows:

§ 23.807 Emergency exits.

* * * * *

(e) * * *

(3) In lieu of paragraph (e)(2) of this section, if any side exit or exits cannot be above the waterline, a device may be placed at each of such exit(s) prior to ditching. This device must slow the inflow of water when such exit(s) is opened with the airplane in a ditching emergency. For commuter category airplanes, the clear opening of such exit or exits must meet the requirements defined in paragraph (d) of this section.

35. Amend § 23.831 by adding paragraphs (c) and (d) to read as follows:

§ 23.831 Ventilation.

* * * * *

(c) For turbojet powered pressurized airplanes, under normal operating conditions and in the event of any probable failure conditions of any system which would adversely affect the ventilating air, the ventilation system must provide reasonable passenger comfort. The ventilation system must also provide a sufficient amount of uncontaminated air to enable the crew members to perform their duties without undue discomfort or fatigue and to provide reasonable passenger comfort. For normal operating conditions, the ventilation system must be designed to provide each occupant with at least 0.55 pounds of fresh air per minute. In the event of the loss of one source of fresh air, the supply of fresh airflow must not be less than 0.4 pounds per minute for any period exceeding five minutes.

(d) Other probable and improbable Environmental Control System failure conditions that adversely affect the passenger and crew compartment environmental conditions may not affect crew performance so as to result in a hazardous condition, and no occupant shall sustain permanent physiological harm.

36. Amend § 23.841 by revising paragraphs (a) and (b)(6), and by adding paragraphs (c), (d), and (e) to read as follows:

§ 23.841 Pressurized cabins.

(a) If certification for operation above 25,000 feet is requested, the airplane must be able to maintain a cabin pressure altitude of not more than 15,000 feet, in the event of any probable failure condition in the pressurization system. During the decompression, the cabin altitude shall not exceed 15,000 feet for more than 10 seconds and 25,000 feet for any duration.

(b) * * *

(6) Warning indication at the pilot station to indicate when the safe or preset pressure differential is exceeded and when a cabin pressure altitude of 10,000 feet is exceeded. The 10,000 foot cabin altitude warning may be increased up to 15,000 feet for operations from high altitude airfields (10,000 to 15,000 feet) provided:

(i) The landing or the take off modes (normal or high altitude) are clearly indicated to the flight crew.

(ii) Selection of normal or high altitude airfield mode requires no crew action beyond normal pressurization system operation.

(iii) The pressurization system is designed to ensure cabin altitude does not exceed 10,000 feet when in flight above flight level (FL) 250.

(iv) The pressurization system and cabin altitude warning system is designed to ensure cabin altitude warning at 10,000 feet when in flight above FL250.

* * * * *

(c) If certification for operation above 41,000 feet and not more than 45,000 feet is requested,

(1) The airplane must prevent cabin pressure altitude from exceeding the following after decompression from any probable pressurization system failure in conjunction with any undetected, latent pressurization system failure condition:

(i) If depressurization analysis shows that the cabin altitude does not exceed 25,000 feet, the pressurization system must prevent the cabin altitude from exceeding the cabin altitude-time history shown in Figure 1 of this section.

(ii) Maximum cabin altitude is limited to 30,000 feet. If cabin altitude exceeds 25,000 feet, the maximum time the cabin altitude may exceed 25,000 feet is 2 minutes; time starting when the cabin altitude exceeds 25,000 feet and ending when it returns to 25,000 feet.

(2) The airplane must prevent cabin pressure altitude from exceeding the following after decompression from any single pressurization system failure in conjunction with any probable fuselage damage:

(i) If depressurization analysis shows that the cabin altitude does not exceed 37,000 feet, the pressurization system must prevent the cabin altitude from exceeding the cabin altitude-time history shown in Figure 2 of this section.

(ii) Maximum cabin altitude is limited to 40,000 feet. If cabin altitude exceeds 37,000 feet, the maximum time the cabin altitude may exceed 25,000 feet is 2 minutes; time starting when the cabin altitude exceeds 25,000 feet and ending when it returns to 25,000 feet.

(3) In showing compliance with paragraphs (c)(1) and (c)(2) of this section, it may be assumed that an emergency descent is made by an approved emergency procedure. A 17-second crew recognition and reaction time must be applied between cabin altitude warning and the initiation of an emergency descent. Fuselage structure, engine and system failures are to be considered in evaluating the cabin decompression.

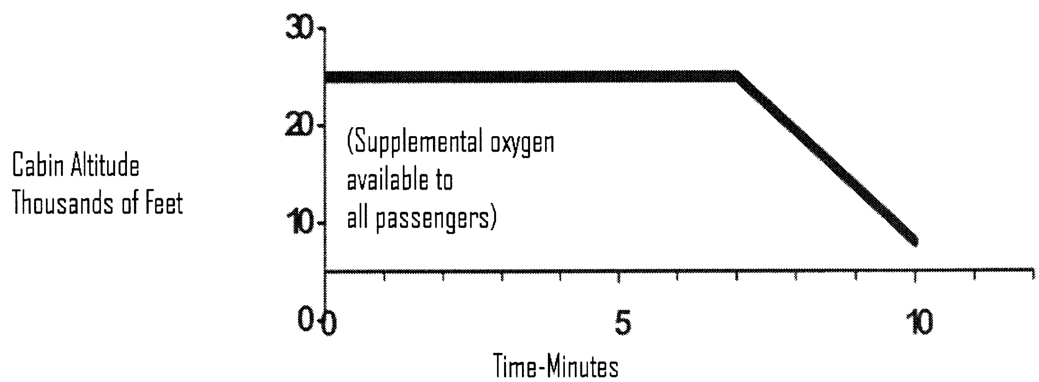

FIGURE 1—Cabin Altitude--Time History

Note: For Figure 1, time starts at the moment cabin altitude exceeds 10,000 feet during decompression.

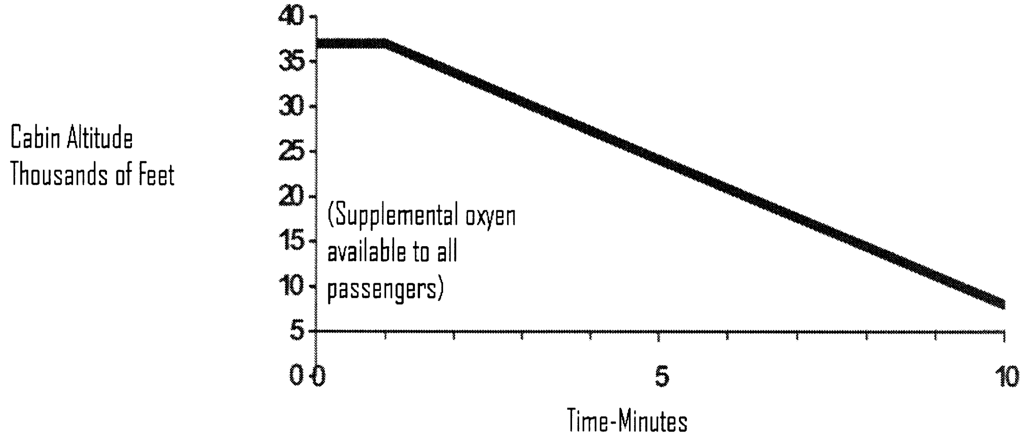

FIGURE 2—Cabin Altitude—Time History

Note: For Figure 2, time starts at the moment cabin altitude exceeds 10,000 feet during decompression.

