DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Parts 21, 23, 35, 43, 91, 121, and 135

[Docket No.: FAA–2015–1621; Notice No. 16–01]

RIN 2120–AK65

Revision of Airworthiness Standards for Normal, Utility, Acrobatic, and Commuter Category Airplanes

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Notice of proposed rulemaking (NPRM).

SUMMARY: The FAA proposes to amend its airworthiness standards for normal, utility, acrobatic, and commuter category airplanes by removing current prescriptive design requirements and replacing them with performance-based airworthiness standards. The proposed standards would also replace the current weight and propulsion divisions in small airplane regulations with performance- and risk-based divisions for airplanes with a maximum seating capacity of 19 passengers or less and a maximum takeoff weight of 19,000 pounds or less. The proposed airworthiness standards are based on, and would maintain, the level of safety of the current small airplane regulations. Finally, the FAA proposes to adopt additional airworthiness standards to address certification for flight in icing conditions, enhanced stall characteristics, and minimum control speed to prevent departure from controlled flight for multiengine airplanes. This notice of proposed rulemaking addresses the Congressional mandate set forth in the Small Airplane Revitalization Act of 2013.

DATES: Send comments on or before May 13, 2016.

ADDRESSES: Send comments identified by docket number FAA–2015–1621 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 (DOT), 1200 New Jersey Avenue SE., Room W12–140, West Building Ground Floor, Washington, DC 20590–0001.
- *Hand Delivery or Courier:* Take 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.

Privacy: In accordance with 5 U.S.C. 553(c), DOT solicits comments from the public to better inform its rulemaking process. DOT posts these comments, without edit, including any personal information the commenter provides, to *www.regulations.gov*, as described in the system of records notice (DOT/ALL–14 FDMS), which can be reviewed at *http://www.dot.gov/privacy*.

Docket: Background documents or comments received may be read at *http://www.regulations.gov* at any time. Follow the online instructions for accessing the docket or go to the 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 action, contact Lowell Foster, Regulations and Policy, ACE–111, Federal Aviation Administration, 901 Locust St., Kansas City, MO 64106; telephone (816) 329–4125; email *lowell.foster@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. This discussion includes 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.

All sections of part 23 would contain proposed revisions, except the FAA would not make any substantive changes to the following sections: §§ 23.1457, Cockpit Voice Recorders, and 23.1459, Flight Data Recorders. The only proposed changes to § 23.1459 would be for the purpose of aligning part 23 references. These sections are nevertheless included in this proposed revision for context.

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I. Executive Summary

A. Purpose and History of the Proposed Performance-Based Standards

Part 23 of Title 14 of the Code of Federal Regulations (14 CFR) prescribes airworthiness standards for issuance and amendment of type certificates for airplanes with a passenger-seating configuration of 19 or less and a maximum certificated takeoff weight of 19,000 pounds or less. Airplanes certificated under part 23 are typically used for recreation, training, personal travel, and limited commercial applications.

The current part 23 airworthiness standards are largely prescriptive, meaning that they describe detailed design requirements, and are based on airplane designs from the 1950's and 1960's. As a result of this prescriptive framework, the FAA often requires a design approval applicant seeking to incorporate new or innovative technology to provide additional documentation that typically results in the FAA's issuance of special conditions, exemptions, or equivalent level of safety (ELOS) findings.[1] The FAA recognizes that these additional procedures and requirements are costly to the FAA and industry, act as barriers to certification, and discourage innovation. Therefore, to encourage the installation of new safety-enhancing technology and streamline the certification process, the FAA proposes replacing the prescriptive requirements found in the current part 23 with performance-based standards.

The FAA believes this proposed rulemaking would maintain the level of safety associated with current part 23, while providing greater flexibility to applicants seeking certification of their airplane designs. By doing so, this proposed rulemaking would hasten the adoption of safety enhancing technology in type-certificated products while reducing regulatory time and cost burdens for the aviation industry and FAA. This proposed rulemaking would also reflect the FAA's safety continuum philosophy,[2] which balances the need for an acceptable level of safety with the societal burden of achieving that level safety, across the broad range of airplane types certificated under part 23.

This proposed rulemaking is the result of an effort the FAA began in 2008 to re-evaluate the way it sets standards for different types of airplanes. Through this effort, a joint FAA and industry team produced the Part 23 Certification Process Study[3] (CPS), which reviewed the life cycle of part 23 airplanes to evaluate certification processes and develop recommendations. Two key recommendations were to (1) reorganize part 23 based on airplane performance and complexity rather than the existing weight and propulsion divisions, and (2) permit the use of consensus standards as a means to keep pace with rapidly increasing design complexity in the aviation industry.

In 2010, with the CPS as a foundation, the FAA conducted a Part 23 Regulatory Review and held meetings with the public and industry to gain input on revising part 23. These meetings confirmed strong public and industry support for the CPS recommendations to revise part 23.

In 2011, the FAA formed the Part 23 Reorganization ARC to consider further the CPS recommendation to reorganize part 23 based on airplane performance and complexity and to investigate the use of consensus standards. The ARC recommendations,[4] published in 2013, echo the CPS recommendations.

On January 7, 2013, Congress passed the Federal Aviation Modernization and Reform Act of 2012[5] (Public Law 112–95; 49 U.S.C. 40101 note) (FAMRA), which requires the Administrator, in consultation with the aviation industry, to assess the aircraft certification and approval process. Based on the ARC recommendations and in response to FAMRA, the FAA began work on this proposed rulemaking on September 24, 2013. Subsequently, on November 27, 2013, Congress passed the Small Airplane Revitalization Act of 2013 (Public Law 113–53, 49 U.S.C. 44704 note) (SARA), which requires the FAA to issue a final rule revising the certification requirements for small airplanes by—

- Creating a regulatory regime that will improve safety and decrease certification costs;
- Setting safety objectives that will spur innovation and technology adoption;
- Replacing prescriptive rules with performance-based regulations; and
- Using consensus standards to clarify how safety objectives may be met by specific designs and technologies.

The FAA believes that the performance-based-standards component of this proposal complies with the FAMRA and the SARA because it would improve safety, reduce regulatory compliance costs, and spur innovation and the adoption of new technology. This proposal would replace the weight-and propulsion-based prescriptive airworthiness standards in part 23 with performance- and risk-based airworthiness standards for airplanes with a maximum seating capacity of 19 passengers or less and a maximum takeoff weight of 19,000 pounds or less. The proposed standards would maintain the level of safety associated with the current part 23, while also facilitating the adoption of new and innovative technology in general aviation (GA) airplanes.

B. Summary of Major Provisions

This proposal to revise part 23 has two principal components: Establishing a performance-based regulatory regime and adding new certification standards for loss of control (LOC) and icing. Where the FAA proposes to establish new certification requirements, these requirements would be adopted within the same performance-based framework proposed for part 23 as a whole.

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[1] Special conditions give the manufacturer permission to build the aircraft, engine or propeller with additional capabilities not addressed in the regulations. A petition for exemption is a request to the FAA by an individual or entity asking for relief from the requirements of a regulation. Equivalent level of safety findings are made when literal compliance with a certification regulation cannot be shown and compensating factors exist which can be shown to provide an equivalent level of safety. 14 CFR parts 11 and 21 provides information on special conditions and exemptions. FAA Order 8110–112A provides standard procedures for issue paper and equivalent level of safety memoranda.

[2] The FAA's safety continuum philosophy is that one level of safety may not be appropriate for all aviation. The FAA accepts higher levels of risk, with correspondingly fewer requirements for the demonstration of compliance, when aircraft are used for personal transportation.

[3] See *www.regulations.gov* (Docket # FAA–2015–1621).

[4] See *www.regulations.gov* (Docket # FAA–2015–1621).

[5] *http://www.gpo.gov/fdsys/pkg/CRPT-112hrpt381/pdf/CRPT-112hrpt381.pdf.*

1. Performance Standards and Airplane Crashworthiness

Airplane crashworthiness and occupant safety is an example of how moving towards performance-based standards and providing greater flexibility to industry would increase aviation safety. Although the FAA has over the years incrementally amended part 23 to enhance occupant safety, these amendments have focused on individual system components, rather than the safety of the system as a whole. By building greater flexibility into FAA regulations governing crash testing, this proposal would allow the aviation industry to develop and implement novel solutions.

2. Loss of Control

One proposed revision to part 23 would improve general aviation safety by creating additional certification standards to reduce LOC accidents. Inadvertent stalls resulting in airplane LOC are the most common cause of small airplane fatal accidents. These LOC accidents frequently occur in the traffic pattern or at low altitudes, where the airplane is too low for a pilot to recover control before impacting the ground. The proposed revisions would require applicants to use new design approaches and technologies to improve airplane stall characteristics and pilot situational awareness to prevent such accidents.

3. Icing Certification Standards

Another proposed revision to part 23 would improve GA safety by addressing severe icing conditions. In the 1990s, the FAA became aware of the need to expand the icing conditions considered during the certification of airplanes and turbine aircraft engines. In particular, the FAA determined that revised icing certification standards should include Supercooled Large Drops (SLD),[6] mixed phase, and ice crystals.

This proposed rule would require manufacturers that choose to certify an airplane for flight in SLD to demonstrate safe operations in SLD conditions. For those manufacturers who choose instead to certify an airplane with a prohibition against flight in SLD conditions, this proposed rule would require a means for detecting SLD conditions and showing the airplane can safely exit such conditions. Industry has indicated that these requirements would not impose significant additional cost burden on industry because many manufacturers already have equipped recent airplanes with technology to meet the standards for detecting and exiting SLD conditions in accordance with current FAA guidance.

C. Cost and Benefits

The goal of this proposal is to create a cost-effective approach to certification that facilitates the adoption of new safety enhancing technologies and allows for alternative means of compliance. The FAA has analyzed the benefits and costs associated with this NPRM. If the proposed rule saves only one human life, for example, by improving stall characteristics and stall warnings, that alone would result in benefits outweighing the costs. The following table shows these results.

ESTIMATED BENEFITS AND COSTS FROM 2017 TO 2036

[2014 $ millions]

	Costs	Safety benefits + cost savings = total benefits
Total	$3.9	$19.6 + $12.6 = $32.2.
Present value	3.9	$6.2 + $5.8 = $12.0.

Accordingly, the FAA has determined that the proposed rule would be cost beneficial.

II. 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 performance-based safety standards for the design of normal, utility, acrobatic, and commuter category airplanes.

Additionally, this rulemaking addresses the Congressional mandate set forth in the Small Airplane Revitalization Act of 2013 (Public Law 113–53; 49 U.S.C. 44704 note) (SARA). Section 3 of SARA requires the Administrator to issue a final rule to advance the safety and continued development of small airplanes by reorganizing the certification requirements for such airplanes under part 23 to streamline the approval of safety advancements. SARA directs that the rule address specific recommendations of the 2013 Part 23 Reorganization Aviation Rulemaking Committee (ARC).

III. Background

The range of airplanes certificated under part 23 is diverse in terms of performance capability, number of passengers, design complexity, technology, and intended use. Currently, each part 23 airplane's certification requirements are determined by reference to a combination of factors, including weight, number of passengers, and propulsion type. The resulting divisions (*i.e.,* normal, utility, acrobatic, and commuter categories) historically were appropriate because there was a clear relationship between the propulsion and weight of the airplane and its associated performance and complexity.

Technological developments have altered the dynamics of that relationship. For example, high-performance and complex airplanes now exist within the weight range that historically was occupied by only light and simple airplanes. The introduction of high-performance, lightweight airplanes required subsequent amendments of part 23 to include more stringent and demanding standards—often based on the part 25 requirements for larger transport category airplanes—to ensure an adequate level of safety for airplanes under part 23. The unintended result is that some of the more stringent and demanding standards for high-performance airplanes now apply to the

[6] SLD conditions include freezing drizzle and freezing rain, which contain drops larger than those specified in appendix C to part 25, and can accrete aft of wing leading edge ice protection systems.

certification of simple and low-performance airplanes.

A. Part 23 History

Part 23 originated from performance-based requirements developed by the Bureau of Air Commerce and the Civil Aeronautics Administration in the 1930s. These regulations were contained in specific Civil Air Regulations (CAR) for the certification of aircraft (*i.e.,* CAR 3, 4, and 4a). These requirements, along with various bulletins and related documents, were subsequently revised and first published as 14 CFR part 23 in 1964 (29 FR 17955, December 18, 1964). Over the past five decades and after numerous amendments, part 23 has evolved into a body of highly complex and prescriptive requirements attempting to codify specific design requirements, address specific problems encountered during prior certification projects, and respond to specific recommendations from the National Transportation Safety Board (NTSB).

Although the intent of the prescriptive language contained in current part 23 was to increase the level of safety, prevent confusion, and clarify ambiguities, the current regulations have also restrained manufacturers' ability to employ new designs and testing methodologies. The FAA believes moving towards performance-based standards should significantly reduce or eliminate barriers to innovation and facilitate the introduction of new safety-enhancing technologies.

In 2008, the FAA conducted a review of part 23 by initiating the Part 23 CPS. Collaborating with industry, the team's challenge was to determine the future of part 23, given today's current products and anticipated future products. The team identified opportunities for improvements by examining the entire life cycle of a part 23 airplane. The CPS recommended reorganizing part 23 using criteria focused on performance and design complexity. The CPS also recommended that the FAA implement general airworthiness requirements, with the means of compliance defined in industry consensus standards standards. In 2010, following the publication of the Part 23 CPS, the FAA held a series of public meetings to seek feedback concerning the findings and recommendations. Overall, the feedback was supportive of and in some cases augmented the CPS recommendations.

One notable difference between the CPS findings and the public feedback was the public's request that the FAA revise part 23 certification requirements for simple, entry-level airplanes. Over the past two decades, part 23 standards have become more complex as industry has generally shifted towards correspondingly complex, high-performance airplanes. This transition has placed an increased burden on applicants seeking to certificate smaller, simpler airplanes. Public comments requested that the FAA focus on reducing the costs and time burden associated with certificating small airplanes by restructuring the requirements based on perceived risk. The safety risk for most simple airplane designs is typically low.

On August 15, 2011, the Administrator chartered the Part 23 Reorganization ARC to consider the following CPS recommendations—

- Recommendation 1.1.1—Reorganize part 23 based on airplane performance and complexity, rather than the existing weight and propulsion divisions; and
- Recommendation 1.1.2—Certification requirements for part 23 airplanes should be written on a broad, general, and progressive level, segmented into tiers based on complexity and performance.

The ARC's recommendations took into account the FAMRA, which requires the Administrator, in consultation with the aviation industry, to assess the aircraft certification and approval process. The purpose of the ARC's assessment was to develop recommendations for streamlining and reengineering the certification process to improve efficiency, reduce costs, and ensure that the Administrator can conduct certifications and approvals in a manner that supports and enables the development of new products and technologies and the global competitiveness of the United States aviation industry.[7] FAMRA also directs the Administrator to consider the recommendations from the Part 23 Certification Process Study.[8]

ARC membership represented a broad range of of stakeholder perspectives, including U.S. and international manufacturers, trade associations, and foreign civil aviation authorities. The ARC was supported by FAA subject matter experts from all affected lines of business, from design and production certification to continued airworthiness and alterations. The following table identifies ARC participants:

U.S. Manufacturers		
Avidyne	Bendix-King	Cessna.
Cirrus	Continental Motors	Cub Crafters.
GAMI	Garmin	Hawker Beechcraft.
Honda	Honeywell	Kestrel.
Lockheed Martin	Rockwell-Collins	Quest.
Sensenich Propellers	Tamarack Aero	TruTrak.
U.S. Organizations		
Aircraft Electronics Association (AEA)	Aircraft Owners and Pilots Association (AOPA).	ASTM.
Experimental Aircraft Association (EAA)	General Aviation Manufacturers Association (GAMA).	National Air Traffic Controllers Association (NATCA).
RTCA	SAE.	
International Manufacturers		
Dassault Falcon	Diamond	Flight Design.
Rotax	Socata.	

[7] Section 312(c)

[8] Section 312 (b)(6)

International Civil Aviation Authorities		
European Aviation Safety Agency (EASA)	Transport Canada Civil Aviation (TCCA)	National Civil Aviation Agency of Brazil (ANAC).
Civil Aviation Administration of China (CAAC)	Civil Aviation Authority of New Zealand.	

Each member or participant on the committee represented an identified segment of the aviation community, with the authority to speak for that segment. The ARC also invited subject matter experts to support specialized working groups and subgroups, as necessary. These working groups developed recommendations and briefed the ARC as a whole. The ARC then collectively discussed and voted to accept or reject the recommendations. All of the recommendations included in the ARC's report had overwhelming majority agreement.

The ARC noted the prevailing view within industry was that the only way to reduce the program risk, or business risk, associated with the certification of new airplane designs was to avoid novel design approaches and testing methodologies. The certification of new and innovative products today frequently requires the FAA's use of ELOS findings, special conditions, and exemptions. These take time, resulting in uncertainty and high project costs. The ARC emphasized that although industry needs from the outset to develop new airplanes designed to use new technology, current certification costs inhibit the introduction of new technology. The ARC identified prescriptive certification requirements as a major barrier to installing safety-enhancing modifications in the existing fleet and to producing newer, safer airplanes.

The ARC also examined the harmonization of certification requirements among the FAA and foreign civil aviation authorities (CAAs), and the potential for such harmonization to improve safety while reducing costs. Adopting performance-based safety regulations that facilitate international harmonization, coupled with internationally accepted means of compliance, could result in both significant cost savings and the enabling of safety-enhancing equipment installations. The ARC recommended that internationally accepted means of compliance should be reviewed and voluntarily accepted by the appropriate aviation authorities, in accordance with a process established by those authorities. Although each CAA would be capable of rejecting all or part of any particular means of compliance, the intent would be to have full civil authority participation in the creation of the means of compliance to ease acceptance of the means of compliance.

B. New Safety Requirements

The performance-based standards proposed in this NPRM are designed to maintain the level of safety provided by current part 23 requirements. The current part 23 weight and propulsion divisions were based on assumptions that do not reflect the diversity of performance capabilities, design complexity, technology, intended use, and seating capacity of today's new airplane designs, or the future airplane designs that will become possible as technology continues to evolve. The FAA would therefore replace the current divisions with certification levels 1 thru 4, low performance, high performance, and simple. Furthermore, this would replace the current divisions within the individual sections with technical and operational capabilities focused on the technical drivers (*e.g.,* stall speed, Visual Flight Rules (VFR) and Instrument Flight Rules (IFR) operations, pressurization). These types of technical and operational criteria would apply a more appropriate set of standards to each airplane, and continue to accommodate the wide range of airplane designs within part 23.

To begin, the FAA proposes to eliminate commuter, utility, and acrobatic airplane categories from part 23, retaining only a normal category for all new part 23 type certificated airplane design approvals. The differences between normal, utility, and acrobatic categories are currently very limited and primarily affect airframe structure requirements. Proposed part 23 would continue to allow a normal category airplane to be approved for aerobatics, provided the airplane is certificated for the safety factors and defined limits of aerobatic operations.

In addition, the FAA proposes that airplanes approved for spins be certificated to aerobatic standards. Under the current § 23.3(b), the utility category provides airplanes additional margin for the more stringent inertial structural loads resulting from intended spins and other maneuvers. An airplane designed with traditional handling qualities and designed to allow spin training is more susceptible to inadvertent departure from controlled flight. The FAA therefore believes that maintaining the current utility category for spin and limited aerobatic maneuver capable airplanes would negate the largest, single safety gain expected from this rulemaking action—the significant reduction in inadvertent stall-related departures from controlled flight.

Under this proposal, airplanes already certificated in the commuter, utility, and acrobatic categories would continue to fall within those categories. Each new airplane design, however, would be subject to varying levels of analysis, based on the potential risk and performance of the airplane's design. A more rigorous standard, such as currently applied to commuter category airplanes, would apply to higher risk and higher performance airplanes.

The proposed requirements would also include new enhanced standards for resistance to departure from controlled flight. Recognizing that the largest number of fatal accidents for part 23 airplanes results from LOC in flight, the FAA proposes to update certification standards to address these risks. LOC happens when an airplane enters a flight regime outside its normal flight envelope or performance capabilities and develops into a stall or spin, an event that can surprise the pilot. A pilot's lack of awareness of the state of the airplane in flight and the airplane's low-speed handling characteristics are the main causal factors of LOC accidents. Furthermore, stall and departure accidents are generally fatal because an airplane is often too low to the ground for the pilot to recover. Improving safety that reduces stall and LOC accidents would save lives. The FAA is therefore proposing new rules for stall characteristics and stall warnings that would result in airplane designs more resistant to inadvertently departing controlled flight.

Another type of low-speed LOC accident that occurs in significant numbers involves minimum control speed (V_{MC}) in light twin-engine airplanes. Virtually all twin-engine airplanes have a V_{MC} that allows directional control to be maintained after one engine fails. This speed is usually above the stall speed of the airplane. However, light twin-engine airplanes typically have limited climb capability on one engine. In the accidents reviewed by the ARC and FAA, often in these situations, pilots attempted to maintain a climb or maintain altitude, which slowed the airplane down, rather than looking for the best landing site immediately, maintaining control the whole way. If the airplane's speed drops below V_{MC}, the pilot can lose control. In tying the minimum control speed to the stall speed of the airplane, pilots, rather than attempting to maintain climb and lose directional control, would instead react appropriately with stall training techniques, resulting in a controlled descent rather than a loss of directional control. This requirement will be on new airplanes and should add little or no cost because it can be designed in from the start.

The FAA also has identified a need for improved certification standards related to operations in severe icing conditions. More specifically, in the 1990's, the FAA became aware of the need to expand the icing conditions considered during the certification of airplanes and turbine aircraft engines, to increase flight safety during some severe icing conditions. The 1994 accident in Roselawn, Indiana, involving an Avions de Transport Regional ATR 72 series airplane in SLD conditions, brought to public and governmental attention safety concerns about the adequacy of the existing icing certification standards.

As a result of the 1994 accident, and consistent with related NTSB recommendations, in 1997 the Administrator tasked the Aviation Rulemaking Advisory Committee (ARAC) (62 FR 64621, December 8, 1997) with defining SLD, mixed phase, and ice crystal icing environments, and designing corresponding safety requirements for those conditions. In June 2000, the ARAC's task was revised to address only transport category airplanes. More recent events, such as an Air France Airbus model A330–203 AF447 [9] accident, in 2009, highlighted the negative effects of ice crystals on airspeed indication systems and turbojet engines.

The FAA ultimately published amendments 25–140 (79 FR 65507, November 4, 2014) and 33–34 (79 FR 65507, November 4, 2014), Airplane and Engine Certification Requirements in Supercooled Large Drop, Mixed Phase, and Ice Crystal Icing Conditions that expanded parts 25 and 33 icing requirements, but did not amend part 23 requirements. On February 19, 2010, the Administrator chartered a Part 23 Icing ARC to review and recommend SLD, mixed phase, and ice crystal icing conditions regulations and guidance for part 23. In February 2012, the Part 23 Icing ARC formally identified a need to improve the part 23 regulations to ensure safe operation of airplanes and engines in SLD and ice crystal conditions.[10] In particular, the Part 23 Icing ARC recommended adopting most of the part 25 icing rules, including the requirement to show either that an airplane can safely fly in SLD conditions, or that it can detect and safely exit SLD. The proposals in this NPRM incorporate the recommendations of the Part 23 Icing ARC.

[9] See *www.regulations.gov* (Docket #FAA–2015–1621), Air France A330–203, Flight AF 447 Final Accident Report

C. Benefits for the Existing Fleet

The proposed revisions would benefit owners and modifiers of existing part 23 airplanes, as well as airplane designers and manufacturers. Both currently and under this proposal, airplanes may be modified by: (1) An alteration to an individual airplane; (2) a supplemental type certificate (STC) for multiple airplanes, or (3) an amendment to an original type design via an amended type certificate (TC). This proposal would streamline each of these methods for modifying airplanes.

The proposed change to § 21.9 would facilitate FAA approval of low-risk equipment produced for installation in type-certificated airplanes, thereby streamlining the process for owners to upgrade equipment on their individual airplanes. An example of how this change would facilitate safety improvements is the installation of inexpensive weather display systems in the cockpits of small airplanes. These systems allow a pilot to view current weather conditions along the planned flight route and at the destination airport, avoiding unexpected or deteriorating weather conditions. Since these systems are not required and because they represent low safety risk from failure, the FAA believes streamlining its approval process to produce them for use in existing airplanes could lower costs and increase availability of these systems.