(d) If certification for operation above 45,000 feet and not more than 51,000 feet is requested—

(1) Pressurized cabins must be equipped to provide a cabin pressure altitude of not more than 8,000 feet at the maximum operating altitude of the airplane under normal operating conditions.

(2) The airplane must prevent cabin pressure altitude from exceeding the following after decompression from any failure condition not shown to be extremely improbable:

(i) Twenty-five thousand (25,000) feet for more than 2 minutes, or

(ii) Forty thousand (40,000) feet for any duration.

(3) Fuselage structure, engine and system failures are to be considered in evaluating the cabin decompression.

(4) In addition to the cabin altitude indicating means in (b)(6) of this section, an aural or visual signal must be provided to warn the flight crew when the cabin pressure altitude exceeds 10,000 feet.

(5) The sensing system and pressure sensors necessary to meet the requirements of (b)(5), (b)(6), and (d)(4) of this section and § 23.1447(e), must, in the event of low cabin pressure, actuate the required warning and automatic presentation devices without any delay that would significantly increase the hazards resulting from decompression.

(e) If certification for operation above 41,000 feet is requested, additional damage-tolerance requirements are necessary to prevent fatigue damage that could result in a loss of pressure that exceeds the requirements of paragraphs (c) and (d) of this section. Sufficient full scale fatigue test evidence must be provided to demonstrate that this type of pressure loss due to fatigue cracking will not occur within the Limit of Validity of the Maintenance program for the airplane. In addition, a damage tolerance evaluation of the fuselage pressure boundary must be performed assuming visually detectable cracks and the maximum damage size for which the requirements of paragraphs (c) and (d) of this section can be met. Based on this evaluation, inspections or other procedures must be established and included in the Limitations Section of the Instructions for Continued Airworthiness required by § 23.1529.

37. Amend § 23.853 by revising paragraph (d)(2) to read as follows:

§ 23.853 Passenger and crew compartment interiors.

* * * * *

(d) * * *

(2) Lavatories must have ''No Smoking'' or ''No Smoking in Lavatory'' placards located conspicuously on each side of the entry door.

* * * * *

38. Add a new § 23.856 to read as follows:

§ 23.856 Thermal/Acoustic insulation materials.

Thermal/acoustic insulation material installed in the fuselage must meet the flame propagation test requirements of part II of Appendix F to this part, or other approved equivalent test requirements. This requirement does not apply to ''small parts,'' as defined in part I of Appendix F of this part.

39. Amend § 23.903 by revising paragraph (b)(2) to read as follows:

§ 23.903 Engines.

* * * * *

(b) * * *

(2) For engines embedded in the fuselage behind the cabin, the effects of a fan exiting forward of the inlet case (fan disconnect) must be addressed, the passengers must be protected, and the airplane must have the ability to maintain controlled flight and landing.

* * * * *

40. Amend § 23.1141 by adding a new paragraph (h) to read as follows:

§ 23.1141 Powerplant controls: General.

* * * * *

(h) Electronic engine control system installations must meet the requirements of § 23.1309.

41. Amend § 23.1165 by revising paragraph (f) to read as follows:

§ 23.1165 Engine ignition systems.

* * * * *

(f) In addition, for commuter category airplanes, each turbine engine ignition system must be an essential electrical load.

42. Amend § 23.1193 by revising paragraph (g) to read as follows:

§ 23.1193 Cowling and nacelle.

* * * * *

(g) In addition, for all turbojet airplanes and commuter category airplanes, the airplane must be designed so that no fire originating in any engine compartment can enter, either through openings or by burn through, any other region where it would create additional hazards.

43. Amend § 23.1195 by revising the introductory text of paragraph (a) and by revising paragraph (a)(2) to read as follows:

§ 23.1195 Fire extinguishing systems.

(a) For all turbojet airplanes and commuter category airplanes, fire extinguishing systems must be installed and compliance shown with the following:

* * * * *

(2) The fire extinguishing system, the quantity of the extinguishing agent, the rate of discharge, and the discharge distribution must be adequate to extinguish fires. An individual ''one shot'' system may be used, except for engine(s) embedded in the fuselage, where a ''two-shot'' system is required.

* * * * *

44. Amend § 23.1197 by revising the introductory text to read as follows:

§ 23.1197 Fire extinguishing agents.

For all turbojet airplanes and commuter category airplanes, the following applies:

* * * * *

45. Amend § 23.1199 by revising the introductory text to read as follows:

§ 23.1199 Extinguishing agent containers.

For all turbojet airplanes and commuter category airplanes, the following applies:

* * * * *

46. Amend § 23.1201 by revising the introductory text to read as follows:

§ 23.1201 Fire extinguishing systems materials.

For all turbojet airplanes and commuter category airplanes, the following apply:

* * * * *

47. Revise § 23.1301 by revising paragraphs (b) and (c) and by removing paragraph (d) to read as follows:

§ 23.1301 Function and installation.

* * * * *

(b) Be labeled as to its identification, function, or operating limitations, or any applicable combination of these factors; and

(c) Be installed according to limitations specified for that equipment.

48. Amend § 23.1303 by revising paragraph (c) to read as follows:

§ 23.1303 Flight and navigation instruments.

* * * * *

(c) A magnetic direction indicator.

* * * * *

49. Amend § 23.1305 by adding a new paragraph (f) to read as follows:

§ 23.1305 Powerplant instruments.

* * * * *

(f) Powerplant indicators must either provide trend or rate-of-change information, or have the ability to:

(1) Allow the pilot to assess necessary trend information quickly, including if and when this information is needed during engine restart;

(2) Allow the pilot to assess how close the indicated parameter is relative to a limit;

(3) Forewarn the pilot before the parameter reaches an operating limit; and

(4) For multiengine airplanes, allow the pilot to quickly and accurately compare engine-to-engine data.

50. Revise § 23.1307 to read as follows:

§ 23.1307 Miscellaneous equipment.

The equipment necessary for an airplane to operate at the maximum operating altitude and in the kinds of operations (*e.g.,* part 91, part 135) and meteorological conditions for which certification is requested and is approved in accordance with § 23.1559 must be included in the type design.

51. Revise § 23.1309 to read as follows:

§ 23.1309 Equipment, systems, and installations.

The requirements of this section, except as identified below, are applicable, in addition to specific design requirements of part 23, to any equipment or system as installed in the airplane. This section is a regulation of general requirements. It does not supersede any specific requirements contained in another section of part 23. This section should be used to determine software and hardware development assurance levels. This section does not apply to the performance, flight characteristics requirements of subpart B of this part, and structural loads and strength requirements of subparts C and D of this part, but it does apply to any system on which compliance with the requirements of subparts B, C, D, and E of this part are based. The flight structure such as wing, empennage, control surfaces and their simple, or simple and conventional systems, the fuselage, engine mounting, and landing gear and their related primary attachments are excluded. For example, it does not apply to an airplane's inherent stall characteristics or their evaluation of § 23.201, but it does apply to a stick pusher (stall barrier) system installed to attain compliance with § 23.201.

(a) The airplane equipment and systems must be designed and installed so that:

(1) Those required for type certification or by operating rules, or whose improper functioning would reduce safety, perform as intended under the airplane operating and environmental conditions, including radio frequency energy and the effects (both direct and indirect) of lightning strikes.

(2) Those required for type certification or by operating rules and other equipment and systems do not adversely affect the safety of the airplane or its occupants, or the proper functioning of those covered by paragraph (a)(1) of this section.

(3) For minor, major, hazardous, or catastrophic failure condition(s), the results of certification testing must not be inconsistent with the results of the safety analysis process.