The proposed changes in the rules would also streamline the process for design approval holders applying for a type design change, or for a third party modifier applying for an STC, to incorporate new and improved equipment in a model or several models of airplanes. Since the revised part 23 standards would be much less prescriptive, the certification process for modifications would be simplified. Certification of an amended TC or STC under the proposed part 23 standards would require fewer special conditions or exemptions, lowering costs and causing fewer project delays.

[10] See *www.regulations.gov* (Docket #FAA–2015–1621)

D. Conforming Amendments and Other Minor Amendments

References to part 23 appear throughout the FAA's current regulations. Accordingly, the FAA proposes to amend the following parts for consistency with the proposed revisions to part 23: Part 21, part 35, part 43, part 91, part 121, and part 135.

The FAA also proposes to revise part 21 to simplify the approval process for low-risk articles. Specifically, the FAA proposes amending § 21.9 to allow FAA-approved production of replacement and modification articles using methods not listed in § 21.9(a). This proposed change is intended to reduce constraints on the use of non-required, low risk articles, such as carbon monoxide detectors and weather display systems.

E. Public Policy Implementation

The intent of this NPRM is to reduce regulatory barriers by establishing a system based on safety-focused performance requirements and FAA acceptance—as a means of compliance—of consensus standards. FAA-accepted consensus standards would add clarity to the certification process and streamline FAA involvement in the development of means of compliance. Additionally, adopting performance standards would significantly reduce the complexity of part 23. Furthermore, the introduction of airplane certification levels based on risk (*i.e.,* number of passengers) and performance (*i.e.,* speed) would advance the FAA's effort to introduce risk-based decision-making and better align with the FAA's safety continuum philosophy. Together, the FAA believes these changes would allow the FAA to provide appropriate oversight based on the safety continuum and would restore a simple and cost effective certification process based on proven engineering practices.

1. Regulatory Planning and Review

In accordance with applicable executive orders, the FAA has determined that the proposed revisions to part 23 are the most cost-beneficial way of achieving the agency's regulatory objectives. This is because the proposal would relieve industry of a significant regulatory burden while maintaining or improving the level of safety under the regulations. In particular, Executive Order 12866, Regulatory Planning and Review (58 FR 51735, October 4, 1993), and Executive Order 13563, Improving

Regulation and Regulatory Review (76 FR 3821, January 21, 2011), direct each Federal agency to propose or adopt a regulation only upon a reasoned determination that the benefits of the intended regulation justify its costs. This proposal is not an economically "significant regulatory action" as defined in section 3(f) of Executive Order 12866 [11] and it satisfies Executive Order 13563 by protecting public health, welfare, safety, while promoting economic growth, innovation, competitiveness, and job creation.

Under the above-referenced executive orders, when an agency determines that a regulation is the best available method of achieving its regulatory objective, the agency must design the regulation or regulations in the most cost-effective manner. In doing so, each agency must consider incentives for innovation, consistency, predictability, enforcement and compliance costs (to the government, regulated entities, and the public), flexibility, distributive impacts, and equity. Each agency must identify and assess alternative forms of regulation and shall specify, to the extent feasible, performance objectives, rather than specifying the behavior or manner of compliance that regulated entities must adopt. This proposal meets these requirements because it would implement performance objectives rather than a prescriptive methodology, thereby reducing time and cost burdens on industry and increasing opportunities for innovation.

Executive Order 13610, Identifying and Reducing Regulatory Burdens (77 FR 28469, May 10, 2012) reiterates the direction from Executive Order 13563 in stating that our regulatory system must measure, and seek to improve, the actual results of regulatory requirements. To promote this goal, agencies are to engage in periodic review of existing regulations, and are required to develop retrospective review plans to examine existing regulations in order to determine whether any such regulations should be modified, streamlined, expanded, or repealed. The purpose of this requirement is to make the agency's regulatory program more effective or less burdensome in achieving the regulatory objectives. In response to Executive Orders13563 and 13610, agencies have developed and made available for public comment retrospective review plans. Both the Part 23 Reorganization ARC and this Part 23 Rulemaking Project are on the Department of Transportation's retrospective review plans.

2. Consensus Standards

Section 3(c) of SARA requires the Administrator, when developing regulations, to comply with the requirements of the National Technology Transfer and Advancement Act of 1995 [12] (Pub. L. 104–113; 15 U.S.C. 272 note) (NTTAA) and to use consensus standards to the extent practicable while maintaining traditional methods for meeting part 23. Section 12(d) of the NTTAA directs Federal agencies to use, either by reference or by inclusion, voluntary consensus standards in lieu of government-mandated standards, except where inconsistent with law or otherwise impractical. The Office of Management and Budget (OMB) Circular A–119,[13] Federal Participation in the Development and Use of Voluntary Consensus Standards and Conformity Assessment Activities, provides guidance to Executive agencies in implementing the requirements of the NTTAA.

Accordingly, the FAA proposes to accept consensus standards as a means of compliance with the proposed part 23 performance-based regulations. The use of consensus standards would be one means of compliance with the performance-based standards of the proposed part 23. Compliance with the current prescriptive provisions within current part 23 would be yet another means of compliance available under this proposal. Applicants would still have the option to propose their own means of compliance as they do today. The process for reviewing new means of compliance would not change substantially from the process in place today.

Although a consensus standard works in some cases, the Part 23 Reorganization ARC expressed concerns that a consensus standard could be biased in favor of a few large manufacturers and thereby create an unfair competitive advantage. OMB Circular A–119 also cautions regulators to avoid such potential biases. The FAA notes that industry groups associated with the Part 23 Reorganization ARC identified ASTM International (ASTM) as the appropriate organization to initiate the development of consensus standards, and that ASTM permits any interested party to participate in the committees developing consensus standards. The FAA expects other consensus standards bodies to allow similar opportunities for interested parties to participate in their standards-development work. In addition to consensus standards and the current prescriptive design standards in part 23, any individual or organization may develop its own proposed means of compliance that may be submitted to the FAA for acceptance.

3. International Cooperation Efforts for Reorganizing Part 23

Executive Order 13609, Promoting International Regulatory Cooperation (77 FR 26413, May 4, 2012), promotes international regulatory cooperation to meet shared challenges and reduce, eliminate, or prevent unnecessary differences in regulatory requirements. Consistent with this Order, the FAA's proposal would address unnecessary differences in regulatory requirements between the United States and its major trading partners. The U.S. GA industry has repeatedly informed the FAA of the high costs to address differences between the airworthiness requirements of the FAA and foreign CAAs. The FAA believes this proposal has the potential to achieve long-term harmonization at an unprecedented level, and should result in a significant savings for both U.S. manufacturers exporting products abroad and foreign manufacturers exporting products to the U.S. The FAA requests comments regarding the potential cost savings.

The work of the Part 23 Reorganization ARC forms the foundation of the proposed changes to part 23. From the onset, the ARC was a cooperative, international effort. Representatives from several foreign CAAs [14] and international members from almost every GA manufacturer of airplanes and avionics participated in the Part 23 Reorganization ARC. Several international light-sport aircraft manufacturers, who were interested in certificating their products using part 23 airworthiness standards, also participated. In addition to recommending changes to part 23, the ARC developed proposals to help reduce certification costs through more international standardization of certification processes and reducing or eliminating redundant certification activities associated with foreign certification.

After the ARC issued its report, the FAA, foreign CAAs, and industry continued to work together to refine the ARC rule language until the FAA began drafting the NPRM in December 2014. This included formal meetings in July and November of 2014. EASA,

[12] *http://www.gpo.gov/fdsys/pkg/PLAW-104publ113/pdf/PLAW-104publ113.pdf.*

[13] *https://www.whitehouse.gov/omb/circulars_a119/.*

[14] CAAs included participants from Brazil, Canada, China, Europe, and New Zealand.

Transport Canada, other foreign authorities, and industry offered significant contributions to these efforts.

In addition, the CAAs from Europe, Canada, Brazil, China, and New Zealand are working to produce rules similar to those contained in this proposal. EASA, for example, published an Advance Notice of Proposed Amendment (A–NPA) 2015–06 on March 27, 2015, which sets forth EASA's concept for its proposed reorganization of CS–23, and on which the FAA provided comments. Like the FAA's current proposal, EASA's A–NPA was also based on the proposed ARC language with the goal of harmonization. Both proposals would adopt performance-based standards that facilitate the use of consensus standards as a means of compliance.

F. Means of Compliance

This proposal would allow type certificate applicants to use FAA-accepted means of compliance to streamline the certification process. This proposal, however, is shaped by two concerns raised in the Part 23 Reorganization ARC. First, the rule needs to clearly state that any applicant must use a means of compliance accepted by the Administrator when showing compliance with part 23. The FAA emphasizes that any means of compliance would require FAA review and acceptance by the Administrator. Second, although a means of compliance developed by a consensus standards body (*i.e.,* ASTM, SAE, RTCA, etc.) may be available, any individual or organization would also be able to submit its own means of compliance documentation to the Administrator for consideration and potential acceptance.

The FAA anticipates that both individuals and organizations would develop acceptable means of complying with the proposed performance standards. The industry groups associated with the ARC discussed the development of consensus-based standards and selected ASTM as the appropriate organization to initiate the effort. A standards organization such as ASTM could, for example, generate a series of consensus-based standards for review, acceptance, and public notice of acceptance by the FAA. The ASTM standards would be one way, but not the only way, to demonstrate compliance with part 23.

Using means of compliance documents to satisfy compliance with the proposed performance-based rules would diminish the need for special conditions, ELOS findings, and exemptions to address new technology advancements. Once the Administrator accepted a means of compliance, it could be used in future certification applications unless formally rescinded. Incorporating the use of consensus standards as a means of compliance with performance-based regulations would provide the FAA with the agility to more rapidly accept new technology as it develops, leverage industry experience and expectations to develop of new means of compliance documents, and encourage the use of harmonized means of compliance among the FAA, industry, and foreign CAAs. Although an applicant would not be required to use previously accepted means of compliance documents, doing so would streamline the certification process by eliminating the need for the FAA to develop an issue paper to address the certification of new technology. Proposed Advisory Circular 23.10, Accepted Means of Compliance, would describe a process for applicants to submit proposed means of compliance to the FAA for acceptance by the Administrator.

The Part 23 Reorganization ARC was also concerned that specialists in the industry could argue for complex means of compliance when the FAA would accept a simpler or more cost effective approach. To address these concerns, the FAA would continue to allow applicants to propose their own means of compliance when the larger industry standard may be the appropriate level of safety for one but not all certification levels, consistent with the guidance in OMB Circular A–119, which reminds the regulator that the government is responsible to the public for setting the appropriate level of safety and avoiding any unfair competitive advantage. Additionally, the FAA proposes to continue to allow the use of the prescriptive means of compliance currently codified in part 23 as yet another alternative means of compliance with proposed part 23. This would not apply, however, to the proposed new requirements, such as §§ 23.200, 23.215, and 23.230.

G. FAA Strategic Initiatives

The FAA's Strategic Initiatives 2014–2018 communicates FAA goals for addressing the challenges presented by the changing aviation industry and how the FAA intends to make the U.S. aviation system safer and smarter, and raise the bar on safety. Specifically, one strategic initiative is for the FAA to embrace and implement risk-based decision making approaches, which build on safety management principles to address emerging safety risks using consistent, data-informed approaches to make smarter, quicker system-level decisions. By establishing performance-based regulations, coupled with industry standards, this proposed rulemaking would provide a calibrated and globally competitive regulatory structure. This new approach would increase safety in general aviation by enabling and facilitating innovation and the implementation of safety enhancing designs in newly certificated products.

This rulemaking effort also directly supports the FAA's Global Leadership Initiative, by encouraging global harmonization and the consistent use of regulations, standards, and practices for general aviation airplanes.

IV. Discussion of Proposal

A. Reorganization of Airworthiness Standards Based on Risk and Performance

The FAA proposes replacing the current weight and propulsion-based airplane certification divisions with airplane certification and performance levels based on the number of potential passengers and the performance of the airplane. The FAA believes this proposed regulatory change would better accommodate the wide range of airplanes certificated under part 23, thereby reducing certification risk, time, and costs.

Historically, turbine-powered airplanes were assumed to fly at or above 18,000 feet (5,486 meters) and at high speeds, whereas piston engine airplanes were assumed to fly below 18,000 feet (5,486 meters) and at lower speeds. Today, with advancements in aviation technology, these general design and performance assumptions may not be valid. Furthermore, the current regulations do not account for airplanes equipped with new technologies, such as electric propulsion systems, which may have features that are entirely different from piston and turbine engines. For these reasons, the FAA is proposing regulations based on airplane performance and potential risk rather than on assumptions about specific technologies. These proposed standards would be appropriate to each specific airplane design.

Certification of airplanes under part 23 would either be conducted using airplane certification levels based on maximum passenger seating configuration and airplane performance levels based on speed, or occur as so-called ''simple airplanes'' that are low-speed airplanes with a stalling speed (V_{SO}) ≤ 45 Knots Calibrated Airspeed (KCAS) approved only for VFR operations. The FAA proposes the following airplane certification levels:

- Level 1—for airplanes with a maximum seating configuration of 0 to 1 passengers, including simple airplanes.
- Level 2—for airplanes with a maximum seating configuration of 2 to 6 passengers.
- Level 3—for airplanes with a maximum seating configuration of 7 to 9 passengers.
- Level 4—for airplanes with a maximum seating configuration of 10 to 19 passengers.

B. Introduction of Simple Airplanes

The regulations contained in part 23 have gradually become more focused on high-performance, turbine-powered airplanes, and this emphasis has become a barrier to the efficient certification and introduction to market of new entry-level, simple airplanes. The Part 23 Reorganization ARC specifically noted that current part 23 does not have appropriate standards for the certification of entry-level airplanes.

The FAA proposes to define ''simple airplanes'' in § 23.5 to recognize the entry-level airplane. Simple airplanes would be limited to airplane designs that allow transport of no more than one passenger (in addition to the pilot), are limited to VFR operations, and have both a low top speed and a low stall speed. These airplanes are similar to EASA's Certification Specification—Very Light Aeroplanes (CS–VLA), which are currently imported to the U.S. and certificated as special class airplanes in accordance with 14 CFR 21.17(b). The proposed change would allow these airplanes to be certified as normal category airplanes under part 23.

The FAA believes that permitting certification of simple airplanes would allow more certified entry-level airplanes to enter the marketplace. The FAA expects simple airplanes to be a more basic sublevel within proposed certification level 1, but recognizes that because of similarities between simple and non-simple airplanes within certification level 1, creating this category may be unnecessary. For this reason, the FAA is specifically asking for comments concerning the utility of creating a separate, simple airplane sublevel.

C. Establishing Performance-Based Standards and the Use of Means of Compliance

The Part 23 Reorganization ARC was aware the Administrator has accepted as evidence of compliance various manufacturers' internal design standards in the past, and the ARC recommended expressly stating that option in the proposal. Proposed § 23.10, Accepted Means of Compliance, would allow individual persons or companies to submit their internal standards as means of compliance for consideration by the Administrator. Proposed § 23.10 would also require an applicant to show the FAA how it would demonstrate compliance with this part using a means of compliance, which may include consensus standards accepted by the Administrator. It would further require an applicant requesting acceptance of a means of compliance to provide the means of compliance to the FAA in a form and manner specified by the Administrator. In addition, proposed § 23.10 specifically recognizes the use of consensus standards as a means of compliance that could be acceptable to the Administrator. If this information is proprietary in nature, it would be afforded the same protections as are applied today in certification applications submitted under 14 CFR part 21.

The phrase ''means of compliance'' may have different connotations depending on its context. Historically, the FAA has treated an applicant's demonstration of compliance as a means of compliance. Alternatively, as indicated by sec. 3(b)(4) of the *SARA,* consensus standards may constitute a means of compliance that can address new and novel designs and technologies. In other words, as suggested by the SARA, an applicant would develop a design to satisfy a performance-based standard, and the design is the means of complying with the standard.

Currently, an applicant for a type certificate must show the FAA how it satisfies the applicable airworthiness standards. The applicant submits the type design, test reports, and computations necessary to show compliance. The applicant approaches the FAA and enters into negotiations regarding what constitutes an adequate demonstration—testing or analysis. The FAA anticipates that, under the proposed framework, standards developed by consensus standards bodies would provide a pre-existing means by which any applicant may demonstrate compliance with the corresponding performance-based requirements. For example, the proposed fuel system requirements would be broad enough to certificate airplanes with electric propulsion systems in which batteries and fuel cells are used as fuel. Airplanes incorporating these systems cannot currently be certificated without applying for special conditions or exemptions.

Elements of this proposal are already in place today. Industry standards bodies like RTCA, SAE, ASTM, and the European Organization for Civil Aviation Equipment (EUROCAE) have already developed detailed means of compliance documents that an applicant for a type certificate may use to demonstrate compliance with our regulatory requirements in 14 CFR parts 23, 25, 27, and 29. For decades, the FAA has identified these means of compliance documents as an acceptable means of complying with our regulatory requirements. This proposal would build on and expand this aspect of our regulations by also transitioning part 23 towards a regulatory framework based on performance standards.

D. Crashworthiness as an Illustration of the Benefits of Performance-Based Regulations

One area where the implications of a change from prescriptive to performance-based requirements are most evident is in the demonstration of crashworthiness. The current part 23 crashworthiness and occupant safety requirements are based on seat and restraint technology used in the 1980's. Currently, an applicant demonstrates crashworthiness by a sled test. Under the proposed standards, an applicant would not necessarily have to perform a sled test, but could instead employ a different method accounting for many other factors, several of which are described below. The FAA is imposing no new requirements, but would, under this proposal, provide greater flexibility to adopt new safety-testing methodologies and, ultimately, more advanced safety technologies.

The FAA proposes to allow greater flexibility with respect to the testing and demonstration, similar to advancements made in the automotive industry over the past 30 years. The proposed regulations would facilitate evaluation of the entirety of a crashworthiness system—namely, the interaction of all crashworthiness features—rather than requiring an evaluation of discrete, individual parameters. A system's ability to protect occupants can be better understood by evaluating it as a complete system, and using that greater understanding to develop and implement new technologies. Such an evaluation could include analyses of important survivability factors identified by the NTSB, including occupant restraints, survivable volume, energy-absorbing seats, and seat retention. These proposed crashworthiness standards would not necessarily prevent accidents, but should improve survivability.

The NTSB produced a series of reports in the 1980s that evaluated over 21,000 GA airplane crashes between 1972 and 1981. The NTSB General

Aviation Crashworthiness Project [15] evaluated airplane orientation, impact magnitudes, and survival rates and factors to provide information supporting changes in crashworthiness design standards for GA seating and restraint systems. The NTSB reports also established conditions approximating survivable accidents and identified factors that would have the largest impact on safety. Amendment 23–36 (53 FR 30802, August 15, 1988) to part 23 referenced these reports for dynamic seats but did not adopt a systems-evaluation approach.

The NTSB reports identified several factors that, working together as a system, should result in a safer airplane. The assessment also indicated, however, that shoulder harnesses offer the most immediate individual improvement for safety. The FAA codified the shoulder harnesses requirement in amendments 23–19 (42 FR 20601, June 16, 1977) and 23–32 (50 FR 46872, November 13, 1985) for newly manufactured airplanes. The FAA also issued policy statement ACE–00–23.561–01, Methods of Approval of Retrofit Shoulder Harness Installations in Small Airplanes,[16] dated September 19, 2000, to streamline the process for retrofitting older airplanes. Current part 23 requires occupant restraints to maintain integrity, stay in place on the occupant throughout an event, properly distribute loads on the occupant, and restrain the occupant by mitigating interaction with other items in the cabin. Newer technologies that enhance or supplement the performance of these restraints, such as airbags, are now being considered for inclusion in designs. The use of airbags has greatly increased passenger safety in automobiles, by offering protection in much more severe impacts and in impacts from multiple directions. The proposed performance standards would enable the use of these technologies.

Survivable volume is another critical factor in crashworthiness. Survivable volume is the ability of the airframe to protect the occupants from external intrusion, or the airplane cabin crushing during and after an accident. There were several observed accidents in the NTSB study where conventional airplane construction simply crushed an otherwise restrained occupant. Crashworthiness regulations have never included survivable volume as a factor, except in some instances in which an airplane turns over. Airplane designs should provide the space needed for the protection and restraint of the occupants. This is one of the first steps in the analysis of airplane crashworthiness.

Data from the NTSB General Aviation Crashworthiness Project suggested that energy-absorbing seats that protect the occupant from vertical impact loads could enhance occupant survivability and prevent serious injury, thereby enhancing odds for exiting the airplane and preventing many debilitating long-term injuries. The FAA established dynamic seat testing requirements in amendment 23–36 for airplanes certificated under part 23. Energy absorbing seats have a smaller impact than some other safety factors because accident impacts with large vertical components tend to have lower odds of survival. Nevertheless, energy attenuation from vertical forces, both static and dynamic, has been important to crashworthiness regulations for the past 25 years. Seats may crush or collapse, but must remain attached to the body of the airplane. Coupling the seat performance to the rest of the airframe response is important to the enhancement and understanding of occupant survivability. The FAA believes allowing designers to consider airframe deformation would result in more accurate floor impulses, which relate to simulated crash impact, and may allow for evaluation for crash impulses in multiple directions.

The NTSB also identified seat retention as another basic building block for airplane crashworthiness. The NTSB reports show more than a quarter of otherwise-survivable accidents included instances where the seats broke free at the attachment to the airplane, resulting in fatalities or serious injuries. Dynamic seat testing requirements address the ability of seat assemblies to remain attached to the floor, even when the floor shifts during impact. Pitching and yawing of the seat tracks during dynamic seat tests demonstrates the gimbaling and flexibility of the seat.

The FAA believes that, under this proposal, all of these crashworthiness factors could be incorporated into future testing methodologies and thereby increase the survivability of accidents in part 23 certificated airplanes. This proposed part 23 amendment would authorize design approval applicants to use these technologies and testing methodologies to enhance occupant safety.

E. Additional Requirements To Prevent LOC

LOC continues to be the leading cause of fatal GA accidents. The FAA identified 74 accidents caused by stall or LOC between January 2008 and December 2013. These accidents, which are listed in Appendix IV of the Part 23 Regulatory Evaluation,[17] represent the type of accidents that could be prevented by the proposed new stall and LOC requirements.

The FAA proposes to add requirements in §§ 23.200 and 23.215 to prevent LOC accidents. Inadvertent stalls resulting in airplane LOC cause a large number of small airplane fatal accidents. These LOC accidents in the traffic pattern or at low altitudes often result in fatalities because the airplane is too low to the ground for the pilot to recover control. The FAA therefore believes it can improve safety by requiring applicants to use new approaches to improve airplane stall characteristics to prevent such accidents.

Another type of low-speed LOC accident that occurs in significant numbers involves V_{MC} in light twin-engine airplanes. Virtually all twin-engine airplanes have a V_{MC} that allows directional control to be maintained after one engine fails. This speed is typically above the stall speed of the airplane. However, light twin-engine airplanes also typically have limited climb capability on one engine. Moreover, after the failure of one engine, pilots often instinctively tend to try to maintain a climb or maintain altitude, which slows the airplane down. If the speed drops below V_{MC}, the pilot can lose control of the airplane. Because pilots tend to be more aware of the airplane's stall speed, the FAA proposes in § 23.200 that certification levels 1 and 2 multiengine airplanes would be required to have a V_{MC} that does not exceed the stall speed of the airplane for each configuration. The FAA believes this proposed requirement would provide a higher level of safety than current § 23.149. The FAA requests comments on this proposal.

The FAA also proposes new requirements in § 23.215 for airplane stall characteristics and stall warning that would result in airplane designs more resistant to inadvertently stalling and departing controlled flight. These proposed requirements would increase the level of safety over the current requirements. At the same time, the FAA proposes to eliminate the spin recovery requirement in the current rules for normal category airplanes. The FAA believes the spin recovery requirement is unnecessary for normal category airplanes because the vast

[15] See *www.regulations.gov* (Docket # FAA–2015–1621).

[16] See *www.regulations.gov* (Docket # FAA–2015–1621).

[17] See *www.regulations.gov* (Docket # FAA–2015–1621).

majority of inadvertent stalls leading to spin entry occur below a safe altitude for spin recovery. However, airplanes certificated for aerobatics would still have to meet spin recovery requirements.

The FAA also proposes to address pilot stall awareness by requiring warnings that are more effective and by allowing new approaches to improve pilot awareness of stall margins. These warnings could be as simple as angle of attack or energy awareness presentations, or sophisticated envelope protection systems that add a forward force to the pilot's controls as the airplane speed and attitude approach stall.

F. Additional Requirements for Flight in Icing Conditions

The FAA proposes to implement the Part 23 Icing ARC's recommendations in §§ 23.230, 23.940 and 23.1405, to allow an applicant the option of certifying an airplane to operate in SLD icing conditions. To do so, an applicant would be required to meet the same safety standards in SLD icing conditions as currently demonstrated for part 23 airplanes in the icing conditions defined in appendix C to part 25.

Currently, the FAA does not certify part 23 airplanes to operate in SLD icing conditions, also known as freezing drizzle and freezing rain. Instead, current part 23 icing regulations require airplane performance, flight characteristics, systems, and engine operation to be demonstrated in the icing conditions defined in appendix C to part 25, which does not contain SLD icing conditions. In 2012, prior to the Part 23 Reorganization ARC, the Part 23 Icing ARC recommended revising part 23 to include SLD icing requirements in subparts B, E, and F (Flight, Powerplant, and Equipment, respectively).

If an applicant chooses not to certify an airplane in SLD icing conditions, proposed § 23.230 would require the applicant to demonstrate that SLD icing conditions could be detected and safely exited. A means of compliance for SLD detection and exit may be found in FAA Advisory Circular 23.1419–2D, Certification of Part 23 Airplanes for Flight in Icing Conditions.[18] The service history of airplanes certificated under part 23 and certified to the latest icing standards has shown that AC 23.1419–2D provides an adequate level of safety for detecting and safely exiting SLD icing conditions. Industry has indicated that these requirements would not impose an additional burden because many manufacturers have already equipped recent airplanes to meet the standards for detecting and exiting SLD in accordance with current FAA guidance. Proposed § 23.230, along with proposed § 23.940, Powerplant ice protection, and § 23.1405, Flight in icing conditions, and their respective means of compliance, address NTSB safety recommendations A–96–54 and A–96–56. The following table provides a summary of the proposed icing regulations.

PROPOSED ICING REGULATIONS

Part 23 type certificate limitations	Engine protection (§ 23.940)	Airframe and system protection, performance and flight characteristics requirements (§§ 23.230, 23.1300, and 23.1405)
Not certified for flight in icing conditions	Safe in part 25, App C conditions, ground ice fog, and falling/blowing snow.	None, except pitot heat required if airplane certified for flight in instrument meteorological conditions (IMC).
Certified for flight in icing conditions, but prohibited for flight in SLD.	Safe in part 25, App C conditions, ground ice fog, and falling/blowing snow.	Safe in part 25, App C conditions. Can detect SLD and safely exit.
Certified for flight in icing conditions and SLD	Safe in part 25, App C conditions, ground ice fog, and falling/blowing snow, and SLD.	Safe in part 25, App C conditions and SLD.

G. Production of Replacement and Modification Articles

The Part 23 Reorganization ARC recommended simplifying certification requirements for non-required systems and equipment, with an emphasis on improvement in overall fleet safety from the prevailing level. In the past, the FAA has not established different production requirements for required and non-required equipment that may enhance safety, or for articles whose improper operation or failure would not cause a hazard. The current requirements for producing articles and representing those articles as suitable for installation on type-certificated products are well suited for articles manufactured in accordance with a product's TC or STC, as well as for TSO and PMA parts. However, they may unnecessarily constrain the production of non-required, low risk articles.

Current standards for the production approval of these articles can create a barrier for their installation in the existing fleet of aircraft. Examples of such articles include carbon monoxide detectors, weather display systems, clocks, small hand-held fire extinguishers, and flashlights. In many cases, these articles are ''off-the-shelf'' products. It is frequently difficult for a person to install these articles on a type-certificated aircraft because the level of design and production details necessary for these articles to meet the provisions of current § 21.9, as expected for more critical articles, are frequently unavailable.

The FAA is therefore proposing to revise § 21.9, Replacement and Modification Articles, to provide applicants with an alternative method to obtain FAA approval to produce replacement and modification articles. This proposed change would allow a production approval applicant to submit production information for a specific article, without requiring the producer of the article to obtain approval of the article's design or approval of its quality system. The FAA intends to use the flexibility provided by this proposal to streamline the approval process for non-required safety enhancing equipment and other articles that pose little or no risk to aircraft occupants and the public. The FAA requests comments on this proposal, and particularly is interested in comments regarding whether the proposed change would safely facilitate retrofit of low risk articles and whether there are alternative methods to address the perceived retrofit barrier.

V. Key Terms and Concepts Used in This Document

The proposal includes a number of terms introduced into the regulations for the first time. These terms may be used

[18] See *www.regulations.gov* (Docket # FAA–2015–1621).

to replace existing prescriptive requirements or may explain other terms that have had longstanding use in the aircraft certification process, but in context of this rulemaking proposal, the FAA wants to specify its meaning. These terms are intended to set forth and clarify the safety intent of the proposed rules. Although certain terms may differ from those currently in use, these differences are not intended to increase the regulatory burden on an applicant unless specifically stated. The FAA's intent is that the proposed requirements incorporating these new terms not change the intent, understanding, or implementation of the original rule unless that requirement has been specifically revised in the proposal, such as is the case for requirements governing stall characteristics. To assist applicants in understanding the intent of the proposal, these terms are discussed below:

Airplane Certification Level—A division used for the certification of airplanes that is associated directly with the number of passengers on the airplane. Airplane certification levels would be established to implement the agency's concept of certificating airplanes using a process that recognizes a safety continuum.

Airplane Performance Level—Maximum airspeed divisions that are intended, along with airplane certification levels, to replace current weight and propulsion divisions used for the certification of airplanes. Current propulsion-based divisions assume that piston engine airplanes are slower than turbine-powered airplanes. Current weight-based divisions assume that heavier airplanes are more complex and would be more likely to be used in commercial passenger carriage than lighter airplanes. These assumptions are no longer valid. Airplane certification based on performance levels would apply regulatory standards appropriate to airplane's performance and complexity.

Departure Resistant—For the purposes of this NPRM, departure resistant refers to stall characteristics that make it very difficult for the airplane to depart controlled flight. Most fatal stall or spin accidents start below 1000 feet above ground level and do not actually spin, but start a yawing and rolling maneuver to enter the spin called a post stall gyration. In these low-altitude accidents, the airplane typically hits the ground before completing one turn. Therefore, the important safety criterion is preventing the airplane from exhibiting stall characteristics that could result in a departure from controlled flight.

Entry-Level Airplane—A two or four-place airplane typically used for training, rental, and by flying clubs. Historically, most of these airplanes have four cylinder engines with less than 200 horsepower. These airplanes typically have fixed-gear and fixed-pitch propellers, but may also have retractable landing gear and constant speed propellers. Entry-level airplanes typically cannot be used to train pilots to meet the requirements to operate a complex aircraft, as that term is defined for airman certification purposes.

Equivalent Level of Safety (ELOS) Finding—A finding made by the accountable aircraft certification directorate when literal compliance with a certification requirement cannot be shown and compensating factors in the design can be shown to provide a level of safety equivalent to that established by the applicable airworthiness standard.

Fuel—Any source used by the powerplant to generate its power.

Hazard—Any existing or potential condition that can lead to injury, illness or death; damage to or loss of a system, equipment, or property; or damage to the environment. A hazard is a condition that is a prerequisite to an accident or an incident. (Cf. Order VS 8000.367, Appendix A)

Issue Paper—A structured means for describing and tracking the resolution of significant technical, regulatory, and administrative issues that occur during a certification project. The issue paper process constitutes a formal communication vehicle for addressing significant issues among an applicant, the FAA, and if applicable, the validating authority (VA) or certificating authority (CA) for type validation programs. An issue paper may also be used to address novel or controversial technical issues.

Means of Compliance—A documented procedure used by an applicant to demonstrate compliance to a performance or outcome-based standard. Similar to an Advisory Circular (AC), a means of compliance is one method, but not the only method, to show compliance with a regulatory requirement. Additionally, if a procedure is used as a means of compliance, it must be followed completely to maintain the integrity of the means of compliance.

Performance- or Outcome-Based Standard—A standard that states requirements in terms of required results, but does not prescribe any specific method for achieving the required results. A performance-based standard may define the functional requirements for an item, operational requirements, or interface and interchangeability characteristics.

Pilot or Flightcrew—This is used generically throughout the proposed part 23 because part 23 has airplanes approved for single pilot operations as well as and two flightcrew members. For most airplanes certificated under part 23 that are single pilot, applicants should consider pilot and flightcrew to be interchangeable.

Prescriptive Design Standard—Specifies a particular design requirement, such as materials to be used, how to perform a test, or how an item is to be fabricated or constructed. (Cf. OMB Circular A–119 Section 5.f.)

Safety Continuum—The concept that one level of safety is not appropriate for all aviation activities. Accordingly, higher levels of risk, with corresponding requirements for less rigorous safety demonstrations for products, are accepted as aircraft are utilized for more personal forms of transportation.

Survivable Volume—The airplane cabin's ability to resist external intrusion or structural collapse during and after impact. The ability to resist is usually represented as a stiffer design around the cabin (not unlike a racecar roll cage) that is generally stronger than the surrounding structure. While the airframe may deform or disintegrate and attenuate impact energy, the cabin of the airplane will still maintain its integrity and protect the occupants restrained within. During otherwise survivable accident scenarios, including rollover, this structure should maintain its shape under static and dynamic loading conditions.

VI. Discussion of the Proposed Regulatory Amendments

A. Part 23, Airworthiness Standards

1. Subpart A—General

a. General Discussion

The FAA proposes eliminating the utility, acrobatic, and commuter categories for future airplanes certificated under part 23. The FAA also proposes to change from weight and propulsion divisions to performance and risk divisions. This would address the wide range of airplanes to be certificated under part 23 and enhance application of the safety continuum approach. Appendix 1 of this preamble contains a cross-reference table detailing how the current regulations are addressed in the proposed part 23 regulations.

b. Specific Discussion of Changes

i. Proposed § 23.1, Applicability and Definition

Proposed § 23.1 would prescribe airworthiness standards for the issuance of type certificates, and changes to those certificates, for airplanes in the normal category. Current § 23.3, Airplane categories, defines normal category as airplanes that have a seating configuration, excluding pilot seats, of nine or less, a maximum certificated takeoff weight of 12,500 pounds or less, and intended for nonacrobatic operation. Proposed § 23.1 would delete references to utility, acrobatic, and commuter category airplanes, and paragraph (b) would not include the current reference to procedural requirements for showing compliance. The reference to procedural requirements for showing compliance is redundant with the requirement in § 21.21, Issue of type certificate: Normal, utility, acrobatic, commuter, and transport category aircraft; manned free balloons; special classes of aircraft; aircraft engines; propellers, to show compliance. Proposed § 23.1 would also add three definitions specific to part 23: (1) Continued safe flight and landing, (2) designated fire zone, and (3) empty weight.

ii. Proposed § 23.5, Certification of Normal Category Airplanes

Proposed § 23.5 would apply certification in the normal category to airplanes with a passenger-seating configuration of 19 or less and a maximum certificated takeoff weight of 19,000 pounds or less. Proposed § 23.5 would also establish certification levels based on the passenger seating configuration and airplane performance levels based on speed.

The diversity of airplanes certificated under part 23 is large relative to performance, numbers of passengers, complexity, technology, and intended use. Airplane certification requirements under part 23 are currently determined using a combination of weight, numbers of passengers, and propulsion type. These divisions historically were appropriate because there was a clear relationship between the propulsion and weight of the airplane and its associated performance and complexity. Recent technological developments have altered the dynamics of this relationship. High-performance and complex airplanes now exist within the weight range that was typical for light and simple airplanes. Furthermore, current part 23 has evolved to meet the additional regulatory requirements resulting from the introduction of high-performance airplanes. This has resulted in the introduction of more stringent and demanding requirements in the lower weight airplanes such as the use of 14 CFR part 25 based requirements for simple, single-engine turbine airplanes. The result is that some of the current requirements have become more demanding for simple and low-performance airplanes.

The FAA proposes replacing the current part 23 weight and propulsion divisions because they were based on assumptions that do not always fit the large diversity of airplane performance, complexity, technology, intended use, and seating capacity encompassed in today's new airplane designs. Also, the current divisions may not be appropriate to address unforeseen designs of the future. The commuter category, originally intended for the certification of airplanes over 12,500 pounds and up to 19 passengers, is currently used for larger business jets with less than ten passengers. The proposed certification and performance level approach, while different from the current divisions, would capture the safety intent of part 23 more appropriately than the current propulsion and weight divisions.

The FAA proposes replacing the current divisions with specific technical and operational capabilities by addressing, for example, stall speed, VFR/IFR operation, pressurization, etc., that represent the actual technical drivers for current prescriptive requirements. These types of design specific technical and operational criteria would be more appropriate for a means of compliance document where a complete range of airplane designs could be addressed. The FAA proposes that high-speed, multiengine airplanes and multiengine airplanes over 12,500 pounds should continue meeting the equivalent commuter category performance-based requirements. The proposed performance requirements would be based on number of passengers (certification level) and airplane performance (performance level); not weight or propulsion type.

The FAA proposes to eliminate commuter, utility, and acrobatic airplane categories in part 23, retaining only normal category for all new part 23 type certificated airplane design approvals. The FAA believes this action would not affect the existing fleet of small airplanes. For example, the commuter category was originally introduced into part 23 to apply to a 10 to 19 passenger, multiengine airplane, operated in scheduled service under 14 CFR parts 121 and 135. However, new airplanes certified under part 23 can no longer be used in scheduled service under part 121 because § 121.157, Aircraft certification and equipment requirements, paragraph (h), requires a part 25 certification for newly type certificated airplanes. The majority of airplanes recently certified in the commuter category are multiengine business jets. Additionally, the certification category of commuter can be confused with the same term in the operating rules because the term is defined differently in the certification and operation rules. The FAA recognizes that moving away from weight and propulsion divisions would result in changes for the criteria used to determine when to apply the existing commuter category certification requirements using the numbers of passenger seats (excluding crewmember seats), performance, and technical divisions proposed in this NPRM. The FAA proposes the following airplane certification levels:

- Level 1—for airplanes with a maximum seating configuration of 0 to 1 passengers.
- Level 2—for airplanes with a maximum seating configuration of 2 to 6 passengers.
- Level 3—for airplanes with a maximum seating configuration of 7 to 9 passengers.
- Level 4—for airplanes with a maximum seating configuration of 10 to 19 passengers.

The differences between normal, utility, and acrobatic categories are currently very limited and primarily affect airframe structure requirements. Proposed part 23 would still allow a normal category airplane to be approved for aerobatics provided the airplane was certified to address the factors affecting safety for the defined limits for that kind of operation. Currently, the utility category provides airplanes additional margin for the more stringent inertial structural loads resulting from intended spins and the additional maneuvers stated in the requirements of the utility category in § 23.3(b). The FAA proposes that airplanes approved for spins be certificated to aerobatic standards. An airplane designed with traditional handling qualities and designed to allow spin training is more susceptible to inadvertent departure from controlled flight. The FAA believes that maintaining the current utility category for airplanes approved for spins and limited aerobatic maneuvers would negate the single largest safety gain expected from this rulemaking action—the significant reduction in inadvertent stall-related departures from controlled flight.

Proposed § 23.5(c) would categorize the performance level of an airplane as low speed or high speed. The combination of certification levels and performance levels is intended to provide divisions that address the actual safety concern of occupant numbers and performance, for example, future designs using novel propulsion methods. The FAA proposes the following airplane performance levels:

• Low speed—for airplanes with a design cruising speed (V_C) or maximum operating limit speed (V_{MO}) ≤ 250 KCAS (or M_{MO} ≤ 0.6).

• High speed—for airplanes with a V_C or V_{MO} > 250 KCAS (or M_{MO} > 0.6).

Proposed § 23.5(d) would identify a simple airplane as one with a certification level 1, a V_C or V_{MO} ≤ 250 KCAS (and M_{MO} ≤ 0.6), and a V_{SO} ≤ 45 KCAS, and approved only for VFR operations. The FAA proposes a simple airplane as equivalent to airplanes certificated under EASA's current CS–VLA. In most cases, EASA's CS–VLA requirements are identical to the proposed corresponding part 23 requirements and have been proposed in the requirements for certification level 1 airplanes. The FAA considered using the CS–VLA standards in combination with the proposed part 23 certification standards for all certification level 1, low-speed airplanes. However, the FAA believes that there are several requirements in CS–VLA that are not appropriate for all certification level 1, low-speed airplanes, such as no requirement for a type certified engine in CS–VLA. Therefore, the FAA proposes creating a limited certification and performance level for simple airplanes. Simple airplanes would be a subset of certification level 1, low-speed airplanes and would have a V_{SO} ≤ 45 KCAS and would only be approved for VFR operations.

In accordance with the FAA's objective to remove weight and propulsion divisions from the rules and use performance and certification divisions, the proposed requirements applicable to the certification of simple airplanes would not completely conform to the criteria EASA uses to certificate very light airplanes. The FAA proposes that simple airplanes would constitute a subset of certification level 1, low-speed airplanes that would be required to have a low stall speed limit and a VFR limitation in order to maintain a level of safety appropriate for these airplanes. The FAA believes that creating the simple certification level would encourage manufacturers of light-sport and experimental aircraft kits to pursue type certificates for their airplane designs without encountering the administrative, procedural or regulatory barriers existing in current part 23, while allowing innovative technology in those designs.

The FAA considered allowing airplanes that meet the consensus standards applicable to the certification of special light-sport aircraft to be included in proposed part 23. However, the FAA decided that this would not be in the best interest of the GA community because it could result in the elimination of the special light-sport aircraft category. There are advantages in the certification of special light-sport aircraft, such as self-certification, that would not be available if the aircraft were type certificated under part 23. This proposal would instead enable a simpler path to part 23 certification for airplanes that meet the definition of a light-sport aircraft and wish to pursue a type of certificate for business reasons.

The FAA expects simple airplanes to be more basic than the proposed certification level 1, low-speed airplanes. A simple airplane is a certification level 1, low-speed airplane with a stall speed limit of 45 KCAS that would be limited to VFR operations. The FAA recognizes that a simple airplane level would have characteristics very similar to certification level 1, low-speed airplanes, and that creating this category may be unnecessary. For this reason, the FAA is specifically asking for comments concerning the value of creating a separate, simple airplane level.

iii. Proposed § 23.10, Accepted Means of Compliance

Proposed § 23.10 would require an applicant to show the FAA how it would demonstrate compliance with this part using a means of compliance, which may include consensus standards, accepted by the Administrator. Proposed § 23.10 would also require an applicant requesting acceptance of a means of compliance to provide the means of compliance to the FAA in a form and manner specified by the Administrator.

Proposed § 23.10 would create flexibility for applicants in developing means of compliance and also specifically identify consensus standards as a means of compliance the Administratory may find acceptable. The Part 23 Reorganization ARC proposed using consensus standards for the detailed means of compliance to the fundamental safety requirements in proposed part 23. As discussed in the International Harmonization Efforts section of this NPRM, the intent of this proposal is to create a regulatory architecture for part 23 that is agile enough to keep up with innovation. Allowing the use of consensus standards would accomplish this goal.

The Part 23 Reorganization ARC recommended creating this proposed section to identify specifically the means of compliance documents developed by industry, users such as large flight schools, the interested public, and the FAA, that an applicant could use in developing a certification application. The ARC expressed two concerns that led to the creation of the proposed requirement. First, applicants need to use a means of compliance accepted by the Administrator when showing compliance to part 23. Second, while a consensus standards body (*i.e.,* ASTM, SAE, RTCA, etc.) developed means of compliance document may be available, individuals or organizations may also submit their own means of compliance documentation to the Administrator for consideration and potential acceptance. Additionally, the FAA wants to ensure applicants understand that an applicant-developed means of compliance document would require FAA review and acceptance by the Administrator.

The FAA anticipates that individuals or organizations would develop acceptable means for complying with the proposed performance standards. A standards organization such as ASTM, for example, could generate a series of consensus-based standards for review, acceptance, and public notice of acceptance by the FAA. The ASTM standards could be one way, but not the only way, to demonstrate compliance with part 23. Other consensus standard bodies such as RTCA and SAE are currently focused on developing standards for aircraft components and appliances.

The proposed airworthiness standards would allow airplanes to be certificated at different airplane certification levels. For example, software integrity levels appropriate for a certification level 1 airplane may not be appropriate for a certification level 4 airplane. Additionally, the takeoff performance of an airplane might be evaluated differently for an airplane intended to be certificated at different airplane certification levels. An applicant seeking certification of a certification level 1 airplane with a takeoff distance of 200 feet, for example, would not need to establish the takeoff distance with the same degree of accuracy as would an applicant seeking certification of a certification level 4 high-speed airplane with a takeoff distance of 4,000 feet.

By using means of compliance documents to show compliance with the proposed performance-based rules, the need for special conditions, ELOS findings, and exemptions to address new technology advancements would diminish. Once the Administrator accepted a means of compliance, it may be used for future applications for certification unless formally rescinded. Allowing the use of consensus standards as a means of compliance to performance-based regulations would provide the FAA with the agility necessary to more rapidly accept new technology, leverage industry expectations in the development of new means of compliance documents, and provide for the use of harmonized means of compliance among the FAA, industry, and foreign CAAs. While an applicant would not be required to use previously accepted means of compliance documents, their use would streamline the certification process by eliminating the need to develop an issue paper to address the certification of new technology. Proposed AC 23.10,[19] Accepted Means of Compliance, would provide guidance for applicants on the process applicants would follow to submit proposed means of compliance to the FAA for consideration by the Administrator.

The Part 23 Reorganization ARC expressed concerns that a consensus standard could be biased in favor of a few large manufacturers and would create an unfair competitive advantage. The FAA notes that any interested party may participate in the ASTM committees developing consensus standards thereby, mitigating this concern. The FAA expects that other consensus standards bodies would allow similar opportunities for interested parties to participate in their standards development work. Additionally, any individual or organization could develop its own means of compliance and submit it to the FAA for acceptance by the Administrator. The other risk identified by the Part 23 Reorganization ARC was that specialists in the industry could argue for complex means of compliance when the FAA would accept a simpler or more cost effective approach. However, the FAA would continue to allow applicants to propose their own means of compliance when the larger industry standard may be the appropriate level of safety for one, but not all certification levels. Lastly, the FAA intends to continue to allow the use of the current prescriptive means of compliance contained in current part 23 requirements as one obvious alternative to showing compliance with proposed part 23. This would not apply to the proposed sections that contain new requirements, such as §§ 23.200, 23.215, and 23.230.

The Part 23 Reorganization ARC also was aware the Administrator has accepted various manufacturers' internal standards in the past and recommended having that option stated in the proposal. Proposed § 23.10 would allow applicants to submit their internal standards as means of compliance for consideration by the Administrator.

iv. Removal of Subpart A Current Regulations

The FAA proposes removing current § 23.2, Special retroactive requirements, from part 23 because the operational rules currently address these requirements. The current retroactive rule is more appropriate in the operating rules. The FAA proposes amending 14 CFR part 91, as discussed later in the Discussion of the Proposed Regulatory Amendments to ensure removing the current § 23.2 requirement would not affect the existing fleet.

2. Subpart B—Flight

a. General Discussion

The FAA proposes moving away from the current stall characteristics and spin testing approach to address the largest cause of fatal accidents in small airplanes. Proposed § 23.215 in subpart B would omit the one turn/three second spin requirement for normal category airplanes, but it would increase the stall handling characteristics and stall warning requirements so the airplane would be substantially more resistant to stall-based departures than the current rules require.