(b) The airplane systems and associated components for the appropriate classes of airplane, considered separately and in relation to other systems, must be designed and installed so that:

(1) Each catastrophic failure condition is extremely improbable and does not result from a single failure;

(2) Each hazardous failure condition is extremely remote;

(3) Each major failure condition is remote; and

(4) Each failure condition meets the relationship among airplane classes, probabilities, severity of failure condition(s), and software and complex hardware development assurance levels shown in Appendix K of this part.

(5) Compliance with the requirements of paragraph (b)(2) of this section may be shown by analysis and, where necessary, by appropriate ground, flight, or simulator tests. The analysis must consider—

(i) Possible modes of failure, including malfunctions and damage from external sources;

(ii) The probability of multiple failures and the probability of undetected faults;

(iii) The resulting effects of the airplane and occupants, considering the stage of flight and operating conditions; and

(iv) The crew warning cues, corrective action required, and the crew's capability of determining faults.

(c) Functional failure condition(s) that are classified as minor do not require a quantitative analysis, but verification by a design and installation appraisal is required.

(d) Systems with major failure condition(s)—

(1) May be verified by a qualitative analysis, if the systems are simple, simple and conventional, or conventional and redundant.

(2) Must be verified by a qualitative and quantitative analysis, if the systems

do not meet the condition(s) prescribed in paragraph (d)(1) of this section.

(e) Systems with hazardous or catastrophic failure condition(s)—

(1) May be verified by a qualitative and quantitative analysis, if the systems are simple and conventional.

(2) Must be verified by a qualitative and quantitative analysis if the systems are not simple and conventional.

(f) Information concerning an unsafe system operating condition(s) must be provided to the crew to enable them to take appropriate corrective action. A warning indication must be provided if immediate corrective action is required. Systems and controls, including indications and annunciations must be designed to minimize crew errors, which could create additional hazards.

52. Add a new § 23.1310 to read as follows:

§ 23.1310 Power source capacity and distribution.

(a) Each item of equipment, each system, and each installation whose functioning is required by this chapter and that requires a power supply is an ''essential load'' on the power supply. The power sources and the system must be able to supply the following power loads in probable operating combinations and for probable durations:

(1) Loads connected to the power distribution system with the system functioning normally.

(2) Essential loads after failure of—

(i) Any one engine on two-engine airplanes, or

(ii) Any two engines on an airplane with three or more engines, or

(iii) Any power converter or energy storage device.

(3) Essential loads for which an alternate source of power is required, as applicable, by the operating rules of this chapter, after any failure or malfunction in any one power supply system, distribution system, or other utilization system.

(b) In determining compliance with paragraph (a)(2) of this section, the power loads may be assumed to be reduced under a monitoring procedure consistent with safety in the kinds of operations authorized. Loads not required in controlled flight need not be considered for the two-engine-inoperative condition on airplanes with three or more engines.

53. Amend § 23.1311 by revising paragraphs (a)(5), (a)(6), (a)(7), and paragraph (b) to read as follows:

§ 23.1311 Electronic display instrument systems.

(a) * * *

(5) Have an independent magnetic direction indicator and an independent secondary mechanical altimeter, airspeed indicator, and attitude instrument or electronic display parameters for the altitude, airspeed, and attitude that are independent from the airplane's primary electrical power system. These secondary instruments may be installed in panel positions that are displaced from the primary positions specified by § 23.1321(d), but must be located where they meet the pilot's visibility requirements of § 23.1321(a).

(6) Incorporate sensory cues that provide a quick glance sense of rate and, when appropriate, trend information to the pilot.

(7) Incorporate equivalent visual displays of the instrument markings required by §§ 23.1541 through 23.1553, or visual displays that alert the pilot to abnormal operational values or approaches to established limitation values, for each parameter required to be displayed by this part.

(b) The electronic display indicators, including their systems and installations, and considering other airplane systems, must be designed so that one display of information essential for continued safe flight and landing will be available within one second to the crew with a single pilot action or by automatic means for continued safe operation, after any single failure or probable combination of failures.

* * * * *

54. Amend § 23.1323 by revising paragraph (e) to read as follows:

§ 23.1323 Airspeed indicating system.

* * * * *

(e) In addition, for normal, utility, and acrobatic category multiengine turbojet airplanes of more than 6,000 pounds maximum weight and commuter category airplanes, each system must be calibrated to determine the system error during the accelerate-takeoff ground run. The ground run calibration must be determined—

(1) From 0.8 of the minimum value of V_1 to the maximum value of V_2, considering the approved ranges of altitude and weight, and

(2) The ground run calibration must be determined assuming an engine failure at the minimum value of V_1.

* * * * *

55. Amend § 23.1331 by revising paragraph (c) to read as follows:

§ 23.1331 Instruments using a power source.

* * * * *

(c) For certification for Instrument Flight Rules (IFR) operations and for the heading, altitude, airspeed, and attitude, there must be at least:

(1) Two independent sources of power (not driven by the same engine on multiengine airplanes), and a manual or an automatic means to select each power source; or

(2) An additional display of parameters for heading, altitude, airspeed, and attitude that is independent from the airplane's primary electrical power system.

56. Amend § 23.1353 by revising paragraph (h) to read as follows:

§ 23.1353 Storage battery design and installation.

* * * * *

(h) In the event of a complete loss of the primary electrical power generating system, the battery must be capable of providing electrical power to those loads that are essential to continued safe flight and landing for:

(1) At least 30 minutes for airplanes that are certificated with a maximum altitude of 25,000 feet or less, and

(2) At least 60 minutes for airplanes that are certificated with a maximum altitude over 25,000 feet.

57. Revise § 23.1443 to read as follows:

§ 23.1443 Minimum mass flow of supplemental oxygen.

(a) If the airplane is to be certified above 40,000 feet, a continuous flow oxygen system must be provided for each passenger and crewmember.

(b) If continuous flow oxygen equipment is installed, an applicant must show compliance with the requirements of either paragraphs (b)(1) and (b)(2) or paragraph (b)(3) of this section:

(1) For each passenger, the minimum mass flow of supplemental oxygen required at various cabin pressure altitudes may not be less than the flow required to maintain, during inspiration and while using the oxygen equipment (including masks) provided, the following mean tracheal oxygen partial pressures:

(i) At cabin pressure altitudes above 10,000 feet up to and including 18,500 feet, a mean tracheal oxygen partial pressure of 100mm Hg when breathing 15 liters per minute, Body Temperature, Pressure, Saturated (BTPS) and with a tidal volume of 700cc with a constant time interval between respirations.

(ii) At cabin pressure altitudes above 18,500 feet up to and including 40,000 feet, a mean tracheal oxygen partial pressure of 83.8mm Hg when breathing 30 liters per minute, BTPS, and with a tidal volume of 1,100cc with a constant time interval between respirations.

Cabin Pressure Altitude Thousands of Feet.

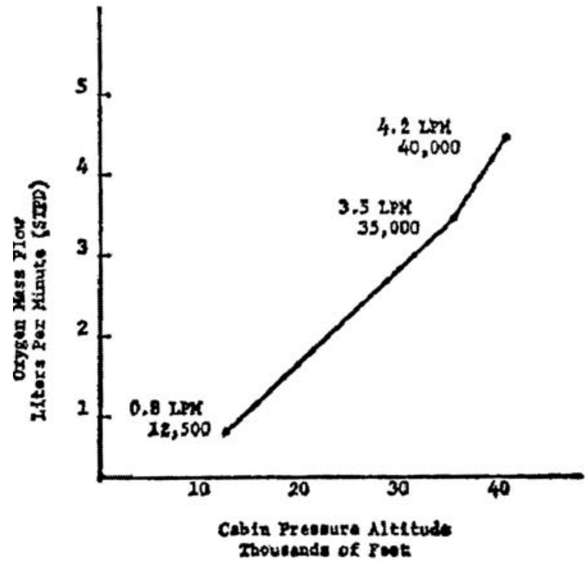

FIGURE 1--Cabin Pressure Altitude

(2) For each flight crewmember, the minimum mass flow may not be less than the flow required to maintain, during inspiration, a mean tracheal oxygen partial pressure of 149mm Hg when breathing 15 liters per minute, BTPS, and with a maximum tidal volume of 700cc with a constant time interval between respirations.