The FAA also proposes eliminating the utility, acrobatic, and commuter categories in part 23. Accordingly, a new airplane would have to be approved for aerobatic loads as the normal category, even if an applicant only wanted to spin the airplane. Therefore, the FAA proposes to restrict certification of new airplanes for dual use, which can be done today using both the normal and utility categories. The FAA believes that if the airplane can spin for spin training, then the airplane can inadvertently stall and depart into a spin during normal operations. One of the FAA's goals is to prevent inadvertent stalls, so allowing airplanes that are commonly used as rental airplanes to spin would defeat the goal. However, the FAA would consider accepting a dual-purpose airplane if the airplane manufacturer provided a system that could be changed mechanically or electronically from normal to aerobatic as a maintenance function rather than controlled by the pilot.

The FAA proposes consolidating the performance requirements for high-speed multiengine airplanes and multiengine airplanes that weigh over 12,500 pounds. These airplanes are currently required to meet a series of one-engine-inoperative climb gradients. These climb gradients were based on part 25 requirements and intended for commuter category airplanes used in scheduled air service under parts 135 and 121. New airplanes certificated under part 23 are not eligible for operation in scheduled service under part 121, diminishing the utility of the commuter category for these airplanes.

More recently, part 23 multiengine jets intended to be used under parts 91 or 135 have been certificated in the commuter category, using part 25 based climb gradient requirements. In the spirit of the proposed rule change, the FAA has decided that the one-engine-inoperative climb requirements would be independent of the number of engines and some of the original requirements would be consolidated into a single requirement that would require performance very close to what is required today. This action intends to maintain the performance capabilities expected in 14 CFR part 135 operations.

The FAA proposes changes in the flight characteristics rules to keep the safety intent of the existing requirements consistent with the other proposed part 23 sections. The current part 23 requirements are based on small airplanes, designed with reversible controls, which include some accommodations for stability augmentation and autopilots. The FAA believes the proposed language would capture the current requirements for flight characteristics and allows for varying degrees of automated flight control systems in the future.

Finally, the FAA proposes adding a requirement to require certification levels 1 and 2 multiengine airplanes, not capable of climbing after a critical loss of thrust, to stall prior to reaching the minimum directional control speed (V_{MC}).

b. Specific Discussion of Changes

i. Proposed § 23.100, Weight and Center of Gravity

Proposed § 23.100 would require an applicant to determine weights and centers of gravity that provide limits for the safe operation of the airplane. Additionally, it would require an applicant to show compliance with each requirement of this subpart at each combination of weight and center of

[19] See *www.regulations.gov* (Docket # FAA–2015–1621).

gravity within the airplane's range of loading conditions using tolerances acceptable to the Administrator. Proposed § 23.100 would also require the condition of the airplane at the time of determining its empty weight and center of gravity to be well defined and easily repeatable.

Proposed § 23.100 would capture the safety intent of current §§ 23.21, Proof of compliance; 23.23, Load distribution limits; 23.25, Weight limits; 23.29, Empty weight and corresponding center of gravity; and 23.31, Removable ballast. This proposed section would ensure an applicant considers the important weight and balance configurations that influence performance, stability, and control when showing compliance with the flight requirements. The main safety requirements of current §§ 23.21–23.31 are located in current §§ 23.21 and 23.23. Current § 23.21 allows for a range of loading conditions shown by test or systematic investigation. The proposed rule would still allow for this flexibility, including the tolerances for flight test. Sections 23.25–23.31 provide definitions and directions for determining weights and centers of gravity and provides directions for informing the pilot. For these reasons, the information in these sections is more appropriate as a means of compliance.

ii. Proposed § 23.105, Performance

Proposed § 23.105 would require an airplane to meet the performance requirements of this subpart in various conditions based on the airplane's certification and performance levels for which certification is requested. Proposed § 23.105 also would require an applicant to develop the performance data required by this subpart for various conditions, while also accounting for losses due to atmospheric conditions, cooling needs, and other demands on power sources. Finally, proposed § 23.105 would require the procedures used for determining takeoff and landing distances to be executed consistently by pilots of average skill in atmospheric conditions expected to be encountered in service.

Proposed § 23.105 would capture the safety intent of current § 23.45, Performance—General. The safety intent of § 23.45(a) is captured in proposed § 23.105(a) and is essentially unchanged from the current rule, except to incorporate the proposed certification levels and speed divisions.

Proposed § 23.105(b) would capture the safety intent of § 23.45(b) by retaining § 23.45(b)(1) requirements and combining § 23.45(b)(2) and (b)(3) and allowing all airplanes to use the cooling climb limits as their upper temperature. The level of safety remains the same as the current part 23 because part 23 airplane pilots only have the limitations identified in the airplane flight manual, including engine temperature limits.

Proposed § 23.105(c) would also capture the safety intent of § 23.45(f). The safety intent of the current rule is to ensure an average pilot can consistently get the same results as published in the Airplane Flight Manual (AFM). The FAA believes this requirement would ensure applicants either perform their performance tests in a conservative manner or add margins and procedures to the AFM performance section so an average pilot can achieve the same performance.

Proposed § 23.105(d) would require performance data to account for losses due to atmospheric conditions, cooling needs, and other demands. The current rule specifies the position of cowl flaps or other means for controlling the engine air supply. The proposed language accounts for airplane performance, if affected by the cooling needs of the propulsion system, which is the safety intent of § 23.45, but would omit the details because they are more appropriate as a means of compliance.

Proposed § 23.105(d) would also capture the safety intent § 23.45(d) and (e). The safety intent of the current rule is to ensure the airplane performance accounts for minimum power available from the propulsion system, considering atmospheric and cooling conditions and accessories requiring power.

iii. Proposed § 23.110, Stall Speed

Proposed § 23.110 would require an applicant to determine the airplane stall speed or the minimum steady flight speed for each flight configuration used in normal operations, accounting for the most adverse conditions for each flight configuration, with power set at idle or zero thrust.

Proposed § 23.110 would capture the safety intent of current § 23.49, Stalling speed. Stall speeds are necessary to define operating and limiting speeds used to determine airplane performance. They also provide a basis for determining kinetic energy in emergency landing conditions. Therefore, determining stall speeds is required in the configurations used in the operation of the airplane.

The FAA proposes removing the 61-knot stall speed division for single-engine airplanes from the rules because this speed has not been a limitation since 1992 with the addition of the options for stall speeds in excess of 61 knots in § 23.562, Emergency landing dynamic conditions. Therefore, the 61-knot stall speed is a technical division rather than a limitation and would be more appropriate as a means of compliance.

The FAA is changing its approach to crashworthiness. Instead of constraining the connection between stall speed and crashworthiness to a single fixed speed, the FAA proposes allowing alternative approaches to crashworthiness. The intent is to encourage incorporation of innovations from other industries to provide more occupant protection in the airframe. This approach would base occupant protection on the actual stall speed rather than a single mandated stall speed.

iv. Proposed § 23.115, Takeoff Performance

Proposed § 23.115 would require an applicant to determine airplane takeoff performance, which includes the determination of ground roll and initial climb distance to 50 feet, accounting for stall speed safety margins, minimum control speeds; and climb gradients. Proposed § 23.115 would also require the takeoff performance determination to include accelerate-stop, ground roll and initial climb to 50 feet, and net takeoff flight path, after a sudden critical loss of thrust for certification levels 1, 2, and 3 high-speed multiengine airplanes, multiengine airplanes with a maximum takeoff weight greater than 12,500 pounds, and certification level 4 multiengine airplanes.

Proposed § 23.115 would capture the safety intent of current §§ 23.51, Takeoff speeds; and 23.61, Takeoff flight path. Takeoff distance information and the associated procedures for achieving those distances are necessary for the safe operation of all airplanes certified under part 23. Proposed § 23.115 would require applicants to determine, develop, and publish distance and procedure data for the pilot to use. The effects of airplane weight, field temperature and elevation, winds, runway gradient, and runway surface also need to be available to the pilot because they affect airplane performance. For proposed simple entry-level airplanes, conservative analysis may supplement flight test while data for larger, higher performance airplanes are expected to provide the level of precision that is accepted today.

Additionally, proposed § 23.115 would require applicants to determine critical thrust loss cases for multiengine airplanes. Today, the loss of one engine on a two-engine airplane is the standard model. The future possibilities for the functions of engines, if different from thrust, and how the engines are controlled, may determine critical thrust loss. For example, a large number of engines along the leading edge of a wing could function as a high-lift device as well as provide thrust.

Historically, limited propulsion options and the need for inherent stability from reversible, mechanical control systems have restrained airplane configurations. The FAA anticipates that new propulsion systems and affordable electronic flight control systems will challenge these traditional designs and need alternative means of compliance. Speed multiples and factors used in current part 23 prescriptive requirements are based on traditional airplane configurations. Part 23 mandates these details of design for compliance. The FAA believes removing these details would provide applicants with the agility and flexibility to address these new airplane configurations. The current factors will still apply for traditional configurations, but proposed performance-based requirements should allow rapid adoption of new means of compliance for future airplane configurations.

The FAA proposes removing airplane categories and weight and propulsion certification divisions for multiengine jets over 6,000 pounds and replacing them with divisions based on risk and performance. The commuter category, originally intended for the certification of airplanes over 12,500 pounds and up to 19 passengers, is currently used for larger business jets with less than ten passengers. The FAA proposes that high-speed, multiengine and multiengine airplanes over 12,500 pounds should continue meeting the equivalent commuter category performance-based requirements. The historical assumption applied to jets was that they were fast, had high wing loadings, and used significant runway distances for takeoff and landing. Therefore, all jets were required to have guaranteed climb performance with one engine inoperative. This requirement does not currently apply to single engine jets. The proposed performance requirements would be based on number of passengers (certification level) and airplane performance (performance level), not weight or propulsion type. The proposed certification and performance levels approach would not offer a one-to-one relationship with the current requirements. A low-speed turbine-powered airplane may be more appropriately addressed by regulations currently applicable to piston-powered airplanes, while a piston-powered or a high-speed electric airplane may be more appropriately addressed by regulations currently used for the certification of turbine-powered airplanes. The proposed certification and performance level approach, while different from the current divisions, would capture the safety intent of part 23 more appropriately than the current propulsion and weight divisions.

v. Proposed § 23.120, Climb Requirements

Proposed § 23.120 would require an applicant to demonstrate various minimum climb performances out of ground effect, depending on the airplane's certification level, engines, and performance capability. This new provision would capture the safety intent of current §§ 23.65, Climb: All engines operating; 23.67, Climb: One engine inoperative; and 23.77, Balked landing. Minimum climb performance information is necessary so pilots can determine if they have adequate clearance from obstacles beyond the end of the runway. New engine technologies, especially electric, would allow for alternative configurations that would invalidate many of the detailed test configuration and power assumptions that are in the current requirements.

Part 23 currently has a large matrix for all the climb requirements that includes category, weight, and number of engines, resulting in over 20 different climb gradient requirements. This reflects the growth in the variety of different airplane types that has occurred since the certification regulations were first adopted in CAR 3. Because the FAA proposes simplifying these divisions using certification levels and airplane performance levels, it can eliminate required climb gradients for three and four engines. The FAA proposes basing multiengine climb gradients on critical loss for thrust and using the gradient for the current twin-engine airplanes because it has resulted in a safe service history. The FAA proposes replacing the term ''failure of the critical engine'' (which addresses a twin engine airplane) with ''critical loss of thrust'' for airplanes certificated under those provisions. The reason for replacing this term is that with configurations utilizing large numbers of engines, the failure modes may not follow the traditional failure modes as with the loss of one engine on a two-engine airplane. Furthermore, the FAA proposes retaining and consolidating the climb gradients from current § 23.67 because these gradients are important minimum performance requirements for maintaining the current level of safety.

Proposed § 23.120(a) would capture the safety intent of current § 23.65. It would retain the existing climb gradients and atmospheric conditions required for pilot planning.

Proposed § 23.120(b) would capture the safety intent of current § 23.67, and consolidates the weight and propulsion divisions into all engines operating, critical loss of thrust, and balked landing groups. Furthermore, for high-speed airplanes, after a critical loss of thrust, the FAA proposes reducing the number of required climb conditions for certification to one gradient at 400 feet (122 meters) above the takeoff surface. For the typical part 23 certified twin-engine airplane, the required climb gradient at 400 feet (122 meters) above the takeoff surface is generally the most challenging. Airplanes that have the performance to meet this one requirement typically can meet all the current requirements. For certification levels 3 and 4, high-speed multiengine airplanes, the FAA proposes consolidating the configurations currently prescribed for the second segment climb and a discontinued approach. The climb gradient difference between these segments is 0.1 percent and uses the takeoff flap configuration rather than the approach flap configuration. Requiring only one climb gradient at 400 feet (122 meters) above the takeoff surface with the landing gear retracted and flaps in the approach position would maintain the current level of safety while reducing the requirements by eliminating initial, final, and discontinued approach climb tests. Because the proposed requirements would reduce the amount of climb testing for designs intended for use under part 91, applicants would also need to provide the traditional operational performance data, as is currently done, if the design is intended to be used for commercial operations under part 135 operating rules.

The FAA also proposes to normalize the initial climb height to 50 feet (15 meters) above the takeoff surface. The regulations for the certification of commuter category airplanes essentially adopted many of the part 25 climb requirements, including an initial climb height of 35 feet (11 meters) above the takeoff surface. When the commuter category was adopted, the expectation was that these airplanes would be used in part 121 service. This expectation allowed the FAA to accept the part 25 assumption that takeoff distances would be factored; thus, providing a safety margin to offset the lower initial climb height. Part 23 requirements provide minimum safe operations for part 91, which does not require factored takeoff distances. Therefore, allowing a 35 foot (11 meters) height above the takeoff surface is a lower safety margin than used for smaller airplanes and, for this reason, the FAA proposes to make all airplanes certificated under part 23 use 50 feet (15 meters) above the takeoff surface.

vi. Proposed § 23.125, Climb Information

Proposed § 23.125 would require an applicant to determine the climb performance for—

- All single engine airplanes;
- Certification level 3 multiengine airplanes after a critical loss of thrust on takeoff in the initial climb configuration; and
- All multiengine airplanes during the enroute phase of flight with all engines operating and after a critical loss of thrust in the cruise configuration.

Proposed § 23.125 would also require an applicant to determine the glide performance of the airplane after a complete loss of thrust for single engine airplanes.

Proposed § 23.125 would capture the safety intent of current §§ 23.63, Climb: General; 23.66, Takeoff climb: One-engine inoperative; 23.69, Enroute climb/descent; and 23.71, Glide: Single-engine airplanes. The intent of these requirements is to provide pilots with climb and glide performance data that is important for safety, especially in conditions near the performance limits of the airplane. Sections 23.63, 23.66, and 23.69 are not minimum performance sections, but contain information used in the development of the AFM. Proposed § 23.125 would require an applicant to determine climb performance. The performance data determination provides a good example of how the use of certification levels can allow simplified approaches to meet applicable airworthiness requirements for simple, and levels 1 and 2 airplanes.

vii. Proposed § 23.130, Landing

Proposed § 23.130 would require an applicant to determine the landing distance for standard temperatures at each weight and altitude within the operational limits for landing. The landing distance determination would start from a height of 50 feet (15 meters) above the landing surface, require the airplane to land and come to a stop (or for water operations, reach a speed of 3 knots) using approach and landing speeds, configurations, and procedures, which allow a pilot of average skill to meet the landing distance consistently and without causing damage or injury. Proposed § 23.130 would require these determinations for standard temperatures at each weight and altitude within the operational limits for landing.

Proposed § 23.130 would capture the safety intent of current § 23.73, Reference landing approach speed, and § 23.75, Landing Distance. Landing distance information and the associated procedures for achieving those distances are necessary to prevent runway overruns. Applicants would be required to determine, develop, and publish distance and procedures data for use in pilot planning. Proposed § 23.130 would combine the current requirements to determine approach speed and landing distance because a determination of both is required for a landing distance determination.

viii. Proposed § 23.200, Controllability

Proposed § 23.200 would require the airplane to be controllable and maneuverable, without requiring exceptional piloting skill, alertness, or strength, within the operating envelope, at all loading conditions for which certification is requested. This would would include during low-speed operations, including stalls, with any probable flight control or propulsion system failure, and during configuration changes. Proposed § 23.200 would require the airplane to be able to complete a landing without causing damage or serious injury, in the landing configuration at a speed of V_{REF} minus 5 knots using the approach gradient equal to the steepest used in the landing distance determination. Proposed § 23.200 would require V_{MC} not to exceed V_{S1} or V_{S0} for all practical weights and configurations within the operating envelope of the airplane for certification levels 1 and 2 multiengine airplanes that cannot climb after a critical loss of thrust. Proposed § 23.200 would also require an applicant to demonstrate those aerobatic maneuvers for which certification is requested and determine entry speeds.

Proposed § 23.200 would capture the safety intent of §§ 23.141, Flight Characteristics—General, 23.143, Controllability and Maneuverability—General; 23.145, Longitudinal control; 23.147 Directional and lateral control; 23.149, Minimum control speed; 23.151, Acrobatic maneuvers; 23.153, Control during landing; 23.155, Elevator control force in maneuvers; 23.157, Rate of roll; 23.697(b) and (c), Wing flap controls. Proposed § 23.200 would ensure the maneuvering flight characteristics of the airplane are safe and predictable throughout the flight envelope and result in repeatable, smooth transitions between turns, climbs, descents, and level flight. Configuration changes, such as flap extension and retraction, landing gear extension and retraction, and spoiler extension and retraction, along with probable failures resulting in asymmetric thrust, would also have to result in safe, controllable, and predictable characteristics.

Proposed § 23.200(a) and (b) would capture the safety intent of §§ 23.143, Controllability and Maneuverability—General; 23.145, Longitudinal control; 23.147, Directional and lateral control; 23.149, Minimum control speed; 23.151, Acrobatic maneuvers; 23.153, Control during landings; 23.155, Elevator control force in maneuvers; and 23.157, Rate of roll. The FAA proposes limiting the requirements for practical loadings and operating altitudes without the use of exceptional piloting skill, alertness, or strength.

Current part 23 provides prescriptive and detailed test requirements based on specific airplane configurations. Additionally, the current rules include flight test procedures that are based on traditional reversible controls and engine locations that are, in some cases, derived from airplanes designed in the 1930's. The FAA proposes performance-based requirements that would remain applicable to traditionally designed airplanes, but allow alternative approaches to showing compliance based on new configurations, flight control systems, engine locations, and number of engines.

Proposed § 23.200(c) would require all certification levels 1 and 2 multiengine airplanes that lack the performance to climb after a critical loss of thrust to stall before loss of directional control. This is a new requirement and it targets the high number of fatal accidents that occur after an engine failure in this class of airplane. Light multiengine airplanes that lack the performance to climb after the critical loss of thrust are especially susceptible to this type of accident. The Part 23 Reorganization ARC discussed and several members proposed that all multiengine airplanes have guaranteed climb performance after a critical loss of thrust. Ultimately, this approach was rejected, as it could impose a significant cost on the production of training airplanes. Furthermore, several members pointed out that the safety concern was not that the airplane could not climb on one engine, but rather that the airplane would depart controlled flight at low speeds above stall as a result of asymmetric thrust. The FAA agrees that loss of control caused by asymmetric thrust is the critical safety issue that should be addressed and the FAA believes that the proposed rule responds to this concern.

The FAA recognizes concerns regarding the proposed requirement—if the airplane is allowed to stall, the asymmetric thrust will still cause the airplane to lose directional control and likely depart controlled flight. The FAA agrees, but believes that pilots are typically more aware of their stall speeds than minimum control speed, especially during turns. Furthermore, these airplanes would be required to meet the proposed stall warning and stall characteristic requirements, which the FAA expects would provide additional safety margins beyond current requirements. Finally, the system that provides stall warning could also be designed to provide V_{MC} warning.

ix. Proposed § 23.205, Trim

Proposed § 23.205 would require the airplane to maintain longitudinal, lateral, and directional trim under various conditions, depending on the airplane's certification level, without allowing residual forces to fatigue or distract the pilot during likely emergency operations, including a critical loss of thrust on multiengine airplanes.

Proposed § 23.205 would capture the safety intent of current § 23.161, Trim. Section 23.161(a) addresses the safety intent while paragraphs (b), (c), (d), and (e) provide prescriptive details on how to do flight testing for traditionally configured airplanes and are more appropriate for inclusion in means of compliance.

x. Proposed § 23.210, Stability

Proposed § 23.210 would require airplanes not certified for aerobatics to have static and dynamic longitudinal, lateral, and directional stability in normal operations, and provide stable control force feedback throughout the operating envelope. Proposed § 23.210 would also preclude any airplane from exhibiting any divergent stability characteristic so unstable as to increase the pilot's workload or otherwise endanger the airplane and its occupants.

Proposed § 23.210 would capture the safety intent of the current §§ 23.171, Stability—General; 23.173, Static longitudinal stability; 23.175, demonstration of static longitudinal stability; 23.177, Static directional and lateral stability; 23.179, Instrumented stick force measurements; and 23.181, Dynamic stability. The current requirements have their origins in Aeronautics Bulletin 7, amendment 7a, effective October 1, 1934, which predates CAR 3. These airplane handling quality and stability requirements were based on the technology associated with simple mechanical control systems and what was considered acceptable on existing airplanes of the time. Although many of these requirements are still appropriate for traditional flight control systems, they do not take into account the capabilities of new computer-based flight control systems. The FAA recognizes the availability of hybrid reversible and automated flight control systems and proposes performance-based language that would allow their installation in part 23 certificated airplanes without the use of special conditions, while still maintaining adequate requirements for reversible controls. The intent is to facilitate the use of systems that may enhance safety while reducing pilot workload.

xi. Proposed § 23.215, Stall Characteristics, Stall Warning, and Spins

Proposed § 23.215 would require an airplane to have controllable stall characteristics in straight flight, turning flight, and accelerated turning flight with a clear and distinctive stall warning that would provide sufficient margin to prevent inadvertent stalling. Proposed § 23.215 would allow for alternative approaches to meeting this requirement for certification levels 1 and 2 airplanes and certification level 3 single-engine airplanes, not certified for aerobatics, in order to avoid a tendency to inadvertently depart controlled flight. Proposed § 23.215 would require airplanes certified for aerobatics to have controllable stall characteristics and the ability to recover within one and one-half additional turns after initiation of the first control action from any point in a spin. Additionally, the airplane would not be allowed to exceed six turns or any greater number of turns for which certification is requested while remaining within the operating limitations of the airplane. Proposed § 23.215 would preclude airplanes certified for aerobatics from having spin characteristics that would result in unrecoverable spins due to pilot disorientation or incapacitation or any use of the flight or engine power controls.

Proposed § 23.215 would capture the safety intent of current §§ 23.201, Wings level stall; 23.203, Turning flight and accelerated turning stalls; 23.207, Stall warning; and 23.221, Spinning. Historically, the FAA focused its requirements on the ability of the airplane to recover from a one-turn or three-second spin more than on the stall characteristics of the airplane. From the first fatal stall accident in the Wright Flyer airplane to today's fatal stall accidents, the number one cause in small airplanes is a departure from controlled flight following an inadvertent stall.

Except for accidental departures from controlled flight during stall training, most of these inadvertent departures occur in close proximity to the ground, and because of this, the current requirement to recover from a one-turn or three-second spin may not be the best method to assess the safety of the airplane. Even an experienced pilot may not have enough altitude to recover from the spin before impacting the ground. For this reason, the FAA proposes to delete the one-turn/three-second spin recovery requirement for normal category airplanes. Instead, the FAA proposes to increase the stall characteristics requirements by requiring that all certification levels 1 and 2 airplanes and certification level 3 single-engine airplanes provide substantial departure resistance to prevent inadvertent stalls from resulting in a departure from controlled flight and becoming fatal accidents.

Accident studies show that even hitting the ground as a result of a stall can be survivable if the airplane is still in controlled flight. Conversely, impacting the ground out of control is typically fatal. The FAA envisions numerous alternative approaches to meeting the proposed requirements, ranging from one extreme of spin resistance to the other extreme of a total systems-based approach such as stick pusher. Furthermore, there are envelope protection systems and stall warning concepts that could also be considered when assessing departure resistance. The possible approaches to meeting the proposed requirements are so broad that these alternatives would be better addressed in means of compliance. This level of protection may vary based on the characteristics of the airplane, but the FAA expects this change in design philosophy would increase the level of protection designed into airplanes under this proposed rule. Certification level 3 multiengine airplanes and certification level 4 airplanes historically have not had a large number of departure-related accidents. While the FAA encourages manufacturers to consider designing departure resistance into these airplanes, the FAA does not propose adding a new requirement for certification level 3 multiengine airplanes and certification level 4 airplanes.

The FAA also proposes revising stall warning requirements by removing prescriptive speed based stall warning requirements and requiring a clear and distinctive warning with sufficient warning margin for the pilot to prevent a stall. Historically, stall warning systems in part 23 airplanes have been simple, mechanical vanes that may or may not provide reasonable lead-time to prevent a stall. These systems also can provide false alerts when they are not needed, creating a nuisance. Furthermore, similar sounding warning horns that alert the pilot of other situations can result in the pilot either becoming used to the warning sounds or mistaking the stall warning for another warning such as the autopilot disconnect horn. The FAA believes removing the current prescriptive speed based stall warning from the rules would encourage the installation of better, more effective low speed awareness systems that may use angle of attack, a speed decay rate, or clear voice commands to alert the pilot.

xii. Proposed § 23.220, Ground and Water Handling Characteristics

Proposed § 23.220 would require airplanes intended for operation on land or water to have controllable longitudinal, and directional handling characteristics during taxi, takeoff, and landing operations. Proposed § 23.220 would also require an applicant to establish a maximum wave height shown to provide for controllable longitudinal, and directional handling characteristics and any necessary water handling procedures for those airplanes intended for operation on water.

Proposed § 23.220 would capture the safety intent of §§ 23.231, Longitudinal stability and control; 23.233, Directional stability and control; 23.235, Operation on unpaved surfaces; 23.237, Operation on water; and 23.239, Spray characteristics.

xiii. Proposed § 23.225, Vibration, Buffeting, and High-Speed Characteristics

Proposed § 23.225 would preclude vibration and buffeting from interfering with the control of the airplane or causing fatigue to the flightcrew, for operations up to V_D/M_D. Proposed § 23.225 would allow stall warning buffet within these limits. Proposed § 23.225 would preclude perceptible buffeting in cruise configuration at 1g and at any speed up to V_{MO}/M_{MO}, except stall buffeting for high-speed airplanes and all airplanes with a maximum operating altitude greater than 25,000 feet (7,620 meters) pressure altitude. Proposed § 23.225 would require an applicant seeking certification of a high-speed airplane to determine the positive maneuvering load factors at which the onset of perceptible buffet occurs in the cruise configuration within the operational envelope and preclude likely inadvertent excursions beyond this boundary from resulting in structural damage. Proposed § 23.225 would also require high-speed airplanes to have recovery characteristics that do not result in structural damage or loss of control, beginning at any likely speed up to V_{MO}/M_{MO}, following an inadvertent speed increase and a high-speed trim upset.

Proposed § 23.225 would capture the safety intent of current §§ 23.251, Vibration and buffeting; 23.253, High speed characteristics; and 23.255, Out of trim characteristics. Proposed § 23.225(a), (b), and (c) would capture the safety of current § 23.251(a), (b), and (c). The current safety intent of §§ 23.253 and 23.255 are incorporated in proposed § 23.225(d).

Proposed § 23.225(d)(1) addresses the current language in § 23.253, which indirectly divides the airplanes by engine type rather than performance. These requirements have typically been applied automatically to turbine-powered airplanes with the assumption that all turbine-powered airplanes flew fast and high. Piston or electric airplanes were not required to meet these requirements even if they were faster than many turboprops, because of propulsion assumptions in the past. For this reason, the FAA is amending this requirement to be based on performance instead of propulsion type using the same high-speed criteria from other subpart B sections. The existing details would be removed from the rules, as they are more appropriate as means of compliance because it would allow for alternatives for non-traditional airplanes, such as very fast piston airplanes.

Proposed § 23.225(d)(2) would address the current safety intent in § 23.255 by relying on performance and design characteristics without discriminating based on propulsion type. The specific design details are more appropriate as means of compliance.

xiv. Proposed § 23.230, Performance and Flight Characteristics Requirements for Flight in Icing Conditions

Proposed § 23.230 would require an applicant requesting certification for flight in icing conditions to demonstrate compliance with each requirement of this subpart. Exceptions to this rule would be those applicable to spins and any requirement that would have to be demonstrated at speeds in excess of 250 KCAS, V_{MO} or M_{MO}, or a speed that an applicant demonstrates the airframe would be free of ice accretion. Proposed § 23.230 would require the stall warning for flight in icing conditions and non-icing conditions to be the same. Proposed § 23.230 would require an applicant requesting certification for flight in icing conditions to provide a means to detect any icing conditions for which certification is not requested and demonstrate the airplane's ability to avoid or exit those conditions. Proposed § 23.230 would also require an applicant to develop an operating limitation to prohibit intentional flight, including takeoff and landing, into icing conditions for which the airplane is not certified to operate. Proposed § 23.230 would also increase safety by adding optional icing conditions a manufacturer may demonstrate its airplane can either safely operate in, detect and safely exit, or avoid. Proposed § 23.230 would only apply to applicants seeking certification for flight in icing.

Proposed § 23.230 would capture the safety intent of the performance and flight characteristics requirements in current § 23.1419(a) and along with proposed §§ 23.940, Powerplant ice protection, and 23.1405, Flight in icing conditions, and their respective means of compliance would address NTSB safety recommendations A–96–54 and A–96–56. Section 23.1419 specifies that airplanes must be able to operate safely in the icing conditions identified in appendix C to part 25, which encompass cloud size drops of less than 100 microns in diameter. Freezing drizzle (*i.e.,* drops up to 500 microns in diameter) and freezing rain (*i.e.,* drops greater than 500 microns in diameter) icing conditions, which can result in ice accretion aft of leading edge ice protection systems, are not included in appendix C to part 25. Amendment 25–140 (79 FR 65507, November 4, 2014) added these icing conditions to appendix O to part 25 and are not being defined in proposed § 23.230. The FAA believes that the definitions of these optional icing conditions would be more appropriate as a means of compliance. The standards for ''capable of operating safely'' in these conditions would be the same as cloud icing with additional icing conditions in the takeoff phase.

If certification for flight in the optional freezing drizzle or freezing rain conditions is not sought, proposed § 23.230 would require these conditions be avoided or detected and exited safely. The means of compliance for the latter, detect and exit the situation, would be similar to current guidance in AC 23.1419–2D, Certification of Part 23 Airplanes for Flight in Icing Conditions, and is currently applied during part 23 airplane icing certifications. These criteria are not as extensive as recommended by the Part 23 Icing ARC, but the FAA did not want to impose an additional burden on industry because the service history of airplanes certified under part 23 and the latest icing regulations at amendment 23–43 (58 FR 18958, April 9, 1993) show no SLD related accidents. The FAA believes the safety of the existing fleet can be greatly increased by improving the freezing drizzle and freezing rain capability of automated surface weather observation systems and pilot education and training of the limits of icing certification.

Proposed § 23.230(b) would provide an option to avoid, in lieu of detecting and exiting, the freezing drizzle or freezing rain icing conditions for which the airplane is not certified. This option is not in current guidance and such technology currently does not exist. The rule would provide an option in the event the technology is developed. The FAA believes avoiding rather than detecting and exiting would provide for safer airplane operations and reduce certification costs.

Proposed § 23.230(c) would require an AFM limitation to prohibit flight in icing conditions for which the airplane is not certified. This reflects current guidance in AC 23.1419–2D, which most manufacturers of new part 23 icing certified airplanes follow today. A minority of new manufacturers are not using AC 23.1419–2D guidance and have inserted AFM limitation language that reflects Airworthiness Directives (AD) that were issued globally to pneumatic boot-equipped airplanes between 1996 and 1998. The ADs in the below table require immediate exit from severe icing and warn that freezing drizzle and freezing rain may be conducive to severe icing. The proposed new limitation is intended to prohibit flight in known icing conditions, not forecast conditions.

Airplane model	Docket	Final rule
Aerostar Aircraft Corporation Models PA–60–600, PA–60–601, PA–60–601P, PA–60–602P, and PA–60–700P Airplanes	97–CE–56–AD	98–04–23
Pilatus Britten-Norman Ltd., Models BN–2A, BN–2B, and BN–2T Airplanes	97–CE–54–AD	98–04–21
Pilatus Aircraft Ltd., Models PC–12 and PC–12/45 Airplanes	97–CE–53–AD	98–20–28
Partenavia Costruzioni Aeronauticas, S.p.A. Model P68, AP68TP 300, AP68TP 600 Airplanes	97–CE–51–AD	98–04–20
Mitsubishi Heavy Industries, Ltd., MU–2B Series Airplanes	96–CE–61–AD	96–25–02
Harbin Aircraft Manufacturing Corp., Model Y12 IV airplanes	97–CE–50–AD	98–04–19
Empresa Brasileira de Aeronautica S.A. Airplanes. (Embraer) Models EMB–110P1 and EMB–110P2 Airplanes	96–CE–02–AD	96–09–12
Dornier Luftfahrt GmbH, 228 Series Airplanes	96–CE–04–AD	96–09–14
De Havilland, Inc., DHC–6 Series Airplanes	96–CE–01–AD	96–09–11
The Cessna Aircraft Company, 208 Series	96–CE–05–AD	96–09–15
The Cessna Aircraft Company, Model T210R airplane	98–CE–19–AD	98–20–33
The Cessna Aircraft Company, Models T210, P210, P210R airplanes	97–CE–62–AD	98–05–14 R1
The Cessna Aircraft Company Models T303, 310R, T310R, 335, 340A, 402B, 402C, 404, F406, 414, 414A, 421B, 421C, 425, and 441 Airplanes	97–CE–63–AD	98–04–28
Jetstream Aircraft Limited Models 3101 and 3201 Airplanes	96–CE–07–AD	96–09–17
The New Piper Aircraft PA–23, PA–30, PA–31, PA–34, PA–39, PA–40, and PA–42 Series Airplanes	98–CE–77–AD	99–14–01
The New Piper Aircraft Corporation Models PA–46–310P and PA–46–350P Airplanes	97–CE–60–AD	98–04–26
Beech Aircraft Corporation Models 99, 99A, A99A, B99, C99, B200, B200C, 1900, 1900C, and 1900D Airplanes	96–CE–03–AD	96–09–13
Raytheon Aircraft Company 200 Series Airplanes	98–CE–17–AD	98–20–38
Raytheon Aircraft Company Models E55, E55A, 58, 58A, 58P, 58PA, 58TC, 58TCA Airplanes, and 60, 65–B80, 65–B90, 90, F90, 100, 300, and B300 Series Airplanes	97–CE–58–AD	98–04–24
Raytheon Aircraft Company Model 2000 Airplanes	97–CE–59–AD	98–04–25
AeroSpace Technologies Of Australia Pty Ltd., Models N22B and N24A	97–CE–49–AD	98–04–18
SIAI Marchetti, S.r.1 Models SF600 and SF600A Airplanes	97–CE–64–AD	98–05–15
SOCATA—Groupe AEROSPATIALE, Model TBM 700 Airplanes	97–CE–55–AD	98–04–22
Twin Commander Aircraft Corporation Models 500, 500–A, 500–B, 500–S, 500–U, 520, 560, 560–A, 560–E, 560–F, 680, 680–E, 680FL(P), 680T, 680V, 680W, 681, 685, 690, 690A, 690B, 690C, 690D, 695, 695A, 695B, and 720 Airplanes	97–CE–57–AD	98–20–34
Fairchild Aircraft Corporation, SA226 and SA227 Series Airplanes	96–CE–06–AD	96–09–16

Recently, manufacturers of airplanes certificated under part 23 have proposed inhibiting, or optimizing, bleed air ice protection systems above an altitude of 30,000 feet (9,144 meters) because the icing conditions defined in the appendix C to part 25 are limited to below this altitude. The FAA believes ice protection design at high altitude should be addressed as a means of compliance and not in the proposed rule due to various acceptable design solutions. An industry means of compliance would negate the need for a special condition or means of compliance issue paper currently required for these projects.

xv. Current Subpart B Regulations Relocated to Other Proposed Subparts

The FAA proposes addressing the safety intent of § 23.33, Propeller speed and pitch limits, in § 23.900(a) of the propulsion rules. Additionally, the first part of the current § 23.251(a) that addresses structural damage has been relocated and is now addressed under ''flutter'' in proposed subpart C to part 23.

The FAA proposes adopting the Part 23 Icing and Part 23 Reorganization ARC's recommendations to move performance and flight characteristics requirements in icing, currently in § 23.1419, to subpart B, so that proposed § 23.1405 only contains systems requirements. Proposed § 23.230(a) would also include stall warning requirements. Current guidance contains these stall warning recommendations (*i.e.,* margin and type of stall) and service history shows them to be necessary for safe flight in icing conditions. The exceptions for spin and high-speed requirements are consistent with the current rule and industry practice that have shown to provide an adequate level of safety in icing conditions. The FAA determined that the evaluations of ice contaminated tailplane stall susceptibility, lateral control in icing, and autopilot operation in icing, which are included in current guidance for part 23 icing certification, are more appropriately addressed as a means of compliance.

xvi. Removal of Subpart B Current Regulations

The FAA proposes removing § 23.45(g) that requires takeoff and landing distances be determined on a smooth, dry, hard-surfaced runway. The FAA believes that most performance tests would be done on smooth, dry, hard-surfaced runways because these surfaces provide applicants with the best results. Performance determinations on surfaces other than smooth, dry hard surfaces would provide conservative results and be acceptable as long as the surface was specified in the AFM. Therefore, the FAA believes retaining this requirement is unnecessary.

The FAA proposes removing § 23.63, Climb: General, which addresses the general climb requirements, because the safety intent contained in this section is redundant with the safety intent proposed in § 23.125 and the testing procedures contained in § 23.63 are more appropriate for inclusion in means of compliance.

The FAA proposes removing current § 23.221(a) and (b), which address spinning requirements for normal and utility category airplanes, and would no longer be necessary. The increased focus on preventing stall-based departures along with improved stall margin awareness would provide a level of safety higher than would be achieved through spin testing.

The FAA proposes removing the reference to appendix C to part 25, part II, currently in § 23.1419, Ice protection, paragraph (a), when relocating § 23.1419 to proposed § 23.230 and 23.1405. Part II is a means of compliance for determining critical ice accretions on transport category airplanes and is not applicable to airplanes certified under part 23.

3. Subpart C—Structures

a. General Discussion

The FAA's intent in proposed subpart C is to provide a regulatory framework that maintains the current level of safety while (1) allowing for certification of unique airplane configurations with new technology and materials, and (2) supporting new means of compliance, testing, and analysis. To support new technologies, the FAA proposes to incorporate the safety intent of recent special conditions for airplanes equipped with systems that affect structural performance, such as load alleviation systems, in proposed § 23.305. To support new means of compliance, the FAA proposes in § 23.600 to emphasize a holistic approach to occupant safety, which would allow certain applicants to omit current required dynamic seat testing.

It is not the FAA's intent to reduce the level of safety in the proposed subpart C. The FAA based the prescriptive requirements in current subparts C and D on service history, historic test data, and lessons learned. These requirements have provided a level of safety where structural failure is rare and most often attributable to airplane upset or pilot disorientation in instrument meteorological conditions. A means of compliance to proposed subpart C must maintain the level of safety provided by the current regulations. Applicants would need to substantiate the level of safety for proposed means of compliance that deviate from the prescriptive regulations.

Proposed subpart C would replace current subpart C and include those sections of current subpart D that are applicable to the airframe. We have arranged proposed subpart C into the following five topics:

- General: Including § 23.300, Structural design envelope; and § 23.305 Interaction of systems and structures.
- Structural Loads: Including § 23.310, Structural design loads; § 23.315, Flight load conditions; § 23.320, Ground and water load conditions; § 23.325, Component loading conditions; and § 23.330, Limit and ultimate loads.
- Structural performance: Including § 23.400, Structural strength; § 23.405, Structural durability; and § 23.410, Aeroelasticity.
- Design: Including § 23.500, Structural design; § 23.505, Protection of structure; § 23.510, Materials and processes; and § 23.515, Special factors of safety.
- Structural occupant protection: Included in § 23.600, Emergency conditions.

The FAA proposes removing the content of current appendix A to part 23, Simplified design load criteria; appendix C to part 23, Basic landing conditions; appendix D to part 23, Wheel spin-up and spring-back loads; and appendix I to part 23, Seaplane loads. The content of these current part 23 appendices is more appropriate for inclusion in means of compliance. The FAA also proposes removing appendix B to part 23, Reserved, since the content of this appendix was removed at amendment 23–42 (56 FR 344, January 3, 1991). Refer to appendix 1 of this preamble for a cross-reference table detailing how the current regulations are addressed in the proposed part 23 regulations.

b. Specific Discussion of Changes

i. Proposed § 23.300, Structural Design Envelope

Proposed § 23.300 would require an applicant to determine the structural design envelope, which describes the range and limits of airplane design and operational parameters for which an applicant would show compliance with the requirements of this subpart. Proposed § 23.300 would capture the safety intent of current §§ 23.321, Loads—General, paragraphs (b) and (c); 23.333, Flight envelope, paragraphs (a), (b), and (d); 23.335, Design airspeeds; 23.337, Limit maneuvering load factors, paragraphs (a) and (b); and 23.343, Design fuel loads, paragraphs (a) and (b).

Proposed § 23.300 would require the applicant to determine and document the range of airplane and operational parameters for which the applicant will show compliance with the requirements of subpart C. These parameters would include the design airspeeds and maneuver load factors often depicted as a V-n diagram. An applicant would be required to determine design airspeeds, including the design maneuvering speed (V_A), the design cruising speed (V_C), the design dive speed (V_D), design flap and landing gear speeds, and any other speed used as a design limitation. For certification of level 4 airplanes, an applicant would be required to determine a rough air penetration speed, V_B.

Additionally, applicants would have to determine the design maneuver load factors based on the intended usage of the airplane and the values associated with the level of safety experienced with current designs. Applicants have rarely used the relief for maneuvering load factors based on airplane capabilities in current § 23.337(c). The FAA views this relief as an application of physical principles, and believes that this current requirement does not need to be addressed in proposed § 23.300.

Design weights and inertia parameters are also part of the structural design envelope. Design weights include the empty weight, maximum weight, takeoff and landing weight, and maximum zero fuel weight. The range of center of gravity locations at these and other weights is depicted as the weight center of gravity envelope. An applicant would have to determine the weight and center of gravity of occupants, payload, and fuel as well as any mass moments of inertia required for loads or flutter analysis. An applicant would also have to specify any other parameters that describe the structural design envelope. These parameters include maximum altitude limitations, Mach number limitations, and control surface deflections.

ii. Proposed § 23.305, Interaction of Systems and Structures

Proposed § 23.305 would provide a regulatory framework for the evaluation of systems intended to modify an airplane's structural design envelope or structural performance and other systems whose normal operating state or failed states may affect structural performance. Compliance with proposed § 23.305 would provide acceptable mitigation of structural hazards identified in the functional hazard assessments required by proposed § 23.1315.

Proposed § 23.305 would apply to airplanes equipped with—

- Structural systems, including load alleviation systems, where the intended function is to modify structural performance, to alleviate the impact of subpart C requirements, or provide a means of compliance to subpart C requirements; and
- Systems where the intended function is non-structural, but whose normal operation or failure states affect the structural design envelope or structural performance, and would include fuel management systems, flight-envelope protection systems, and active control systems.

Under the current regulations, an applicant seeking certification of airplanes incorporating structural and non-structural systems must ensure that failures of these systems will not result in exceeding the structural design envelope or the structural design loads, or other structural performance characteristics. An applicant has the option of designing the structure to the full subpart C and subpart D requirements, including margins of safety, with the system in its failed state. This option may result in increased structural weight and reduced airplane performance and utility.

Proposed § 23.1315 in subpart F would apply to both structural and non-structural systems. Guidance material for current § 23.1309, the corresponding regulation to proposed § 23.1315, allows for different acceptable values for likelihood of failures based on the severity of the hazard, airplane weight, and method of propulsion. These different values encourage the incorporation of equipment that improves pilot situational awareness and other systems that promote the overall airplane level of safety.

In most cases, means of compliance with proposed § 23.305 would follow an approach somewhat similar to that used in the guidance material for current § 23.1309. Structural failures resulting in fatalities are rare, occurring at a rate of approximately 3×10^{-8} per flight hour for small airplanes. The reason for incorporating structural systems is not, in general, to improve safety, but rather to reduce structural weight and thereby improve airplane performance. Proposed § 23.305 would require that the level of safety must be the same for airplanes equipped with systems that affect the structure and airplanes without such systems.

An existing acceptable means of complying with proposed § 23.305 is provided in several existing special conditions that address the interaction of systems and structures, for example, FAA Special Condition 25–390–SC.[20] Most of these special conditions address load alleviation systems. Load alleviation systems counteract the effects of gust and maneuver loads and allow an applicant to design a lighter structure, thereby improving the performance and utility of the airplane. These special conditions require that an applicant design the structure to the required structural safety margins with the load alleviation system its normal functioning state. The special conditions provide a means for an applicant to maintain the required structural safety margins with the system in its failed state by adjusting the required safety margins based on the likelihood of system failure. Systems that fail frequently require higher safety margins than systems that rarely fail in order to maintain the same level of safety. The means of compliance described in these special conditions allow an applicant to utilize the benefits of structural systems and potentially eliminate weight and performance penalties associated with structural hazards due to system failures.

Applicants who use the means of compliance described in the existing special conditions would be able to use data developed for compliance with proposed § 23.1315. This data includes identification of failure modes, identification of hazards resulting from the failure modes, and the likelihood of the occurrence of the failure modes. With or without the proposed § 23.305 requirements, an applicant would have to account for structural performance with the system in its normal operating and failed states and evaluate the system for compliance to the proposed § 23.1315. The FAA does not expect that additional detailed structural analysis would be required for compliance with proposed § 23.305 other then the application of optional lower safety margins to the structural performance analysis.

Proposed § 23.305 would allow an applicant to realize the value of structural and non-structural systems and would potentially allow reduced structural weight of the airplane. The magnitude of the weight reduction would depend on the functional characteristics of the systems and the likelihood of system failures. The FAA believes proposed § 23.305 would reduce the need for special conditions that deal with interaction of systems and structures, saving time and effort for the FAA and the applicant.

iii. Proposed § 23.310, Structural Design Loads

Proposed § 23.310 would require an applicant to determine structural design loads resulting from any externally or internally applied pressure, force, or moment, which may occur in flight, ground and water operations, ground and water handling, and while the airplane is parked or moored. Proposed § 23.310 would require the applicant to determine structural design loads at all combinations of parameters on and within the boundaries of the structural design envelope which result in the most severe loading conditions. Proposed § 23.310 would also require the magnitude and distribution of these loads to be based on physical principles and would be no less than service history has shown can occur within the structural design envelope.

Proposed § 23.310 would capture the safety intent of §§ 23.301, Loads; 23.302, Canard or tandem wing configurations; 23.321, Flight Loads—General, paragraph (a); and 23.331, Symmetrical flight conditions. Proposed § 23.310 would also capture the intent of several current requirements for sound and physics-based engineering evaluations. An example is in current § 23.301(b), which requires that the forces and moments applied to the airplane must balance in equilibrium, and the distribution of loads on the airplane must reasonably approximate actual conditions. The part 23 regulations should not need to prescribe basic physical principles, sound engineering judgment, and common sense. Proposed § 23.310 would place the burden on the applicant to properly account for loads acting on the structure.

[20] *http://rgl.faa.gov/Regulatory_and_Guidance_Library/rgSC.nsf/0/7B2D4B459E2784858625 7620006A6999?OpenDocument&Highlight=25-390-sc*

iv. Proposed § 23.315, Flight Load Conditions

Proposed § 23.315 would require an applicant to determine the loads resulting from vertical and horizontal atmospheric gusts, symmetric and asymmetric maneuvers, and, for multiengine airplanes, failure of the powerplant unit which results in the most severe structural loads. Proposed § 23.315 would capture the safety intent of current §§ 23.333, Flight envelope, paragraph (c); 23.341, Gust loads factors; 23.347, Unsymmetrical flight conditions; 23.349, Rolling conditions; 23.351, Yawing conditions; 23.367, Unsymmetrical loads due to engine failure; 23.421, Balancing loads; 23.423, Maneuvering loads; 23.425, Gust loads; 23.427, Unsymmetrical loads; 23.441, Maneuvering loads; 23.443, Gust loads; and 23.445, Outboard fins or winglets, paragraphs (b), (c), and (d).