(3) The minimum mass flow of supplemental oxygen supplied for each user must be at a rate not less than that shown in the following figure for each altitude up to and including the maximum operating altitude of the airplane.

(c) If demand equipment is installed for use by flight crewmembers, the minimum mass flow of supplemental oxygen required for each flight crewmember may not be less than the flow required to maintain, during inspiration, a mean tracheal oxygen partial pressure of 122mm Hg up to and including a cabin pressure altitude of 35,000 feet, and 95 percent oxygen between cabin pressure altitudes of 35,000 and 40,000 feet, when breathing 20 liters per minutes BTPS. In addition, there must be means to allow the crew to use undiluted oxygen at their discretion.

(d) If first-aid oxygen equipment is installed, the minimum mass flow of oxygen to each user may not be less than 4 liters per minute, STPD. However, there may be a means to decrease this flow to not less than 2 liters per minute, STPD, at any cabin altitude. The quantity of oxygen required is based upon an average flow rate of 3 liters per minute per person for whom first-aid oxygen is required.

(e) As used in this section:

(1) BTPS means Body Temperature, and Pressure, Saturated (which is 37 °C, and the ambient pressure to which the body is exposed, minus 47mm Hg, which is the tracheal pressure displaced by water vapor pressure when the breathed air becomes saturated with water vapor at 37 °C).

(2) STPD means Standard Temperature and Pressure, Dry (which is 0 °C at 760mm Hg with no water vapor).

58. Amend § 23.1445 by adding a new paragraph (c) to read as follows:

§ 23.1445 Oxygen distribution system.

* * * * *

(c) If the flight crew and passengers share a common source of oxygen, a means to separately reserve the minimum supply required by the flight crew must be provided.

59. Amend § 23.1447 by adding a new paragraph (g) to read as follows:

§ 23.1447 Equipment standards for oxygen dispensing units.

* * * * *

(g) If the airplane is to be certified for operation above 40,000 feet, a quick-donning oxygen mask system, with a pressure demand, mask mounted regulator must be provided for the flight crew. This dispensing unit must be immediately available to the flight crew when seated at their station and installed so that it:

(1) Can be placed on the face from its ready position, properly secured, sealed, and supplying oxygen upon demand, with one hand, within five seconds and without disturbing eyeglasses or causing delay in proceeding with emergency duties, and

(2) Allows, while in place, the performance of normal communication functions.

60. Amend § 23.1505 by revising paragraph (c) to read as follows:

§ 23.1505 Airspeed limitations.

* * * * *

(c) Paragraphs (a) and (b) of this section do not apply to turbine airplanes or the airplanes for which a design diving speed V_D/M_D is established under § 23.335(b)(4). For those airplanes, a maximum operating limit speed (V_{MO}/M_{MO} airspeed or Mach number, whichever is critical at a particular altitude) must be established as a speed that may not be deliberately exceeded in any regime of flight (climb, cruise, or descent) unless a higher speed is authorized for flight test or pilot training operations. V_{MO}/M_{MO} must be established so that it is not greater than the design cruising speed V_C/M_C and so that it is sufficiently below V_D/M_D, or V_{DF}/M_{DF} for turbojets, and the maximum speed shown under § 23.251 to make it highly improbable that the latter speeds will be inadvertently exceeded in operations. The speed margin between V_{MO}/M_{MO} and V_D/M_D, or V_{DF}/M_{DF} for turbojets, may not be less than that determined under § 23.335(b), or the speed margin found necessary in the flight tests conducted under § 23.253.

61. Revise § 23.1525 to read as follows:

§ 23.1525 Kinds of operation.

The kinds of operation authorized (*e.g.*, VFR, IFR, day, night, part 91, part 135) and the meteorological conditions (*e.g.*, icing) to which the operation of the airplane is limited or from which it is prohibited, must be established appropriate to the installed equipment.

62. Amend § 23.1545 by revising paragraph (d) to read as follows:

§ 23.1545 Airspeed indicator.

* * * * *

(d) Paragraphs (b)(1) through (b)(4) and paragraph (c) of this section do not apply to airplanes for which a maximum operating speed V_{MO}/M_{MO} is established under § 23.1505(c). For those airplanes, there must either be a maximum allowable airspeed indication showing the variation of V_{MO}/M_{MO} with altitude or compressibility limitations (as appropriate), or a radial red line marking for V_{MO}/M_{MO} must be made at the lowest value of V_{MO}/M_{MO} established for any altitude up to the maximum operating altitude for the airplane.

63. Amend § 23.1555 by adding a new paragraph (d)(3) to read as follows:

§ 23.1555 Control markings.

* * * * *

(d) * * *

(3) For fuel systems having a calibrated fuel quantity indication system complying with § 23.1337(b)(1) and accurately displaying the actual quantity of usable fuel in each selectable tank, no fuel capacity placards outside of the fuel quantity indicator are required.

* * * * *

64. Amend § 23.1559 by adding a new paragraph (d) to read as follows:

§ 23.1559 Operating limitations placard.

* * * * *

(d) The placard(s) required by this section need not be lighted.

65. Amend § 23.1563 by adding a new paragraph (d) to read as follows:

§ 23.1563 Airspeed placards.

* * * * *

(d) The airspeed placard required by this section need not be lighted if the landing gear operating speed is indicated on the airspeed indicator or other lighted area such as the landing gear control and the airspeed indicator has features such as low speed awareness that provide ample warning prior to V_{MC}.

66. Amend § 23.1567 by adding a new paragraph (e) to read as follows:

§ 23.1567 Flight maneuver placard.

* * * * *

(e) The placards required by this section need not be lighted.

67. Amend § 23.1583 as follows:

a. Revise the introductory text of paragraphs (c)(3) and (c)(4);

b. Redesignate paragraphs (c)(4)(iii) and (c)(4)(iv) as paragraphs (c)(4)(ii)(A) and (c)(4)(ii)(B); and

c. Revise paragraph (c)(5) introductory text to read as follows:

§ 23.1583 Operating limitations.

* * * * *

(c) * * *

(3) For reciprocating engine-powered airplanes of more than 6,000 pounds maximum weight, single-engine turbines, and multiengine turbine airplanes 6,000 pounds or less maximum weight in the normal, utility, and acrobatic category, performance operating limitations as follows—

* * * * *

(4) For normal, utility, and acrobatic category multiengine turbojet powered airplanes over 6,000 pounds and commuter category airplanes, the maximum takeoff weight for each airport altitude and ambient temperature within the range selected by the applicant at which—

* * * * *

(5) For normal, utility, and acrobatic category multiengine turbojet powered airplanes over 6,000 pounds and commuter category airplanes, the maximum landing weight for each airport altitude within the range selected by the applicant at which—

* * * * *

68. Amend § 23.1585 by revising paragraph (f) introductory text to read as follows:

§ 23.1585 Operating procedures.