These current part 23 sections establish prescriptive requirements for gust loads and symmetrical, rolling, and yawing maneuvering loads, acting on the wing, horizontal tail, vertical tail, and other lifting surfaces. Portions of the current sections, such as § 23.331(c), are restatements of basic physical principles. Proposed § 23.315 would remove this language.

The FAA's intent is not to lessen the structural load requirements. The current prescriptive flight load requirements have established a level of safety where structural failure due to overloading is rare. When structural failures do occur, the most common cause is airplane upset or pilot disorientation in instrument meteorological conditions.

The FAA believes the prescriptive content of the current regulations, including the modified Pratt formula for gust loads, the descriptions of symmetrical maneuvers, checked and unchecked maneuvers, rolling maneuvers, and yawing maneuvers are more appropriate for inclusion in means of compliance. Applicants who wish to propose alternate design loading conditions should note that extensive data collection, testing, and evaluation may be necessary to substantiate their proposal.

v. Proposed § 23.320, Ground and Water Load Conditions

Proposed § 23.320 would require an applicant to determine the loads resulting from taxi, take-off, landing, and ground handling conditions occurring in normal and adverse attitudes and configurations. Proposed § 23.320 would capture the safety intent of current §§ 23.471, Ground Loads—General; 23.473, Ground load conditions and assumptions; 23.477, Landing gear arrangement; 23.479, Level landing conditions; 23.481, Tail down landing conditions; 23.483, One-wheel landing conditions; 23.485, Side load conditions; 23.493, Braked roll conditions; 23.497, Supplementary conditions for tail wheels; 23.499, Supplementary conditions for nose wheels; 23.505, Supplementary conditions for skiplanes; 23.507, Jacking loads; 23.509, Towing loads; 23.511, Ground load; unsymmetrical loads on multiple-wheel units; 23.521, Water load conditions; 23.523, Design weights and center of gravity positions; 23.525, Application of loads; 23.527, Hull and main float load factors; 23.529 Hull and main float landing conditions; 23.531, Hull and main float takeoff condition; 23.533, Hull and main float bottom pressures; 23.535, Auxiliary float loads; 23.537, Seawing loads, and 23.753 Main float design.

The current requirements set forth prescriptive requirements for determining takeoff and landing loads for airplanes operated on land, loads acting on floats and hulls for airplanes operated on water, as well as ground handling loads, including jacking and towing conditions. The current requirements also provide applicants with descriptions of the normal and adverse operating conditions and configurations for which applicants must determine ground and water loads.

The FAA believes that the prescriptive descriptions of the loading conditions, normal and adverse conditions, and configurations are more appropriate for inclusion in means of compliance. Applicants who wish to propose alternate design loading conditions should note that extensive data collection, testing, and evaluation may be necessary to substantiate their proposal.

vi. Proposed § 23.325, Component Loading Conditions

Proposed § 23.325 would require an applicant to determine the loads acting on each engine mount, flight control and high lift surface, and the loads acting on pressurized cabins. Proposed § 23.325 would capture the safety intent of current §§ 23.345, High lift devices; 23.361, Engine torque; 23.363, Side load on engine mount; 23.365, Pressurized cabin loads; 23.371, Gyroscopic and aerodynamic loads; 23.373, Speed control devices; 23.391, Control surface loads; 23.393, Loads parallel to hinge line; 23.395, Control system loads; 23.397, Limit control forces and torques; 23.399, Dual control system; 23.405, Secondary control system; 23.407, Trim tab effects; 23.409, Tabs; 23.415, Ground gust conditions; 23.455, Ailerons; and 23.459, Special devices.

The current part 23 regulations establish prescriptive requirements for determining loads acting on pressurized cabins, engine mounts and attachment structure, control surfaces, high lift surfaces, and speed control devices. The FAA believes that these prescriptive requirements in the current regulations are more appropriate for inclusion in means of compliance. However, in proposed § 23.325, we have retained some of the prescriptive requirements for pressurized cabins, including descriptions of combined loading conditions and additional factors of safety for determining limit load.

vii. Proposed § 23.330, Limit and Ultimate Loads

Proposed § 23.330 would describe how the applicant must determine the limit and ultimate loads associated with the structural design loads. Proposed § 23.330 would capture the safety intent of current §§ 23.301, Loads, paragraph (a); and 23.303, Factor of safety. These current sections specify factors of safety for determining limit and ultimate loads.

Proposed § 23.330 retains the current 1.5 safety factor for ultimate loads. This safety factor has resulted in a service history where structural failures due to applied static loads are rare. The FAA believes the 1.5 factor of safety is critical to maintaining the current level of safety.

Proposed § 23.330 would allow for additional special factors of safety to account for material and manufacturing variability. Proposed § 23.330 would also allow alternate factors of safety when showing compliance with occupant protection loading conditions and when showing compliance with proposed § 23.305.

viii. Proposed § 23.400, Structural Strength

Proposed § 23.400 would require an applicant to demonstrate that the structure will support limit and ultimate loads. Proposed § 23.400 would capture the safety intent of current §§ 23.305, Strength and deformation; and 23.307, Proof of structure.

These current sections provide performance criteria for the structure when subjected to limit and ultimate loads. Proposed § 23.400 would retain these performance criteria and would require the applicant to demonstrate that the structure will meet these performance criteria. In this context, "demonstrate" means the applicant must conduct structural tests to show compliance with the structural performance requirements, unless the applicant shows that a structural analysis is reliable and applicable to the structure. The FAA proposes not to retain the ''3 second'' rule in proposed § 23.400. This prescriptive requirement in current § 23.305(b) requires the applicant to demonstrate that the structure will support ultimate load for at least three seconds. The FAA believes this prescriptive requirement is a statement of physical principles and testing experience and is more appropriate for inclusion in means of compliance.

ix. Proposed § 23.405, Structural Durability

Proposed § 23.405 would require an applicant to develop and implement procedures to prevent structural failures due to foreseeable causes of strength degradation, and to prevent rapid decompression in airplanes with a maximum operating altitude above 41,000 feet. Proposed § 23.405 would also require an airplane to be reasonably capable of continued safe flight and landing with foreseeable structural damage caused by high-energy fragments from an uncontained engine or rotating machinery failure. Proposed § 23.405 would capture the safety intent of current §§ 23.365(e), Pressurized cabin loads; 23.571, Metallic pressurized cabin structures; 23.572, Metallic wing, empennage, and associated structures; 23.573, Damage tolerance and fatigue evaluation of structure; 23.574, Metallic damage tolerance and fatigue evaluation of commuter category airplanes; 23.575, Inspections and other procedures; and 23.627, Fatigue strength.

Proposed § 23.405(a) would require an applicant to develop and implement procedures to prevent structural failures. These procedures may include the safe-life, damage tolerance, or fail-safe design approaches described in the current regulations. An applicant can propose other means of compliance, but these means must provide at least the same level of safety as current means of compliance. Any new means of compliance must consider the airplane design, manufacturing, operational, and maintenance environments. The FAA proposes implementing these procedures by including them in the airplane's Instructions for Continued Airworthiness.

The procedures must be able to prevent structural failures due to foreseeable causes of strength degradation. Foreseeable causes include fatigue and corrosion in metallic structures, and fatigue, delaminations, disbonds, and impact damage in composite structures. New material systems or structural designs, such as additive manufacturing, may introduce new causes of strength degradation and may require development of new and unique procedures to prevent structural failures.

The current part 23 regulations use prevention of catastrophic failures as the safety intent of the regulations. The word ''catastrophic'' is used throughout the current regulations, current policy, and guidance material, especially in context of system safety analysis. To avoid any potential conflict over the meaning of ''catastrophic,'' proposed § 23.405(a) would specify the consequences we want to prevent. These consequences include the obvious performance criteria for prevention of serious injuries, fatalities, or hull loss of the airplane.

The FAA also wants to prevent extended periods of operations with reduced safety margins in those structural components whose failure could result in serious injuries, fatalities, or hull loss. One situation that can result in reduced safety margins is fail-safe design. The FAA has identified potential shortcomings in fail-safe designs, including an applicant's difficulty to anticipate all possible failure scenarios and ensure that all structural failures would be immediately obvious and corrected before further flight. The concept of failures being obvious and repaired before further flight is basic to the successful implementation of a fail-safe design. This scenario could allow operation for extended periods with a passive structural failure and reduced safety margins. If an applicant chooses fail-safe design as a means of compliance, an applicant would have to ensure that the structure was not operating for extended periods with reduced safety margins. An applicant may be able to apply safe-life or damage tolerance principles to ensure that fail-safe structure maintains the required safety margins without extended periods of operation with reduced safety margins through life limits or damage tolerance based inspections.

Proposed § 23.405(b) would capture the safety intent of current § 23.365(e), requiring the applicant to design the structure for sudden loss of pressurization after the failure of a door or window in pressurized compartments. Proposed § 23.405(c) incorporates the safety intent of current § 23.571(d). Our intention is that the damage tolerance methodology would remain the accepted means of compliance. The FAA views damage tolerance as necessary since current § 23.571(d) and proposed § 23.405(c) require the applicant to assume that structural damage exists in the pressurized cabin. However, proposed § 23.405(c) would allow for other means of compliance as long as serious injuries and fatalities will be prevented. Examples of other means of compliance might include requiring pilots and occupants to use oxygen masks or wear pressurized flight suits when operating above 41,000 feet (12,497 meters). This means of compliance could be acceptable in certain airplane designs, such as two-seat jet trainers.

Proposed § 23.405(d) would capture the safety intent of current § 23.903(b)(1) to minimize hazards to the airframe resulting from turbine engine rotorburst. The FAA would move the structural portion of the rotorburst evaluation from current § 23.903(b)(1) to proposed § 23.405(d) to ensure all structural requirements are contained in subpart C and to avoid potential confusion over the structural rotorburst requirements in part 23.

Proposed § 23.405(d) would require an applicant to show that the design of the structure would provide sufficient structural capability to allow continued safe flight and landing with foreseeable structural damage caused by high energy fragments from an uncontained engine or rotating machinery failure. The FAA recognizes that some high-energy fragment events may result in catastrophic failures that may not be avoidable and that complete elimination of the hazards resulting from high energy fragment events may not be possible.

An applicant would be required to address other sources of high energy rotating machinery fragments in the proposed structural rotorburst requirements. Our intent is to ensure an adequate regulatory framework for applications of electrical propulsion systems and other unique and novel approaches to propulsion, which may release high-energy fragments.

Applicants who have shown compliance with current § 23.903(b)(1) would be able to show compliance with proposed § 23.405(d). Applicants should note that previous certification programs with turbine engine installations have been able to show that the airplane structure is capable of continued safe flight and landing following a rotorburst event. AC 23–13A, Fatigue, Fail-Safe, and Damage Tolerance Evaluation of Metallic Structure for Normal, Utility, Acrobatic, and Commuter Category airplanes, provides guidance on the required structural evaluation.

x. Proposed § 23.410, Aeroelasticity

Proposed § 23.410 would require an airplane to be free from flutter, control reversal, and divergence at all speeds within and sufficiently beyond the structural design envelope, for any configuration and condition of operation, accounting for critical degrees of freedom, and any critical failures or malfunctions. Proposed § 23.410 would also require an applicant to establish tolerances for all quantities that affect flutter.

Proposed § 23.410 would capture the safety intent of the current §§ 23.629, Flutter; 23.677, Trim systems, paragraph (c); and 23.687, Spring devices, in part. Specifically, proposed § 23.410 would address the safety intent of these rules by requiring freedom from flutter, control reversal, and divergence, while accounting for all speeds, configurations, modes, and failures, and to establish tolerances on anything affecting flutter. The current § 23.629(a) states that freedom from flutter, control reversal, and divergence must be shown by the methods of § 23.629(b) and (c) or (d). These paragraphs are prescriptive in nature and some portions are applicable only to very specific types of designs and include speed limitations. Therefore, these paragraphs are more appropriate as means of compliance.

The current § 23.629(e) requires the evaluation of whirl mode flutter. Since this is another flutter mode, it must be accounted for when an airplane is determined to be free from flutter. The current § 23.629(f), (g), (h), and (i) provide instructions on how to evaluate (1) certain airplane design types, (2) designs employing certain methods (fail-safe or damage tolerant), or (3) airplanes incorporating design modifications. The current § 23.677(c) requires either that the tab be balanced or that the tab controls be irreversible. Additionally, it requires that irreversible tab systems have adequate rigidity and reliability. These are very specific design solutions for ensuring freedom from flutter. The current § 23.687 requires that the reliability of spring devices used in control systems be established by tests unless its failure would not cause flutter. This is a method of compliance to ensure freedom from flutter. All of these current requirements are more appropriate as means of compliance because they describe how to ensure freedom from flutter, control reversal, and divergence. They are not the safety intent, but just one method to achieve the safety intent. As such, they serve only specific designs utilizing current methods, and may or may not be adequate for innovative designs or accommodate new analytical methods or testing techniques.

xi. Proposed § 23.500, Structural Design

Proposed § 23.500 would require an applicant to design each part, article, and assembly for the expected operating conditions of the airplane. Proposed § 23.500 would require the design data to adequately define the part, article, or assembly configuration, its design features, and any materials and processes used. Proposed § 23.500 would require an applicant to determine the suitability of each design detail and part having an important bearing on safety in operations. Proposed § 23.500 would also require the control system to be free from—

- Jamming;
- Excessive friction, and
- Excessive deflection when the control system and its supporting structure are subjected to loads corresponding to the limit airloads when the primary controls are subjected to the lesser of the limit airloads or limit pilot forces and when the secondary controls are subjected to loads not less than those corresponding to maximum pilot effort.

Proposed § 23.500 would capture the safety intent of the current §§ 23.601, Design and Construction—General; 23.603, Materials and workmanship, paragraph (b); 23.671, Control Systems—General, paragraph (a); 23.683, Operation tests; 23.685, Control system details; 23.687, Spring devices, in part; and 23.689, Cable systems. These current requirements explain methods and techniques to ensure an adequate design. The proposed rule would require an applicant to produce an adequate design without specifying how. The prescriptive language within these current sections noted above, are more appropriate for a means of compliance.

xii. Proposed § 23.505, Protection of Structure

Proposed § 23.505 would require an applicant to protect each part of the airplane, including small parts such as fasteners, against deterioration or loss of strength due to any cause likely to occur in the expected operational environment. Proposed § 23.505 would require each part of the airplane to have adequate provisions for ventilation and drainage and would require an applicant to incorporate a means into the airplane design to allow for required maintenance, preventive maintenance, and servicing.

Proposed § 23.505 would capture the safety intent of the current §§ 23.607, Fasteners; 23.609, Protection of structure; and 23.611, Accessibility. These current requirements explain methods and techniques to ensure an adequate design. This proposed rule would require the applicant to produce an adequate design without specifying how to accomplish it. The prescriptive language within these current sections is more appropriate as a means of compliance.

xiii. Proposed § 23.510, Materials and Processes

Proposed § 23.510 would require an applicant to determine the suitability and durability of materials used for parts, articles, and assemblies, the failure of which could prevent continued safe flight and landing, while accounting for the effects of likely environmental conditions expected in service. Proposed § 23.510 would require the methods and processes of fabrication and assembly used to produce consistently sound structures and, if a fabrication process requires close control to reach this objective, an applicant would have to perform the process under an approved process specification. Additionally, proposed § 23.510 would require an applicant to justify the selected design values to ensure material strength with probabilities, account for—

- The criticality of the structural element; and
- The structural failure due to material variability, unless each individual item is tested before use to determine that the actual strength properties of that particular item would equal or exceed those used in the design, or the design values are accepted by the Administrator.

Proposed § 23.510 would require a determination of required material strength properties to be based on sufficient tests of material meeting specifications to establish design values on a statistical basis. Proposed § 23.510 would also require an applicant to determine the effects on allowable stresses used for design if thermal effects were significant on an essential component or structure under normal operating conditions.

Proposed § 23.510 would capture the safety intent of the current §§ 23.605, Fabrication methods and 23.613, Material strength properties and design values. These current requirements explain methods and techniques to ensure adequate materials and process controls. This proposed rule would require the applicant to ensure the resulting materials and processes are adequate without specifying how. The prescriptive language within the current sections is more appropriate as a means of compliance.

xiv. Proposed § 23.515, Special Factors of Safety

Proposed § 23.515 would require an applicant to determine a special factor of safety for any critical design value that was uncertain, used for a part, article, or assembly likely to deteriorate in service before normal replacement, or subject to appreciable variability because of uncertainties in manufacturing processes or inspection methods. Proposed § 23.515 would require an applicant to determine a special factor of safety using quality controls and specifications that accounted for each structural application, inspection method, structural test requirement, sampling percentage, and process and material control. Proposed § 23.515 would require an applicant to apply any special factor of safety in the design for each part of the structure by multiplying each limit load and ultimate load by the special factor of safety.

Proposed § 23.515 would capture the safety intent of current §§ 23.619, Special factors; 23.621, Casting factors; 23.623, Bearing factors; 23.625, Fitting factors; 23.657, Hinges; 23.681(b), Limit load static test (in part); and 23.693, Joints. These current requirements explain methods and techniques to ensure adequate special factors are used and the proposed rule would simply require the applicant to determine and apply adequate special factors without specifying what these are. The prescriptive language within the current sections is more appropriate as a means of compliance.

xv. Proposed § 23.600, Emergency Conditions

Proposed § 23.600 would require the airplane, even if damaged in emergency landing conditions, to provide protection to each occupant against injury that would preclude egress. Proposed § 23.600 would require the airplane to have seating and restraints for all occupants, consisting of a seat, a method to restrain the occupant's pelvis and torso, and a single action restraint release, which meets its intended function and does not create a hazard that could cause a secondary injury to an occupant. Proposed § 23.600 would require the airplane seating, restraints, and cabin interior to account for likely flight and emergency landing conditions. Additionally, they could not prevent occupant egress or interfere with the operation of the airplane when not in use.

Proposed § 23.600 would require each baggage and cargo compartment be designed for its maximum weight of contents and for the critical load distributions at the maximum load factors corresponding to the determined flight and ground load conditions. Proposed § 23.600 would also require each baggage and cargo compartment to have a means to prevent the contents of the compartment from becoming a hazard by impacting occupants or shifting, and to protect any controls, wiring, lines, equipment, or accessories whose damage or failure would affect operations.

Proposed § 23.600 would capture the safety intent of current §§ 23.561, Emergency Landing Conditions—General; 23.562, Emergency landing dynamic conditions; 23.785, Seats, berths, litters, safety belts, and shoulder harnesses; and 23.787, Baggage and cargo compartments. The prescriptive language within these current sections are more appropriate as a means of compliance, and thus would allow flexibility for new technology to be available in new part 23 airplanes in a timely manner.

Occupant safety for aviation has progressed incrementally over the years. This has resulted in rulemaking that has enhanced safety for individual system components, but not in an integrated fashion. Modeling and analysis techniques have matured to a point that may allow evaluation of more crash scenarios and crashworthiness components as an integrated system. The FAA has relied on many industry studies to develop current occupant safety rules. These studies evaluated characteristics of actual accidents, full-scale aircraft drop testing, and dynamic seat testing on a sled. When dynamic seat testing began, determination of an adequate generic floor impulse that represented a survivable aircraft crash was established. As an alternative to current crashworthiness requirements, the proposed rule would allow for evaluation of the conditions of likely impacts, assessment of vehicle response, and ultimately, evaluation of occupant reaction to vehicle impact and vehicle response.

Technology used in aviation crashworthiness, in a large part, has come from the automotive industry. The automotive industry has analyzed crashworthiness components as a system for many years. The automotive industry generally has a more developed crashworthiness analysis capability than that used in the aviation industry. This advanced crashworthiness analysis capability has evolved primarily because of the—

- Public expectation for automobile safety;
- Higher general public likelihood and exposure to automobile accidents; and
- High automobile production rates allow for multiple actual full-vehicle crash tests that result in very accurate crash impulse data from the outer surface of the vehicle all the way to the occupant.

Because of these facts, automotive designers know accurate impulses and the specific vehicle response for impact conditions. Furthermore, this data can be extrapolated to consider many more accident scenarios. Automotive safety requirements progressively add new impact scenario requirements and enhanced impulse magnitudes, thus requiring more industry innovation. This innovation has enabled rapid advances in automotive occupant protection systems.

Automotive safety begins at the outside of the vehicle, evaluating the entire system's response. In contrast, aircraft manufacturers have used essentially the same generic designed pulse imparted at the cabin floor for the last 25 years. The same impulse applies to all GA airplanes independent of the structure below the cabin floor and the aircraft's stall speed, unless the stall speed is greater than 61 knots. Determining airplane crashworthiness is a more complex process than determining automotive crashworthiness because of higher impact speeds, lighter weight structures, and the effect of the third dimension of altitude on the aircraft. Dynamic seat testing has improved crashworthiness in aviation; however, the FAA believes that newer means of evaluating the full aircraft response to crash conditions via modeling, newer materials, and new technologies promise to offer improved features, evaluation, and accuracy that would facilitate consideration of more crash scenarios and evaluation of more variables that could improve survivability.

The NTSB produced a series of reports, called the General Aviation Crashworthiness Project,[21] in the 1980s that evaluated over 21,000 GA airplane crashes that occurred between 1972 and 1981. The NTSB evaluated airplane orientation, impact magnitudes, and survival rates and factors on many of these accidents in order to provide information to support changes in crashworthiness design standards for seating and restraint systems in GA airplanes. These reports also established

[21] See *www.regulations.gov* (Docket #FAA–2015–1621).

conditions approximating survivable accidents, and categorized factors that would have the largest impact on safety. These reports further illuminated the various crashworthiness systems and their respective impact to overall safety. Amendment 23–36 (53 FR 30802, August 15, 1988), to part 23 referenced these reports for dynamic seats but did not adopt a systems-approach to evaluating crashworthiness of an airplane design.

The NTSB reports identified several factors that would enhance safety. All of these factors working together as a system should result in a safer airplane. However, the assessment indicated that shoulder harnesses offer the fastest individual improvement for safety. The FAA codified the shoulder harnesses requirement in amendments 23–19 (42 FR 20601, June 16, 1977) and 23–32 (50 FR 46872, November 13, 1985), for newly manufactured airplanes. The FAA also issued policy statement ACE–00–23.561–01,[22] Methods of Approval of Retrofit Shoulder Harness Installations in Small Airplanes, to streamline the process for retrofitting older airplanes.

Survivable volume is another critical factor to survival. Survivable volume is the ability of the airframe to protect the occupants from external intrusion or cabin crushing during and after the accident sequence. There were several observed accidents in the NTSB study where conventional aircraft construction simply crushed an otherwise restrained occupant. Crashworthiness regulations have never included survivable volume as a factor, except for aircraft turnover. Airplane designs should provide the space needed for the protection and restraint of the occupants. A compromised survivable volume could cause occupant impact with objects in the cabin. This is one of the first steps in the analysis of airplane crashworthiness.

Additional data from the NTSB General Aviation Crashworthiness Project suggested that energy-absorbing seats that protect the occupant from vertical loads could enhance occupant survivability and work to prevent serious injury, thereby enhancing odds for egress and preventing many debilitating long-term injuries. The FAA established dynamic seat testing requirements in amendment 23–36 for airplanes certificated under part 23. Energy absorbing seats benefit a smaller portion of accident occupants because accident impacts with larger vertical components tend to reduce occupant survival odds. Energy attenuation from vertical forces, both static and dynamic, has been important to crashworthiness regulations within the past 25 years. Seat deformation throughout the emergency landing sequence is acceptable if the load path through attachment, seat, and restraint remains continuous. Coupling the seat performance to the rest of the airframe response is important to the enhancement and understanding of occupant survivability. The FAA believes that allowing designers to consider a particular airframe's unique deformation in a crash, the designers can create a safer cabin for the occupants. Using unique airframe deformations would result in more accurate accident floor impulses and may allow evaluation of crash impulses in multiple directions; instead of only two directions considered in current certification.

Occupant restraints must maintain integrity, stay in place on the occupant throughout the event, properly distribute loads on the occupant, and restrain the occupant by mitigating interaction with other items in the cabin. Restraints originally were comprised of lap belts. Shoulder harnesses were later required as discussed above. Newer technology that enhances or supplements the performance of restraints, like airbags and consideration of items in the cabin that the occupant might impact, are now being considered for inclusion in designs. The use of airbags has greatly increased passenger safety in automobiles, which offer protection in much more severe impacts and in impacts from multiple directions, and could be a viable option for airplanes as well.

Seat retention in airplanes is a factor identified as another basic building block for crashworthiness. The NTSB reports shows more than a quarter of otherwise-survivable accidents included instances where the seats broke free at the attachment to the airplane, resulting in fatalities or serious injuries. Dynamic seat testing requirements address the ability of seat assemblies to remain attached to the floor, even when the floor shifts during impact. Pitching and yawing of the seat tracks during dynamic seat tests demonstrates the gimbaling and flexibility of the seat.

All of the aforementioned safety considerations must work together to enhance occupant safety and survivability. The FAA believes that evaluating occupant safety, as a whole system, would allow for a better understanding of vehicle performance in an emergency landing, enabling the incorporation of innovative technology. The transportation industry has made significant progress with energy absorbing seats and restraint technology. The FAA believes enhanced cabin strength that improves survivable volume, coupled with better restraint technology and refined energy absorbing seats, would be key factors in improving expansion of the survivable accident envelope. These factors and additional considerations were included in the Small Airplane Crashworthiness Design Guide.[23] This guide was prepared for the Advanced General Aviation Transports Experiments and the National Aerospace and Space Administration and addresses the concept of designing crashworthiness into an airplane design as a system.

In order to evaluate an accident from an occupant's perspective, the emergency landing condition must first be defined, starting with the conditions external to the aircraft. In most survivable accidents, the pilot is able to maintain control of the aircraft prior to impact. Accidents where the airplane impacts the ground out of control are typically much less survivable. Speed and impact orientation are significant factors in crash survivability. Therefore, considerations for impact beyond a controllable impact are beyond the scope of these proposed regulations. The slowest forward speed that any fixed wing airplane can fly is its stall speed. This stall speed can vary with airplane configuration and weight, but represents the most universal parameter for impact speed and energy attenuation at impact. For this reason, stall speed is the starting point for consideration of expected impact conditions.

Orientation of impact can vary with pitch, yaw, terrain angle, and angle of flight path and becomes dynamic as the pilot loses control effectiveness at stall. The result is the airplane impact angle can result in a combination of horizontal and vertical loads and impulses that vary widely. Angle of impact, the line of the center of mass with respect to the angle of the impact surface, can also affect the amount of energy absorbed or transmitted to the occupant.

An accident impulse is a dynamic event that rapidly loads and unloads the structure. Dynamic impacts accurately represent the impact event, often including load levels far surpassing the static load requirements. Dynamic testing is also subject to a wide variation of results due to the unpredictable dynamic responses of varying

[22] See *www.regulations.gov* (Docket #FAA–2015–1621).

[23] See *www.regulations.gov* (Docket #FAA–2015–1621).

construction methods and materials, resulting in complicated modeling and analysis. This contrasts with static load tests that load the structure slowly, maintain that load at high levels, are generally simpler, and often provide adequate demonstration of part strength. Static analysis is generally more reliable with both testing and modeling; however, it does not capture the nature of rapid loading. Some combination of dynamic and static testing allows for the best understanding of airplane behavior during an accident.

Compliance with the proposed rule could be shown using conventional means of compliance like dynamic testing of seats, and static testing of other components using the prescriptive methods contained in the current part 23. Alternative compliance methods could include analysis or modeling supported by testing using an airframe coupled with the airplane's performance envelope, viewing the entire interaction of ground, airplane, and occupant, thus using a more complete systemic approach to achieve improved protection.

Proposed § 23.600(a) is intended to provide structural performance that protects the occupant during an emergency landing while accounting for only static loads and assuming all safety equipment is in use. The proposed section would capture the safety intent of the current § 23.561. As noted earlier, static loads are generally lower than peak dynamic loads; however, they may offer a more-easily predictable loading condition and are generally of longer duration such that the structure can fully react to the load. The landing conditions should consider possible accident sequence variables at impact, including restraint of items of mass within the cabin, directions of loading along or about the three axes, and airframe response with respect to the occupants and effects of airframe deflection during an emergency landing. Effects of emergency landing on the airplane should also be considered to include the effect of airframe damage and how static loads would affect egress and survivable cabin volume. Items of mass within the cabin and rear mounted engines have also been traditionally considered using even higher static loads as an additional factor of safety to ensure that these items of mass are restrained and would be among the last items to come free in an accident.

Proposed § 23.600(b) is intended to provide boundary conditions for the emergency landing sequence for both static and dynamic load considerations. The proposed section would capture the safety intent of the current §§ 23.561 and 23.562. The airplane stall speed limits the maximum forward impact speed. The emergency landing condition assumes the pilot maintains airplane control at or near final impact, thereby limiting impact velocity.

Proposed § 23.600(c) would capture the survivability factors for the occupant in the cabin during the emergency landing sequence and would capture the safety intent of current § 23.562. These factors include proper use and loading of seats and restraints, and the interaction of the occupants with each other and the cabin interior. Survivability is determined upon the occupant's interaction with the interior, seat, and restraints, and bounded by established human injury criteria.

Proposed § 23.600(d) would provide the framework for seats and occupant restraints and would require simplified seat and restraint requirements for all occupants. This proposed section would capture the safety intent of current § 23.785.

Proposed § 23.600(e) would establish requirements for baggage and cargo compartments and the restraint of contents. The proposed section would capture the safety intent of current § 23.787.

xvi. Current Subpart C Regulations Relocated to Other Proposed Subparts

As discussed, the FAA proposes removing current §§ 23.561, 23.562, 23.785, and 23.787. Also, this proposal would consolidate the safety intent of these crashworthiness regulations in proposed § 23.600.

4. Subpart D—Design and Construction

a. General Discussion

The FAA proposes restructuring current subpart D to retain the requirements for flight control systems, along with their attachment to the structure and landing gear, and occupant safety other than structural requirements. The FAA proposes to align structural requirements, found in current §§ 23.601 through 23.659, to proposed subpart C. Aspects that directly affected the pilot's interface with the airplane, such as the throttle shape, would be relocated to proposed § 23.1500, Flightcrew Interface.

The FAA also proposes, in those sections where there are requirements specific to the current commuter category, to use certification level 4. In those sections where there are current requirements specific to multiengine jets over 6,000 pounds, the FAA proposes requirements for certification level 3, high-speed multiengine airplanes as discussed earlier in this proposal. Refer to appendix 1 of this preamble for a cross-reference table detailing how the current regulations are addressed in the proposed part 23 regulations.

The subpart D organization was more complex than other subparts due to the relocation and removal of many requirements at the sub-paragraph level. To reduce confusion, the specific discussion of subpart D changes is shown in a cross reference table at the end of the specific discussion section below rather than the Relocation and Removal paragraphs in other subparts.

b. Specific Discussion of Changes

i. Proposed § 23.700, Flight Controls Systems

Proposed § 23.700 would require an applicant to design airplane flight control systems to prevent major, hazardous, and catastrophic hazards. Proposed § 23.700 would require an applicant to design trim systems to prevent inadvertent, incorrect, or abrupt trim operation. In addition, proposed § 23.700 would require an applicant to design trim systems to provide a means to indicate—

- The direction of trim control movement relative to airplane motion;
- The trim position with respect to the trim range;
- The neutral position for lateral and directional trim; and
- For all airplanes except simple airplanes, the range for takeoff for all applicant requested center of gravity ranges and configurations.

Proposed § 23.700 would also require an applicant to design trim systems to provide control for continued safe flight and landing when any one connecting or transmitting element in the primary flight control system failed, except for simple airplanes. Additionally, proposed § 23.700 would require an applicant to design trim systems to limit the range of travel to allow safe flight and landing, if an adjustable stabilizer is used.

Furthermore, proposed § 23.700 would require the system for an airplane equipped with an artificial stall barrier system to prevent uncommanded control or thrust action and provide for a preflight check. The FAA also proposes requiring an applicant seeking certification of a certification level 3 high-speed or certification level 4 airplane to install a takeoff warning system on the airplane, unless the applicant demonstrates that the airplane, for each configuration, could takeoff at the limits of its trim and flap ranges.

Proposed § 23.700(b)(3) would also allow an exception for simple airplanes from the requirement to provide control for continued safe flight and landing when any one connecting or transmitting element in the primary control system fails. This would provide a level of safety equivalent to that specified in EASA's CS–VLA. Last, proposed § 23.700(d) would maintain the level of safety in the current requirements for a takeoff warning system.

Proposed § 23.700 would capture the safety intent of current §§ 23.677, Trim systems, paragraphs (a), (b), and (d); 23.689, Cable systems, paragraphs (a) and (f); 23.691, Artificial stall barrier system, paragraphs (a), (b), (d), (e) and (f); 23.697, Wing flap controls, paragraphs (a); and 23.703, Takeoff warning system, paragraphs (a) and (b). This proposed section would apply to the function, usability, and hazard levels of all mechanical, electrical, or electronic control systems. The certification levels proposed in this NPRM would be incorporated into the mechanical, electrical, or electronic control systems to maintain the differences in airplanes certificated under part 23 (*i.e.,* weight and powerplant.)

ii. Proposed § 23.705, Landing Gear Systems

Proposed § 23.705 would require an airplane's landing gear and retracting mechanism be able to withstand operational and flight loads. Proposed § 23.705 would require an airplane with retractable landing gear to have a positive means to keep the landing gear extended and a secondary means for extending the landing gear that could not be extended using the primary means. Proposed § 23.705 would also require a means to inform the pilot that each landing gear is secured in the extended and retracted positions. Additionally, proposed § 23.705 would require an airplane, except for airplanes intended for operation on water, with retractable landing gear to also have a warning to the pilot if the thrust and configuration is selected for landing and yet the landing gear is not fully extended and locked.

Furthermore, if the landing gear bayis used as the location for equipment other than the landing gear, proposed § 23.705 would require that equipment be designed and installed to avoid damage from tire burst and from items that may enter the landing gear bay. Proposed § 23.705 would also require the design of each landing gear wheel, tire, and ski account for critical loads and would require a reliable means of stopping the airplane with kinetic energy absorption within the airplane's design specifications for landing. For certification level 3 high-speed multiengine and certification level 4 multiengine airplanes, proposed § 23.705 would require the braking system to provide kinetic energy absorption within the design of the airplane specifications for rejected takeoff as the current rules do for multiengine jets over 6,000 pounds and commuter category airplanes.

Proposed § 23.705 would capture the safety intent of current §§ 23.729, Landing gear extension and retraction system, paragraphs (a), (b), (c), and (e); 23.731, Wheels; 23.733, Tires, paragraph (a); 23.735, Brakes, paragraphs (a), (b), and (e); 23.737, Skis. The FAA proposes to combine the fixed and retractable landing gear systems into the proposed section, which would apply to the function, usability, and hazard levels of all mechanical, electrical, or electronic landing gear systems.

iii. Proposed § 23.710, Buoyancy for Seaplanes and Amphibians

Proposed § 23.710 would require airplanes intended for operations on water to provide buoyancy of 80 percent in excess of the buoyancy required to support the maximum weight of the airplane in fresh water. Proposed § 23.710 would also require airplanes intended for operations on water to have sufficient watertight compartments so the airplane will stay afloat at rest in calm water without capsizing if any two compartments of any main float or hull are flooded.

Proposed § 23.710 would capture the safety intent of current §§ 23.751(a), Main float buoyancy; 23.755, Hulls; and 23.757, Auxiliary floats. The FAA proposes combining the floats or hulls landing gear systems into the proposed section and having it apply to the function, usability, and hazard levels of hulls and floats. The existing rule requires at least four watertight compartments of approximately equal volume, which the FAA proposes to remove because they are specific design requirements and are addressed in the proposed performance-based requirements.

To encourage the installation of buoyancy systems with new safety enhancing technology and streamlining the certification process, the FAA proposes removing most of the current prescriptive requirements and the detailed means of compliance for these requirements from the current part 23 and replacing them with performance-based regulations. The FAA expects the current means of compliance would continue to be used for the traditional airplane designs under part 23.

iv. § 23.750, Means of Egress and Emergency Exits

Proposed § 23.750 would require the airplane cabin exit be designed to provide for evacuation of the airplane within 90 seconds in conditions likely to occur, excluding ditching, following an emergency landing. For ditching, proposed § 23.750 would require the cabin exit for all certification levels 3 and 4 multiengine airplanes be designed to allow evacuation in 90 seconds. Proposed § 23.750 would require each exit to have a simple and obvious means, marked inside and outside the airplane, to be opened from both inside and outside the airplane, when the internal locking mechanism is in the locked position.

Proposed § 23.750 would also require airplane evacuation paths to protect occupants from serious injury from the propulsion system, and require that doors, canopies, and exits be protected from opening inadvertently in flight. Proposed § 23.750 would preclude each exit from being obstructed by a seat or seat back, unless the seat or seat back could be easily moved in one action to clear the exit. Proposed § 23.750 would also require airplanes certified for aerobatics to have a means to exit the airplane in flight.

Proposed § 23.750 would capture the safety intent of current §§ 23.783, Doors, paragraphs (a), (b), (c), and (d); 23.791, 23.803, Emergency evacuation, paragraph (a); 23.805, Flightcrew emergency exits; 23.807, Emergency exits except paragraphs (a)(3), (b)(1), (c), (d)(1) and (d)(4); 23.811, Emergency exit marking; 23.812, Emergency lighting; 23.813, Emergency exit access, paragraph (a); and 23.815, Width of aisle; and CS–VLA–783, Exits. This proposed rule would incorporate the requirements for all door and emergency exits and remove specified design solutions and means of compliances.

To encourage the installation of egress and emergency exits with new safety enhancing technology and streamline the certification process, the FAA proposes removing most of the current prescriptive requirements and the detailed means of compliance for these requirements from the current part 23. The FAA expects that the current prescriptive means of compliance would continue to be used for traditional part 23 airplane designs.

The FAA would continue to accept an airplane designed to meet these prescriptive design constraints as means of compliance to meet the proposed performance standard. However, if an airplane did not meet the prescriptive design constraints, the applicant could propose its own means of compliance to show compliance with the proposed performance standard. Historically, the FAA has accepted an emergency evacuation demonstration in less than 90 seconds as an ELOS for airplanes that did not meet the prescriptive design requirements in the current part 23 regulations. AC 20–118A, Emergency Evacuation Demonstration, contains an acceptable means of compliance for the 90-second requirement for emergency evacuation.

v. Proposed § 23.755, Occupant Physical Environment

Proposed § 23.755 would require an applicant to design the airplane to allow clear communication between the flightcrew and passengers and provide a clear, sufficiently undistorted external view to enable the flightcrew to perform any maneuvers within the operating limitations of the airplane. Proposed § 23.755 would also require an applicant to design the airplane to protect the pilot from serious injury due to high energy rotating failures in systems and equipment, and protect the occupants from serious injury due to damage to windshields, windows, and canopies.

Additionally, proposed § 23.755 would require, for certification level 4 airplanes, each windshield and its supporting structure directly in front of the pilot to withstand the impact equivalent of a two-pound bird at maximum approach flap airspeed and allow for continued safe flight and landing after the loss of vision through any one panel.

Furthermore, proposed § 23.755 would require any installed oxygen system to include a means to determine whether oxygen is being delivered and a means for the flightcrew to turn on and shut off the oxygen supply, and the ability for the flightcrew to determine the quantity of oxygen available. Proposed § 23.755 would also require any installed pressurization system to include a pressurization system test and a warning if an unsafe condition exists.

Proposed § 23.755 would capture the safety intent of current §§ 23.771, Pilot compartment, paragraphs (b) and (c); 23.775, Windshields and windows, paragraphs (a), (b), (c), (d), and (h); 23.831, Ventilation; 23.841, Pressurized cabins, paragraphs (a), (b)(6), (c) and (d); 23.843, Pressurization tests; 23.1441, Oxygen equipment and supply, paragraphs (c), (d) and (e); 23.1443, minimum mass flow of supplemental oxygen, paragraphs (a), (b), and (c); 23.1445; Oxygen distribution system; 23.1447, Equipment standards for oxygen dispensing units, paragraphs (a) through (d) and (f); 23.1449, means of determining use of oxygen; and 23.1461, Equipment containing high energy rotors. Current part 23 regulations contain prescriptive language and means of compliance for the occupant physical environment requirements. The FAA proposes to remove the specific requirements to allow an applicant to specify the means of compliance for the physical needs of the occupants including temperature, ventilation, pressurization, supplemental oxygen, etc. For example, current § 23.831(a) requires carbon monoxide not exceeding one part in 20,000 parts of air. The FAA proposes revising this by requiring breathable atmosphere without hazardous concentrations of gases and vapors.

vi. Proposed § 23.800, Fire Protection Outside Designated Fire Zones

Proposed § 23.800 would require that insulation on electrical wire and electrical cable outside designated fire zones be self-extinguishing. Proposed § 23.800 would require airplane cockpit and cabin materials in certification levels 1, 2, and 3 be flame-resistant. Proposed § 23.800 would require airplane cockpit and cabin materials in certification level 4 airplanes be self-extinguishing. Proposed § 23.800 would also require that airplane materials in the baggage and cargo compartments, which are inaccessible in flight and outside designated fire zones, be self-extinguishing. Proposed § 23.800 would require that any electrical cable installation that would overheat in the event of circuit overload or fault be flame resistant. Additionally, proposed § 23.800 would preclude thermal acoustic materials outside designated fire zones from being a flame propagation hazard. Proposed § 23.800 would also require sources of heat that are capable of igniting adjacent objects outside designated fire zones to be shielded and insulated to prevent such ignition.

Proposed § 23.800 would require airplane baggage and cargo compartments, outside designated fire zones, to be located where a fire would be visible to the pilots, or equipped with a fire detection system and warning system, and be accessible for the manual extinguishing of a fire, have a built-in fire extinguishing system, or be constructed and sealed to contain any fire within the compartment.

Proposed § 23.800 would require a means to extinguish any fire in the cabin, outside designated fire zones, such that the pilot, while seated, could easily access the fire extinguishing means, and for certification levels 3 and 4 airplanes, passengers would have a fire extinguishing means available within the passenger compartment. Where flammable fluids or vapors might escape by leakage of a fluid system, proposed § 23.800 would require each area, outside designated fire zones, be defined and have a means to make fluid and vapor ignition, and the resultant hazard, if ignition occurs, improbable. Additionally, proposed § 23.800 would also require combustion heater installations outside designated fire zones be protected from uncontained fire.

Proposed § 23.800 would capture the safety intent of current §§ 23.851, Fire extinguishers, paragraphs (a) and (b); 23.853, Passenger and crew compartment interiors, Paragraphs (a), (d)(3)(i), (d)(3)(iii) and (d)(3)(iv), (e), and (f); 23.855, Cargo and baggage compartment fire protection; 23.856, Thermal/acoustic insulation materials; 23.859, Combustion heater fire protection, paragraph (a); 23.863, Flammable fluid fire protection, paragraphs (a) and (d); 23.1359, Electrical system fire protection, paragraph (c); 23.1365, Electric cables and equipment, paragraph (b); 23.1383, Taxi and landing lights, paragraph (d); 23.1385, Position light system installation, paragraph (d). It would also capture the safety intent of CS–VLA–853, Compartment interiors. Proposed § 23.800 would incorporate the requirements for flammability of all subpart D and F systems and equipment outside designated fire zones needed for continued safe flight and landing and remove specified design solutions and means of compliances.

vii. Proposed § 23.805, Fire Protection in Designated Fire Zones

Proposed § 23.805 would require flight controls, engine mounts, and other flight structures within or adjacent to designated fire zones be capable of withstanding the effects of a fire. Proposed § 23.805 would require engines inside designated fire zones to remain attached to the airplane in the event of a fire or electrical arcing. Proposed § 23.805 would also require terminals, equipment, and electrical cables, inside designated fire zones, used during emergency procedures, be fire-resistant.

Proposed § 23.805 would capture the safety intent of current § 23.865, Fire protection of flight controls, engine mounts, and other flight structure and § 23.1359(b), Electrical system fire protection. The intent of proposed § 23.805 is to protect flight controls, engine mounts, and other flight structure as well as electrical cables, terminals and equipment from the effects of fire in designated fire zones.

viii. Proposed § 23.810, Lightning Protection of Structure

Proposed § 23.810 would preclude primary structure failure caused by exposure to the direct effects of lightning, that could prevent continued safe flight and landing for airplanes approved for IFR. Proposed § 23.810 would require airplanes approved only for VFR to achieve lightning protection by following FAA accepted design practices found in FAA issued advisory circulars and in FAA accepted consensus standards.

Proposed § 23.810 would capture the safety intent of the current § 23.867(a) and (c), Electrical bonding and protection against lightning and static electricity. The FAA proposes adopting the structure requirements in part 23, amendment 23–7 (34 FR 13078, August 13, 1969), to limit the rule to protection of primary structure from direct effects of lightning.

ix. Reorganization of Subpart D

The FAA proposes relocating the underlying safety. intent of various subpart D sections with proposed sections in subparts B, C, F, and G. The following table shows where the FAA proposes moving the current subpart D sections in part 23.

Current section	Title	Proposed section	Proposed title
23.601	General	23.500	Structural design.
23.603	Materials and workmanship	23.500	Structural design.
23.605	Fabrication methods	23.510	Materials and processes.
23.607	Fasteners	23.505	Protection of structure.
23.609	Protection of Structure	23.505	Protection of structure.
23.611	Accessibility	23.505	Protection of structure.
23.613	Material strength properties and design values.	23.510	Materials and processes.
23.619	Special factors	23.515	Special factors of safety.
23.621	Casting factors	23.515	Special factors of safety.
23.623.	Bearing factors	23.515	Special factors of safety.
23.625	Fitting factors	23.515	Special factors of safety.
23.627	Fatigue strength	23.405	Structural durability.
23.629	Flutter	23.410	Aeroelasticity.
23.641	Proof of strength	Means of Compliance.	
23.651	Proof of strength	Means of Compliance.	
23.655	Installation	Means of Compliance.	
23.657	Hinges	23.515	Special factors of safety.
23.659	Mass balance	23.315	Flight load conditions.
23.671	Control Surfaces—General.		
(a)		23.500	Structural design.
(b)		23.1305	Function and installation.
23.672	Stability augmentation and automatic and power-operated systems.	23.1305	Function and installation.
23.673	Primary flight controls	23.1305	Function and installation.
23.675	Stops	23.1305	Function and installation.
23.677	Trim systems.		
(a)		23.700	Flight control systems.
(b)		23.700	Flight control systems.
(c)		23.410	Aeroelasticity.
(d)		23.700	Flight control systems.
23.679	Control system locks	23.1305	Function and installation.
23.681(a)	Limit load static tests	23.325(b)	Component loading conditions.
23.681(b)	Limit load static tests	23.515	Special factors of safety.
23.683	Operation tests	23.500(d)	Structural design.
23.685(a), (b), (c)	Control system details	23.500(d)	Structural design.
23.685(d)	Control system details	23.1305	Function and installation.
23.687	Spring devices	23.410 and 23.500	Aeroelasticity and Structural design.
23.689	Cable systems		Component loading conditions, Structural design, and Equipment Systems and Installations.
(a)		23.700	Flight control systems.
(b)		23.325(b), 23.500(d)	Component loading conditions, Structural design.
(c)		23.325(b), 23.500(d)	Component loading conditions, Structural design.
(d)		23.325(b), 23.500(d)	Component loading conditions, Structural design.
(e)		23.325(b), 23.500(d)	Component loading conditions, Structural design.
(f)		23.700	Flight control systems.
23.691	Artificial stall barrier system.		
(a)		23.700	Flight control systems.
(b)		23.700	Flight control systems.
(c)		23.1305	Function and installation.
(d)		23.700	Flight control systems.
(e)		23.700	Flight control systems.
(f)		23.700	Flight control systems.
(g)		23.1315	Equipment, systems and Installations.
23.693	Joints	23.515	Special factors of safety.