* * * * *

(f) In addition to paragraphs (a) and (c) of this section, for normal, utility, and acrobatic category multiengine turbojet powered airplanes over 6,000 pounds, and commuter category airplanes, the information must include the following:

* * * * *

69. Amend § 23.1587 by revising paragraph (d) introductory text to read as follows:

§ 23.1587 Performance information.

* * * * *

(d) In addition to paragraph (a) of this section, for normal, utility, and acrobatic category multiengine turbojet powered airplanes over 6,000 pounds, and commuter category airplanes, the following information must be furnished—

* * * * *

70. Amend Appendix F to Part 23 by:

a. Redesignating the existing text as Part I and adding a new Part I heading;

b. Removing the introductory paragraph; and

c. Adding a new Part II.

The additions read as follows:

APPENDIX F TO PART 23—TEST PROCEDURE

Part I—Acceptable Test Procedure for Self-Extinguishing Materials for Showing Compliance With §§ 23.853, 23.855 and 23.1359

* * * * *

Part II—Test Method To Determine the Flammability and Flame Propagation Characteristics of Thermal/Acoustic Insulation Materials

Use this test method to evaluate the flammability and flame propagation characteristics of thermal/acoustic insulation when exposed to both a radiant heat source and a flame.

(a) *Definitions.*

''*Flame propagation*'' means the furthest distance of the propagation of visible flame towards the far end of the test specimen, measured from the midpoint of the ignition source flame. Measure this distance after initially applying the ignition source and before all flame on the test specimen is extinguished. The measurement is not a determination of burn length made after the test.

''*Radiant heat source*'' means an electric or air propane panel.

''*Thermal/acoustic insulation''* means a material or system of materials used to provide thermal and/or acoustic protection. Examples include fiberglass or other batting material encapsulated by a film covering and foams.

''Zero point'' means the point of application of the pilot burner to the test specimen.

(b) *Test apparatus.*

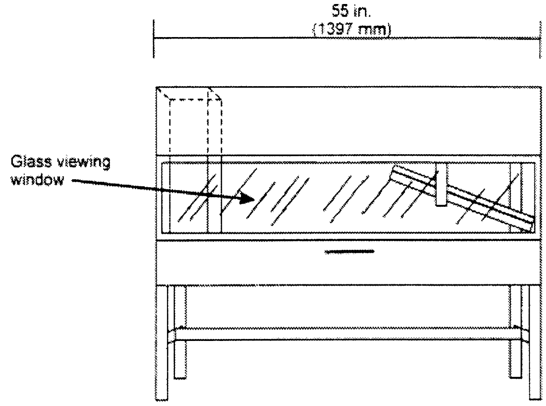

FIGURE F1—Radiant Panel Test Chamber

(1) *Radiant panel test chamber.* Conduct tests in a radiant panel test chamber (see figure F1 above). Place the test chamber under an exhaust hood to facilitate clearing the chamber of smoke after each test. The radiant panel test chamber must be an enclosure 55 inches (1397 mm) long by 19.5 (495 mm) deep by 28 (710 mm) to 30 inches (maximum) (762 mm) above the test specimen. Insulate the sides, ends, and top with a fibrous ceramic insulation, such as Kaowool MTM board. On the front side, provide a 52 by 12-inch (1321 by 305 mm) draft-free, high-temperature, glass window for viewing the sample during testing. Place a door below the window to provide access to the movable specimen platform holder. The bottom of the test chamber must be a sliding steel platform that has provision for securing the test specimen holder in a fixed and level position. The chamber must have an internal chimney with exterior dimensions of 5.1 inches (129 mm) wide, by 16.2 inches (411 mm) deep by 13 inches (330 mm) high at the opposite end of the chamber from the radiant energy source. The interior dimensions must be 4.5 inches (114 mm) wide by 15.6 inches (395 mm) deep. The chimney must extend to the top of the chamber (*see* figure F2).

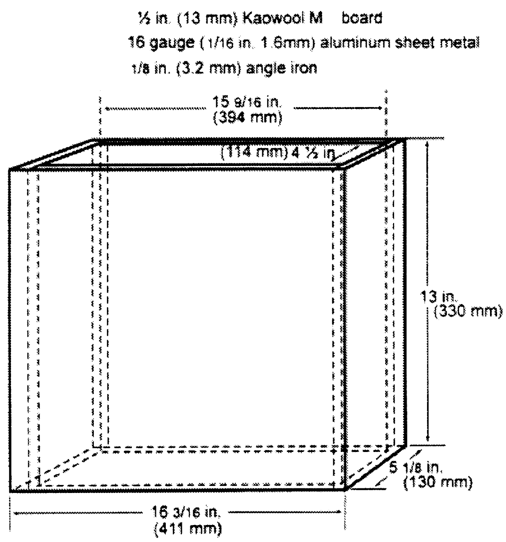

FIGURE F2—Internal Chimney

(2) *Radiant heat source.* Mount the radiant heat energy source in a cast iron frame or equivalent. An electric panel must have six, 3-inch wide emitter strips. The emitter strips must be perpendicular to the length of the panel. The panel must have a radiation surface of 12 ⅞ by 18 ½ inches (327 by 470 mm). The panel must be capable of operating at temperatures up to 1300 °F (704 °C). An air propane panel must be made of a porous refractory material and have a radiation surface of 12 by 18 inches (305 by 457 mm). The panel must be capable of operating at temperatures up to 1,500 °F (816 °C). *See* figures 3a and 3b.

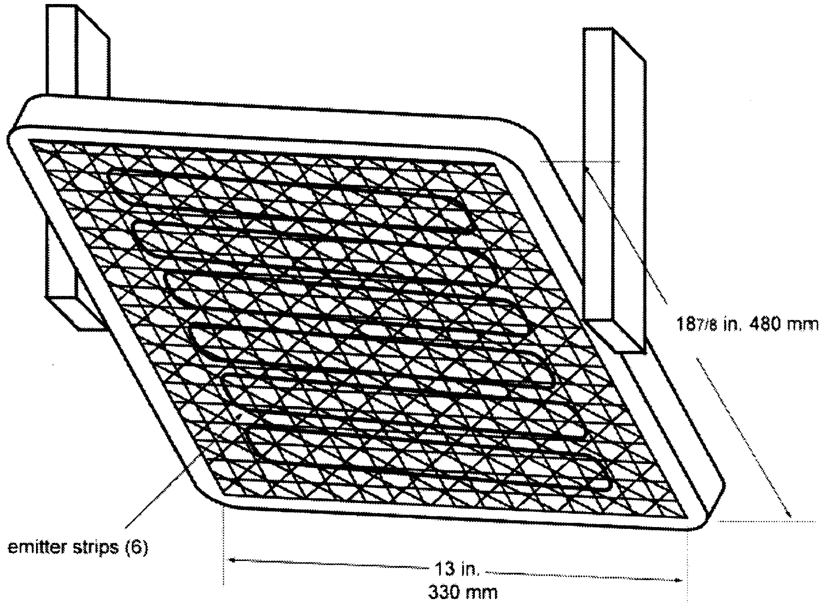

FIGURE F3A—Electric Panel

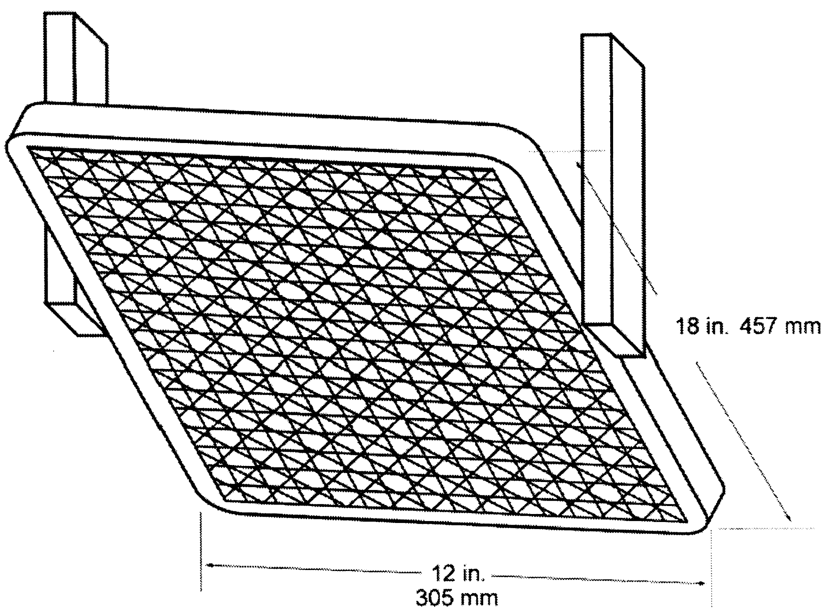

FIGURE F3b—Air Propane Radiant Panel

(i) *Electric radiant panel.* The radiant panel must be 3-phase and operate at 208 volts. A single-phase, 240 volt panel is also acceptable. Use a solid-state power controller and microprocessor-based controller to set the electric panel operating parameters.

(ii) *Gas radiant panel.* Use propane (liquid petroleum gas—2.1 UN 1075) for the radiant panel fuel. The panel fuel system must consist of a venturi-type aspirator for mixing gas and air at approximately atmospheric pressure. Provide suitable instrumentation for monitoring and controlling the flow of fuel and air to the panel. Include an air flow gauge, an air flow regulator, and a gas pressure gauge.

(iii) *Radiant panel placement.* Mount the panel in the chamber at 30 degrees to the horizontal specimen plane, and 7½ inches above the zero point of the specimen.

(3) *Specimen holding system.*

(i) The sliding platform serves as the housing for test specimen placement. Brackets may be attached (via wing nuts) to the top lip of the platform in order to accommodate various thicknesses of test specimens. Place the test specimens on a sheet of Kaowool MTM board or 1260 Standard Board (manufactured by Thermal Ceramics and available in Europe), or equivalent, either resting on the bottom lip of the sliding platform or on the base of the brackets. It may be necessary to use multiple sheets of material based on the thickness of the test specimen (to meet the sample height requirement). Typically, these non-combustible sheets of material are available in ¼ inch (6 mm) thicknesses. *See* figure F4. A sliding platform that is deeper than the 2-

inch (50.8 mm) platform shown in figure F4 is also acceptable as long as the sample height requirement is met.

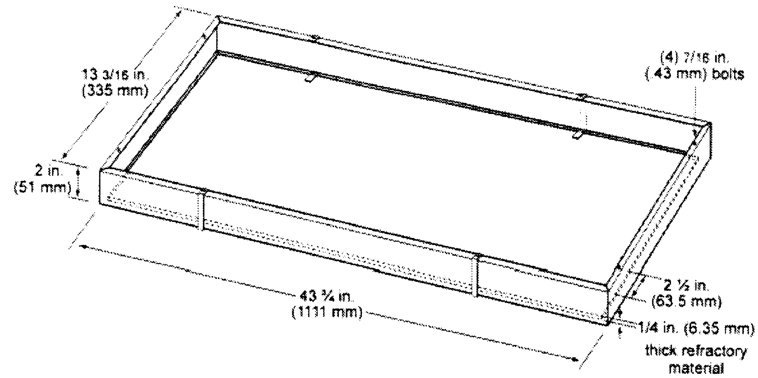

FIGURE F4—Sliding Platform

(ii) Attach a ½ inch (13 mm) piece of Kaowool MTM board or other high temperature material measuring 41½ by 8¼ inches (1054 by 210 mm) to the back of the platform. This board serves as a heat retainer and protects the test specimen from excessive preheating. The height of this board must not impede the sliding platform movement (in and out of the test chamber). If the platform has been fabricated such that the back side of the platform is high enough to prevent excess preheating of the specimen when the sliding platform is out, a retainer board is not necessary.

(iii) Place the test specimen horizontally on the non-combustible board(s). Place a steel retaining/securing frame fabricated of mild steel, having a thickness of ⅛ inch (3.2 mm) and overall dimensions of 23 by 13⅛ inches (584 by 333 mm) with a specimen opening of 19 by 10¾ inches (483 by 273 mm) over the test specimen. The front, back, and right portions of the top flange of the frame must rest on the top of the sliding platform, and the bottom flanges must pinch all 4 sides of the test specimen. The right bottom flange must be flush with the sliding platform. *See* figure F5.

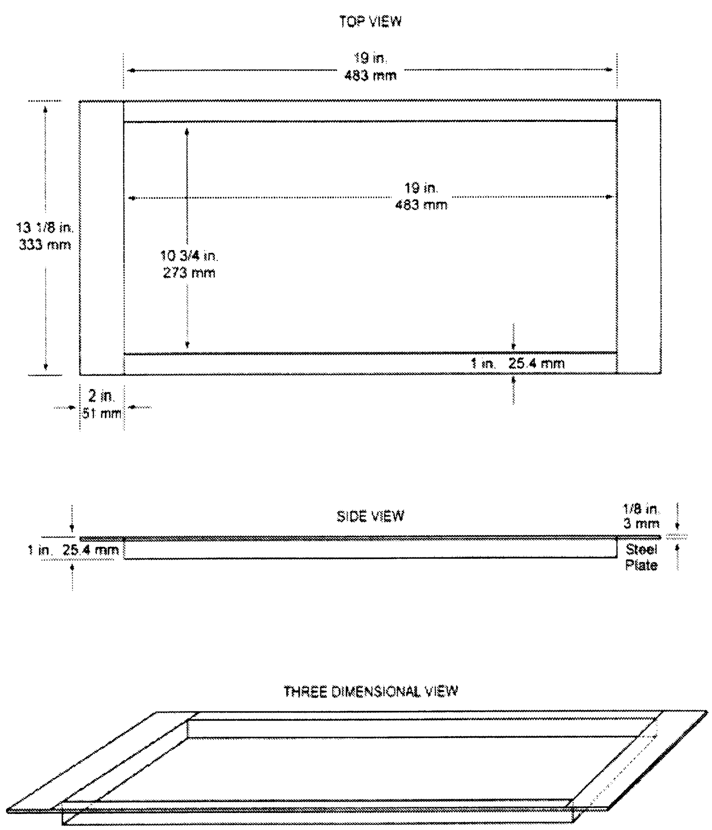

FIGURE F5: 3 Views

(4) *Pilot Burner.* The pilot burner used to ignite the specimen must be a BernzomaticTM commercial propane venturi torch with an axially symmetric burner tip and a propane supply tube with an orifice diameter of 0.006 inches (0.15 mm). The length of the burner tube must be 2⅞ inches (71 mm). The propane flow must be adjusted via gas pressure through an in-line regulator to produce a blue inner cone length of ¾ inch (19 mm). A ¾ inch (19 mm) guide (such as a thin strip of metal) may be soldered to the top of the burner to aid in setting the flame height. The overall flame length must be approximately 5 inches long (127 mm). Provide a way to move the burner out of the ignition position so that the flame is horizontal and at least 2 inches (50 mm) above the specimen plane. *See* figure F6.

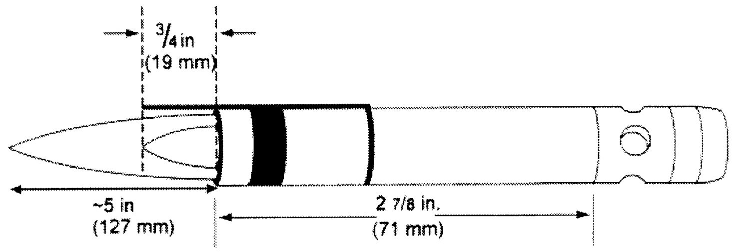

FIGURE F6—Propane Pilot Burner

(5) *Thermocouples.* Install a 24 American Wire Gauge (AWG) Type K (Chromel-Alumel) thermocouple in the test chamber for temperature monitoring. Insert it into the chamber through a small hole drilled through the back of the chamber. Place the thermocouple so that it extends 11 inches (279 mm) out from the back of the chamber wall, 11½ inches (292 mm) from the right side of the chamber wall, and is 2 inches (51 mm) below the radiant panel. The use of other thermocouples is optional.

(6) *Calorimeter.* The calorimeter must be a one-inch cylindrical water-cooled, total heat flux density, foil type Gardon Gage that has a range of 0 to 5 BTU/ft^2 -second (0 to 5.7 Watts/cm^2).

(7) *Calorimeter calibration specification and procedure.*

(i) Calorimeter specification.

(A) Foil diameter must be 0.25 ± 0.005 inches (6.35 ± 0.13 mm).

(B) Foil thickness must be 0.0005 ± 0.0001 inches (0.013 ± 0.0025 mm).

(C) Foil material must be thermocouple grade Constantan.

(D) Temperature measurement must be a Copper Constantan thermocouple.

(E) The copper center wire diameter must be 0.0005 inches (0.013 mm).

(F) The entire face of the calorimeter must be lightly coated with ''Black Velvet'' paint having an emissivity of 96 or greater.

(ii) Calorimeter calibration.

(A) The calibration method must be by comparison to a like standardized transducer.

(B) The standardized transducer must meet the specifications given in paragraph VI(b)(6) of this appendix.

(C) Calibrate the standard transducer against a primary standard traceable to the National Institute of Standards and Technology (NIST).

(D) The method of transfer must be a heated graphite plate.

(E) The graphite plate must be electrically heated, have a clear surface area on each side of the plate of at least 2 by 2 inches (51 by 51 mm), and be ⅛ inch ± 1⁄16 inch thick (3.2 ± 1.6 mm).

(F) Center the 2 transducers on opposite sides of the plates at equal distances from the plate.

(G) The distance of the calorimeter to the plate must be no less than 0.0625 inches (1.6 mm), nor greater than 0.375 inches (9.5 mm).

(H) The range used in calibration must be at least 0–3.5 BTUs/ft^2 second (0–3.9 Watts/cm^2) and no greater than 0–5.7 BTUs/ft^2 second (0–6.4 Watts/cm^2).

(I) The recording device used must record the 2 transducers simultaneously or at least within 1⁄10 of each other.

(8) *Calorimeter fixture.* With the sliding platform pulled out of the chamber, install the calorimeter holding frame and place a sheet of non-combustible material in the bottom of the sliding platform adjacent to the holding frame. This will prevent heat losses during calibration. The frame must be 13⅛ inches (333 mm) deep (front to back) by 8 inches (203 mm) wide and must rest on the top of the sliding platform. It must be fabricated of ⅛ inch (3.2 mm) flat stock steel and have an opening that accommodates a ½ inch (12.7 mm) thick piece of refractory board, which is level with the top of the sliding platform. The board must have three 1-inch (25.4 mm) diameter holes drilled through the board for calorimeter insertion. The distance to the radiant panel surface from the centerline of the first hole (''zero'' position) must be 7½ ± ⅛ inches (191 ± 3 mm). The distance between the centerline of the first hole to the centerline of the second hole must be 2 inches (51 mm). It must also be the same distance from the centerline of the second hole to the centerline of the third hole. See figure F7. A calorimeter holding frame that differs in construction is acceptable as long as the height from the centerline of the first hole to the radiant panel and the distance between holes is the same as described in this paragraph.

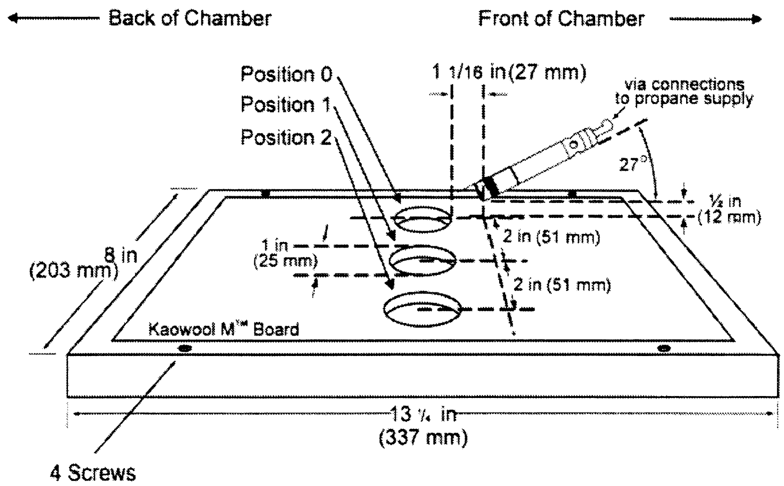

FIGURE F7—Calorimeter Holding Frame

(9) *Instrumentation.* Provide a calibrated recording device with an appropriate range or a computerized data acquisition system to measure and record the outputs of the calorimeter and the thermocouple. The data acquisition system must be capable of recording the calorimeter output every second during calibration.

(10) *Timing device.* Provide a stopwatch or other device, accurate to ± 1 second/hour, to measure the time of application of the pilot burner flame.

(c) *Test specimens.*

(1) *Specimen preparation.* Prepare and test a minimum of three test specimens. If an oriented film cover material is used, prepare and test both the warp and fill directions.

(2) *Construction.* Test specimens must include all materials used in construction of the insulation (including batting, film, scrim, tape, *etc.*). Cut a piece of core material such as foam or fiberglass, and cut a piece of film cover material (if used) large enough to cover the core material. Heat sealing is the preferred method of preparing fiberglass samples, since they can be made without compressing the fiberglass (''box sample''). Cover materials that are not heat sealable may be stapled, sewn, or taped as long as the cover material is over-cut enough to be drawn down the sides without compressing the core material. The fastening means should be as continuous as possible along the length of the seams. The specimen thickness must be of the same thickness as installed in the airplane.

(3) *Specimen Dimensions.* To facilitate proper placement of specimens in the sliding platform housing, cut non-rigid core materials, such as fiberglass, 12½ inches (318 mm) wide by 23 inches (584 mm) long. Cut rigid materials, such as foam, 11½ ± ¼ inches (292 mm ± 6 mm) wide by 23 inches (584 mm) long in order to fit properly in the sliding platform housing and provide a flat, exposed surface equal to the opening in the housing.

(d) *Specimen conditioning.* Condition the test specimens at 70 ± 5 °F (21 ± 2 °C) and 55 percent ± 10 percent relative humidity, for a minimum of 24 hours prior to testing.

(e) *Apparatus Calibration.*

(1) With the sliding platform out of the chamber, install the calorimeter holding frame. Push the platform back into the chamber and insert the calorimeter into the first hole (''zero'' position). *See* figure F7. Close the bottom door located below the sliding platform. The distance from the centerline of the calorimeter to the radiant panel surface at this point must be 7½ inches ± ⅛ (191 mm ± 3). Before igniting the radiant panel, ensure that the calorimeter face is clean and that there is water running through the calorimeter.

(2) Ignite the panel. Adjust the fuel/air mixture to achieve 1.5 BTUs/feet^2 − second ± 5 percent (1.7 Watts/cm^2 ± 5 percent) at the ''zero'' position. If using an electric panel, set the power controller to achieve the proper heat flux. Allow the unit to reach steady state (this may take up to 1 hour). The pilot burner must be off and in the down position during this time.

(3) After steady-state conditions have been reached, move the calorimeter 2 inches (51 mm) from the ''zero'' position (first hole) to position 1 and record the heat flux. Move the calorimeter to position 2 and record the heat flux. Allow enough time at each position for the calorimeter to stabilize. Table 1 depicts typical calibration values at the three positions.

TABLE 1—CALIBRATION TABLE

Position	BTU's/feet^2 sec	Watts/cm^2
''Zero'' Position	1.5	1.7
Position 1	1.51–1.50–1.49	1.71–1.70–1.69
Position 2	1.43–1.44	1.62–1.63

(4) Open the bottom door, remove the calorimeter and holder fixture. Use caution as the fixture is very hot.

(f) *Test Procedure.*

(1) Ignite the pilot burner. Ensure that it is at least 2 inches (51 mm) above the top of the platform. The burner must not contact the specimen until the test begins.

(2) Place the test specimen in the sliding platform holder. Ensure that the test sample surface is level with the top of the platform. At ''zero'' point, the specimen surface must be 7½ inches ± ⅛ inch (191 mm ± 3) below the radiant panel.

(3) Place the retaining/securing frame over the test specimen. It may be necessary (due to compression) to adjust the sample (up or down) in order to maintain the distance from the sample to the radiant panel (7½ inches ± ⅛ inch (191 mm ± 3) at ''zero'' position). With film/fiberglass assemblies, it is critical to make a slit in the film cover to purge any air inside. This allows the operator to maintain the proper test specimen position (level with the top of the platform) and to allow ventilation of gases during testing. A longitudinal slit, approximately 2 inches (51 mm) in length, must be centered 3 inches ± ½ inch (76 mm ± 13 mm) from the left flange of the securing frame. A utility knife is acceptable for slitting the film cover.

(4) Immediately push the sliding platform into the chamber and close the bottom door.

(5) Bring the pilot burner flame into contact with the center of the specimen at the ''zero'' point and simultaneously start the timer. The pilot burner must be at a 27 degree angle with the sample and be approximately ½ inch (12 mm) above the sample. *See* figure F7. A stop, as shown in figure F8, allows the operator to position the burner correctly each time.

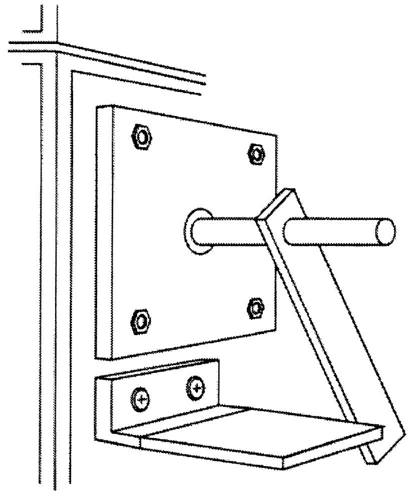

FIGURE F8—Propane Burner Stop

(6) Leave the burner in position for 15 seconds and then remove to a position at least 2 inches (51 mm) above the specimen.

(g) *Report.*

(1) Identify and describe the test specimen.

(2) Report any shrinkage or melting of the test specimen.

(3) Report the flame propagation distance. If this distance is less than 2 inches, report this as a pass (no measurement required).

(4) Report the after-flame time.

(h) *Requirements.*

(1) There must be no flame propagation beyond 2 inches (51 mm) to the left of the centerline of the pilot flame application.

(2) The flame time after removal of the pilot burner may not exceed 3 seconds on any specimen.

71. Add a new Appendix K to part 23 to read as follows:

Appendix K to Part 23—Relationship Among Airplane Classes, Probabilities, Severity of Failure Conditions, and Software and Complex Hardware Development Assurance Levels

Classification of failure conditions	No safety effect	Minor	Major	Hazardous	Catastrophic
Allowable qualitative probability	No probability requirement	Probable	Remote	Extremely remote	Extremely improbable
Effect on Airplane	No effect on operational capabilities or safety.	Slight reduction in functional capabilities or safety margins.	Significant reduction in functional capabilities or safety margins.	Large reduction in functional capabilities or safety margins.	Normally with hull loss.
Effect on Occupants	Inconvenience for passengers.	Physical discomfort for passengers.	Physical distress to passengers, possibly including injuries.	Serious or fatal injury to an occupant.	Multiple fatalities
Effect on Flight Crew	No effect on flight crew.	Slight increase in workload or use of emergency procedures.	Physical discomfort or a significant increase in workload.	Physical distress or excessive workload impairs ability to perform tasks.	Fatal Injury or incapacitation.
Classes of Airplanes	Allowable Quantitative Probabilities and Software (SW) and Complex Hardware (HW) Development Assurance Levels (Note 2)				
Class I (Typically SRE under 6,000#).	No Probability or SW & HW Development Assurance Levels Requirement.	$<10^{-3}$, Note 1, P=D	$<10^{-4}$, Notes 1 & 4, P=C, S=D.	$<10^{-5}$, Notes 4, P=C, S=D.	$<10^{-6}$, Note 3, P=C, S=C.
Class II (Typically MRE, STE, or MTE under 6,000#).	No Probability or SW & HW Development Assurance Levels Requirement.	$<10^{-3}$, Note 1, P=D	$<10^{-5}$, Notes 1 & 4, P=C, S=D.	$<10^{-6}$, Notes 4, P=C, S=C.	$<10^{-7}$, Note 3, P=C, S=C.

Class III (Typically SRE, STE, MRE, & MTE equal or over 6,000#).	No Probability or SW & HW Development Assurance Levels Requirement.	$<10^{-3}$, Note 1, P=D	$<10^{-5}$, Notes 1 & 4, P=C, S=D.	$<10^{-7}$, Notes 4, P=C, S=C.	$<10^{-8}$, Note 3, P=B, S=C.
Class IV (Typically Commuter Category).	No Probability or SW & HW Development Assurance Levels Requirement.	$<10^{-3}$, Note 1, P=D	$<10^{-5}$, Notes 1 & 4, P=C, S=D.	$<10^{-7}$, Notes 4, P=B, S=C.	$<10^{-9}$, Note 3, P=A, S=B.

Note 1: Numerical values indicate an order of probability range and are provided here as a reference.

Note 2: The alphabets denote the typical SW and HW Development Assurance Levels for Primary System (P) and Secondary System (S). For example, HW or SW Development Assurance Level A on Primary System is noted by P=A.

Note 3: At airplane function level, no single failure will result in a Catastrophic Failure Condition.

Note 4: Secondary System (S) may not be required to meet probability goals. If installed, S must meet stated criteria.

Acronyms: SRE—single, reciprocating engine, MRE—multiple, reciprocating engines, STE—single, turbine engine, MTE—multiple, turbine engines, SW—software, HW—hardware.

Issued in Washington, DC, on August 6, 2009.

Dorenda D. Baker,

Director, Aircraft Certification Service, Office of Aviation Safety.

[FR Doc. E9–19350 Filed 8–14–09; 8:45 am]

BILLING CODE 4910–13–P