Current section	Title	Proposed section	Proposed title
23.697	Wing flap controls.		
(a)		23.700	Flight control systems.
(b) and (c)		23.200	Controllability.
23.699	Wing flap position indicator	23.1500	Flightcrew interface.
23.701	Flap interconnection	Means of Compliance.	
23.703	Takeoff warning system.		
(a)		23.700	Flight control systems.
(b)		23.700	Flight control systems.
(c)		Definition.	
23.721	General	23.910	Powerplant installation hazard assessment.
23.723.	Shock absorption tests	Means of Compliance.	
23.725	Limit drop tests	Means of Compliance.	
23.726	Ground load dynamic tests	Means of Compliance.	
23.727	Reserve energy absorption drop tests	Means of Compliance.	
23.729	Landing gear extension and retraction system.		
(a)		23.705	Landing gear systems.
(b)		23.705	Landing gear systems.
(c)		23.705	Landing gear systems.
(d)		Means of Compliance.	
(e)		23.705	Landing gear systems.
(f)		23.1315	Equipment, systems and installation.
(g)		Means of Compliance.	
23.731	Wheels	23.705	Landing gear systems.
23.733	Tires.		
(a)		23.705	Landing gear systems.
(b)		Means of Compliance.	
(c)		Means of Compliance.	
23.735	Brakes	23.705.	
(a)		23.705	Landing gear systems.
(1)		Means of Compliance.	
(2)		Means of Compliance.	
(b)		23.705	Landing gear systems.
(c)		Means of Compliance.	
(d)		23.1315	Equipment, systems and installation.
(e)		23.705	Landing gear systems.
(1)		Means of Compliance.	
(2)		Means of Compliance.	
23.737	Skis	23.705	Landing gear systems.
23.745	Nose/Tail wheel steering	23.1500	Flightcrew interface.
23.751	Main float buoyancy.		
(a)		710	Buoyancy for seaplanes and amphibians.
(b)		Means of Compliance.	
23.753	Main float design.	23.320	Ground and water load conditions.
23.755	Hulls	23.710	Buoyancy for seaplanes and amphibians.
23.757	Auxiliary floats	23.710	Buoyancy for seaplanes and amphibians.
23.771	Pilot compartment.		
(a)		23.1500	Flightcrew interface.
(b)		23.755	Occupant physical environment.
(c)		23.755	Occupant physical environment.
23.773	Pilot compartment view.		
(a)		23.1500	Flightcrew interface.
(b)		23.755	Occupant physical environment.
23.775	Windshields and windows.		
(a), (b), (c), (d)		23.755	Occupant physical environment.
(e)		Means of Compliance.	
(f)		23.1405	Flight in icing conditions.
(g)		Means of Compliance.	
(h)		23.755	Occupant physical environment.
23.777	Cockpit controls	23.1500	Flightcrew interface.
23.779	Motion and effect of cockpit controls	23.1500	Flightcrew interface.
23.781	Cockpit control knob shape	23.1500	Flightcrew interface.
23.783	Doors.		
(a), (b), (c), (d)		23.750	Means of egress and emergency exits.
(e), (f), (g)		Means of Compliance.	
23.785	Seats, berths, litters, safety belts, and shoulder harnesses.	23.600 and 23.515	Special factors of safety, Emergency landing conditions.
23.787	Baggage and cargo compartments	23.600(e)	Emergency landing conditions.
23.791	Passenger information signs	23.755	Occupant physical environment.
23.803	Emergency evacuation.		

Current section	Title	Proposed section	Proposed title
(a)		23.750	Means of egress and emergency exits.
(b)		Means of Compliance.	
23.805	Flightcrew emergency exits	23.750	Means of egress and emergency exits.
23.807	Emergency exits.		
(a)(3), (b)(1), (c), (d)(1), (d)(4).		Means of Compliance.	
Balance of 23.807		23.750	Means of egress and emergency exits.
23.811	Emergency exit marking	23.750	Means of egress and emergency exits.
23.812	Emergency lighting	23.750	Means of egress and emergency exits.
23.813	Emergency exit access.		
(a)		23.750	Means of egress and emergency exits.
(b)		Means of Compliance.	
CS–VLA 853		23.750	Means of egress and emergency exits.
23.815	Width of aisle	23.750	Means of egress and emergency exits.
23.831	Ventilation	23.755	Occupant physical environment.
23.841(a), (b)(6), (c), (d)	Pressurized cabins	23.755	Occupant physical environment.
(b)(1) through (5) and (7)		Means of Compliance.	
23.843	Pressurization tests	23.755	Occupant physical environment.
23.851	Fire extinguishers.		
(a) and (b)		23.800	Fire protection outside designated fire zones.
(c)		Means of Compliance.	
23.853	Passenger and crew compartment interiors.		
(a)		23.800	Fire protection outside designated fire zones.
(b)(c) and (d)(1)(2)		Means of Compliance.	
(d)(3)(i), (d)(3)(iii), (d)(3)(iv)		23.800	Fire protection outside designated fire zones.
(e)		23.800	Fire protection outside designated fire zones.
(f)		23.800	Fire protection outside designated fire zones.
23.855	Cargo and baggage compartment fire protection.	23.800	Fire protection outside designated fire zones.
23.856	Thermal/acoustic insulation materials	23.800	Fire protection outside designated fire zones.
23.859	Combustion heater fire protection.		
(a)		23.800	Fire protection outside designated fire zones.
(b) thru (i)		Means of Compliance.	
23.863	Flammable fluid fire protection.		
(a) and (d)		23.800	Fire protection outside designated fire zones.
(b) and (c)		Means of Compliance	Fire protection outside designated fire zones.
23.865	Fire protection of flight controls, engine mounts, and other flight structure.	23.805	Fire protection in designated fire zones.
23.867	Electrical bonding and protection against lightning and static electricity.		
(a), (c)		23.810	Lightning protection of structure.
(b)		23.1320	Electrical and electronic system lightning protection.
23.871	Leveling means	Means of Compliance.	

5. Subpart E—Powerplant

a. General Discussion

The FAA proposes substantial changes to subpart E based on two considerations. First, many of the current regulations could be combined to provide fewer regulations that accomplish the same safety intent. Second, part 23 overlaps with the requirements in parts 33 and 35. Refer to appendix 1 of this preamble for a cross-reference table detailing how the current regulations are addressed in the proposed part 23 regulations.

b. Specific Discussion of Changes

i. Proposed § 23.900, Powerplant Installation

Proposed § 23.900 would clarify, for the purpose of this subpart, that the airplane powerplant installation must include each component necessary for propulsion, affects propulsion safety, or provides auxiliary power to the airplane. Proposed § 23.900 would require the applicant to construct and arrange each powerplant installation to account for likely hazards in operation and maintenance and, except for simple airplanes,[24] each aircraft engine would have to be type certificated.

Proposed § 23.900 would capture the safety intent of current §§ 23.901, Installation, paragraphs (a), (b), and (f); 23.903, Engines, paragraph (a); 23.905, Propellers, paragraph (a), 23.909, Turbocharger systems, paragraphs (a) and (c); and 23.925, Propeller clearance. Proposed § 23.900 would combine the installation requirements that are scattered throughout the subpart into a

[24] Refer to Section III, Discussion of Proposal, paragraphs A and B of this NPRM for definition and discussion of a simple airplane.

general requirement for installation, and remove any duplication with part 33. The following table illustrates the duplication between the current part 23 regulations and part 33 requirements:

Part 23	Part 33
§ 23.901(d), Installation	§ 33.33, Vibration.
§ 23.901(e), Installation	§ 33.1, Applicability.
§ 23.934, Turbojet and turbofan engine thrust reverser systems tests	§ 33.97, Thrust reversers.
§ 23.939, Powerplant operating characteristics	§§ 33.61 thru 33.79.
§ 23.1011, Oil System—General	§§ 33.39 and 33.71, Lubrication system.
§ 23.1013(a) and (d), Oil tanks	§§ 33.39, and 33.71, Lubrication system.
§ 23.1015, Oil tank tests	§ 33.33, Vibration.
§ 23.1023, Oil radiators	§ 33.33, Vibration.
§ 23.1041, Cooling—General	§ 33.1, Applicability.
§ 23.1043, Cooling tests	§§ 33.41 and 33.81, Applicability—Block Tests.
§ 23.1045, Cooling test procedures for turbine engine powered airplanes.	§ 33.81, Applicability—Block Tests.
§ 23.1047, Cooling test procedures for reciprocating engine powered airplanes.	§ 33.35, Fuel and induction system.
§ 23.1061, Liquid Cooling—Installation	§ 33.21, Engine cooling.
§ 23.1063, Coolant tank tests	§ 33.41 and 33.81, Applicability—Block Tests.
§ 23.1093, Induction system icing protection	§§ 33.35(b), Fuel and induction system and 33.68, Induction system icing.
§ 23.1099, Carburetor deicing fluid system detail design	§ 33.35, Fuel and induction system.

Additionally, proposed § 23.900 would identify the scope of the powerplant installation in the same manner as the current requirements. However, the FAA would redefine several terms to allow for alternate sources of propulsion, such as electric motors. The FAA considers the term powerplant to include all equipment used by the airplane that provides propulsion or auxiliary power. The word engine would be replaced with the term power unit and would include other power sources driven by fuel such as liquid fuel, electrical, or other power sources not yet envisioned. This proposal also predicates that each airplane power unit or propeller receive a type certificate as a prerequisite for installation, with the exception of simple airplanes. The current part 33 airworthiness standards did not envision providing certification requirements for types of engines outside of those that operate on fossil fuels. As such, the ability of an applicant to obtain the required engine type certificate for an alternate fuel type may be impractical. For those power units, the FAA proposes to include them in the airplane certification, which could include the use of an ELOS to part 23. The FAA would expect an applicant to utilize all the requirements listed in part 33 as a baseline matrix to find compliance for an alternate powerplant type and for those requirements that could not be met. Also, § 21.16, Special conditions, may apply. It should be noted that additional requirements might also be necessary due to an absence of a corresponding part 33 requirement. This matrix would become part of the certification baseline and recorded in an issue paper as an ELOS, exemption, or special condition. Also, simple airplanes will follow the precedence set for CS–VLA and will maintain the exception to the requirement to be type certificated.

ii. Proposed § 23.905, Propeller Installation

Proposed § 23.905 would retain the requirement that each propeller be type certificated, except for simple airplanes. Proposed § 23.905 would retain the requirement that each pusher propeller be marked so that it is conspicuous under daylight conditions. All the other requirements of the current section either duplicate part 35 standards, or would condense into the other requirements proposed in §§ 23.900, Powerplant installation; 23.910, Powerplant installation hazard assessment; and 23.940, Powerplant ice protection.

iii. Proposed § 23.910, Powerplant Installation Hazard Assessment

Proposed § 23.910 would require an applicant to assess each powerplant separately and in relation to other airplane systems and installations to show that a failure of any powerplant system component or accessory will not—

- Prevent continued safe flight and landing;
- Cause serious injury; and
- Require immediate action by crewmembers for continued operation of any remaining powerplant system.

Proposed § 23.910 would capture the safety intent of current §§ 23.721, Landing gear—General; 23.903, Engines, paragraph (c); 23.905, Propellers, paragraph (h); 23.909, Turbocharger systems, paragraph (b), (c), and (e); 23.933 Reversing systems, paragraph (b); 23.937, Turbopropeller-drag limiting systems, paragraph (a); 23.959, Unusable fuel supply; 23.979, Pressure fueling systems, paragraphs (c) and (d); 23.991, Fuel pumps, paragraph (d); 23.994, Fuel system components; 23.1001, Fuel jettisoning system, paragraph (h); 23.1027, Propeller feathering system; 23.1111, Turbine engine, paragraph (a) and (c); 23.1123, Exhaust system; 23.1125 Exhaust heat exchangers, paragraph (a); 23.1142, Auxiliary power unit controls, paragraphs (d) and (e); 23.1155, Turbine engine reverse thrust and propeller pitch settings below the flight regime; 23.1163, Powerplant accessories, paragraphs (b) and (d); 23.1191, Firewalls, paragraph (f); 23.1193, Cowling and nacelle, paragraphs (f) and (g); 23.1201, Fire extinguishing systems materials, paragraph (a); and 23.1203, Fire detector system, paragraphs (b) and (c).

The proposed standard would reduce the repetitive requirements found throughout the subpart and create one general powerplant requirement to analyze and mitigate hazards associated with the powerplant installation. For example, current § 23.903(b)(1) requires that design precautions be taken to minimize the hazards to the airplane in the event of an engine rotor failure or a fire originating inside the engine that could burn though the engine case. These are very specific failure conditions, but are actually only two small categories of many engine failure conditions an applicant must assess. Section 23.903(c) requires that multiple engines must be isolated from one another so a malfunction of one engine does not affect the operation of the other. This is a general analysis technique frequently called common mode analysis that should apply to all powerplant components and include other critical airplane systems that are not powerplant related, but could be affected by a powerplant failure. Hazards the FAA proposes to remove from other regulations and which would be addressed in this proposed section include, but are not limited to, fire, ice, rain and bird ingestion, rotorburst, engine case burn through, and flammable leakage.

iv. Proposed § 23.915, Automatic Power Control Systems

Proposed § 23.915 would require a power or thrust augmentation system that automatically controls the power or thrust on the operating powerplant to provide an indication to the flightcrew when the system is operating; provide a means for the pilot to deactivate the automatic functions; and prevent inadvertent deactivation.

Proposed § 23.915 would capture the safety intent of current § 23.904, Automatic power reserve system and appendix H to part 23—Installation of An Automatic Power Reserve (APR) System. To foster the growth and approval of technological advances, the FAA believes that the detailed and prescriptive language of appendix H is more appropriate as means of compliance. We would also include requirements for thrust augmenting systems into this proposed section since there seems to be a trend in general aviation to provide thrust management systems more sophisticated than historical automatic power reserve systems.

v. Proposed § 23.920, Reversing Systems

Proposed § 23.920 would require an airplane to be capable of continued safe flight and landing under any available reversing system setting, and would capture the safety intent of current § 23.933(a) and (b). The current rule includes a separate requirement for a propeller reversing system that would be covered in the more general language of the proposed section and applied to any type of reverser system. Current § 23.933 also requires an analysis of the system for a failure condition. Those provisions would be addressed in the general analysis requirements of proposed § 23.910.

vi. Proposed § 23.925, Powerplant Operational Characteristics

Proposed § 23.925 would require the powerplant to operate at any negative acceleration that could occur during normal and emergency operation within the airplane operating limitations. Proposed § 23.925 would require the pilot to have the capability to stop and restart the powerplant in flight. Proposed § 23.925 would require the airplane to have an independent power source for restarting each powerplant following an in-flight shutdown.

Proposed § 23.925 would capture the safety intent of current §§ 23.903, Engines, paragraph (d), (e), (f), and (g); 23.939, Powerplant operating characteristics; and 23.943, Negative acceleration. Current § 23.939 addresses powerplant operating characteristics and clearly requires an analysis that would be required by proposed § 23.910 and the existing requirements of part 33. Current § 23.943 would be included in this proposed rule because it is another analysis requirement, and one that provides an environment where powerplant systems are required to operate.

vii. Proposed § 23.930, Fuel Systems

Proposed § 23.930 would require that each fuel system provide an independent fuel supply to each powerplant in at least one configuration and prevent ignition from an unknown source. This section would require that each fuel system provide the fuel required to achieve maximum power or thrust plus a margin for likely variables in all temperature conditions within the operating envelope of the airplane and provide a means to remove the fuel from the airplane. Proposed § 23.930 would require each fuel system to be capable of retaining fuel when subject to inertia loads under expected operating conditions and prevent hazardous contamination of the fuel supply.

Proposed § 23.930 would require each fuel storage system to withstand the loads and pressures under expected operating conditions and provide a means to prevent loss of fuel during any maneuver under operating conditions for which certification is requested. Also, proposed § 23.930 would require each fuel storage system to prevent discharge when transferring fuel, provide fuel for at least one-half hour of operation at maximum continuous power or thrust, and be capable of jettisoning fuel, if required for landing.

Proposed § 23.930 would require installed pressure refueling systems to have a means to prevent the escape of hazardous quantities of fuel, automatically shut-off before exceeding the maximum fuel quantity of the airplane, and provide an indication of a failure at the fueling station. Proposed § 23.930 would capture the safety intent of current §§ 23.951, Fuel System—General, paragraphs (a), (b), (c), and (d); 23.953, Fuel System; 23.954, Fuel system lightning protection; 23.955, Fuel flow; 23.957, Flow between interconnected tanks, paragraph (a); 23.961, Fuel system hot weather operation; 23.963, Fuel tanks: General, paragraphs (a), (d), and (e); 23.977, Fuel tank outlet; 23.979, Pressure fueling systems, paragraphs (a) and (b); 23.991, Fuel pumps, paragraphs (a), (b), and (c); 23.997, Fuel strainer or filter, paragraphs (a), (b), (c), and (d); 23.999, Fuel system drains; and 23.1001, Fuel jettisoning system, paragraph (a).

The FAA believes that the regulations for the design of fuel systems may be overly prescriptive and exceed what is necessary to design a safe system. Accordingly, a more general set of requirements could include the intent of many current rules. More importantly, this proposed rule would allow for other types of energy sources to power propulsion systems such as electrical motors and future energy sources.

viii. Proposed § 23.935, Powerplant Induction and Exhaust Systems

Proposed § 23.935 would require the air induction system to supply the air required for each power unit and its accessories under expected operating conditions, and provide a means to discharge potential harmful material. Proposed § 23.935 would capture the safety intent of current §§ 23.1091, Air induction system, paragraph (a); 23.1101, Induction air preheater design, paragraph (a); 23.1103, Induction system ducts; 23.1107, Induction system filters; and 23.1121, Exhaust System—General, paragraphs (a) through (g). This proposed rule would combine induction and exhaust systems into a single rule because of the commonality with issues associated with moving air. The prescriptive language of the regulations identified above in this paragraph drove the development of this proposed section. For example, § 23.1091(b) mandates a certain number of intake sources and specifies particular requirements for a primary and alternate intakes. Current § 23.1101 requires inspection access of critical parts, and current § 23.1103 is considered a part of a proper safety analysis that would be required by proposed § 23.910.

ix. Proposed § 23.940, Powerplant Ice Protection

Proposed § 23.940 would require the airplane design, including the engine induction system, to prevent foreseeable accumulation of ice or snow that would adversely affect powerplant operation. Proposed § 23.940 would also require the applicant design the powerplant to prevent any accumulation of ice or snow that would adversely affect powerplant operation, in those icing conditions for which certification is requested. Proposed § 23.940 would capture the safety intent of current §§ 23.905, Propellers, paragraph (e); 23.929, Engine installation ice protection; 23.975, Fuel tank vents and carburetor vapor vents, paragraph (a)(1); 23.1093, Induction system icing protection; 23.1095, Carburetor deicing fluid flow rate; 23.1097, Carburetor deicing fluid system capacity; and 23.1099, Carburetor deicing fluid system detail design.

Proposed § 23.940(a) would reflect the requirements in current § 23.1093, which applies to all airplanes, regardless if flight in icing certification is sought. We are proposing to remove the type of powerplant to accommodate for new powerplant technologies. In addition, we propose to define other foreseeable icing in the means of compliance, which would include conditions conducive to induction icing of reciprocating engines. Foreseeable icing in the means of compliance would also include the cloud icing conditions of appendix C to part 25, currently defined in § 23.1093(b)(1)(i), falling and blowing snow currently defined in § 23.1093(b)(1)(ii), and ground ice fog conditions currently defined in § 23.1093(b)(2). The FAA proposes to remove the prescriptive requirements of the current §§ 23.1093(a), 23.1095, 23.1097, and 23.1099 as these are more appropriately considered as means of compliance. The FAA would expect the means of compliance to expand the ground ice fog conditions to colder ambient temperatures to harmonize with EASA. The FAA would also expect the means of compliance to include optional ground and flight freezing drizzle and freezing rain conditions, similar to appendix O of part 25, for those airplanes that seek certification to operate in those conditions. The Part 23 Icing ARC had recommended specific pass/fail criteria for the effect of ice accretion on engine operation. The FAA would expect this criterion to be defined in a means of compliance. Proposed paragraph (a) would require an airplane design to prevent ''foreseeable'' ice or snow accumulation, including accumulation in inadvertent icing encounters, described in appendix C to part 25, on airplanes not certified for icing, which may pose a shed hazard to the powerplant.

Airplane design in proposed § 23.940(a) refers to the engine induction system and airframe components on which accumulated ice may shed into the powerplant. Powerplant design in proposed § 23.940(b) refers to the engine, propeller, and other powerplant components such as cooling inlets.

Proposed § 23.940(b) would apply only to airplanes certified for flight in icing and would require compliance to the icing requirements in part 33, which currently only apply to turbine engines. Part 33, amendment 33–34 (79 FR 65507, November 4, 2014) and effective January 5, 2015, added SLD and ice crystal requirements to § 33.68 and amended the engine ice ingestion requirements in § 33.77. Proposed § 23.940(b) would require installation of an engine(s) certified to § 33.68 amendment 33–34, or later, if the airplane will be certified for flight in freezing drizzle and freezing rain. Proposed § 23.940(b) would allow an airplane manufacturer to install an engine, type certified at an earlier amendment, in an airplane not certified for flight in freezing drizzle or freezing rain, as long as no ADs have been applied that relate to engine operation in inadvertent SLD or ice crystal conditions. Airplanes certified under part 23 have not had ADs related to SLD or ice crystals. Certain part 23 turbojet engines have experienced thrust rollback due to ice crystals blocking the heated inlet temperature probe. The FAA would expect the means of compliance to address this in a similar manner to what is accomplished on current certification projects. The engine ice ingestion requirements of the current § 23.903(a)(2) would be moved to proposed § 23.940(b).

x. Proposed § 23.1000, Powerplant Fire Protection

Proposed § 23.1000 would require that a powerplant only be installed in a designated fire zone and would require an applicant to install a fire detection system in each designated fire zone for certification levels 3 and 4 airplanes. This rulemaking effort is maintaining the current level of safety for fire protection. While not a perfect one-to-one relationship, airplanes equivalent to certification levels 1 and 2 airplanes are not required to have a fire detection system today and therefore, should not be required to have them in this proposed rule. This would increase the cost of certification. Each fire detection system would be required to provide a means to alert the flightcrew in the event of a detection of fire or failure of the system and a means to check the fire detection system in flight. Proposed § 23.1000 would also require an applicant to install a fire extinguishing system for certification levels 2, 3, and 4 airplanes with a powerplant located outside the pilot's view that uses combustible fuel.

Additionally, proposed § 23.1000 would require each component, line, and fitting carrying flammable fluids, gases, or air subject to fire conditions to be fire resistant, except components storing concentrated flammable material would have to be fireproof or enclosed by a fireproof shield. Proposed § 23.1000 would also require an applicant to provide a means to shut off fuel or flammable material for each powerplant, while not restricting fuel to remaining units, and prevent inadvertent operation. Proposed § 23.1000 would capture the safety intent of current §§ 23.1181, Designated fire zones: Regions included; 23.1182, Nacelle areas behind firewalls; 23.1183, Lines, fittings, and components; 23.1189, Shutoff means; 23.1191, Firewalls; 23.1192 Engine accessory compartment diaphragm; 23.1193, Cowling and nacelle; 23.1195, Fire extinguishing systems; 23.1197, Fire extinguishing agents; 23.1199, Extinguishing agent containers; 23.1201, Fire extinguishing system materials; and 23.1203, Fire detector system.

Regulations for fuel may have become too detailed and prescriptive. A more general set of requirements should capture the intent of these many rules. More importantly, this new proposed rule would allow other types of energy sources to power propulsion systems such as electrical motors and future energy sources.

xi. Current Subpart E Regulations Relocated to Other Proposed Subparts

The requirements of current § 23.903(b)(1) would be moved to subpart C, § 23.405, Structural durability, paragraph (d). Section 23.903(b)(1) requires design precautions for turbine engine installations to be taken to minimize hazards to the airplane in the event of an engine rotor failure or of a fire originating inside the engine which burns through the engine case.

Additionally, the requirements of current § 23.929 would be moved to proposed § 23.940(b) and would only apply to airplanes certified for flight in icing. The means of compliance for § 23.940(b) should address propeller ice protection system design and analysis. However, the means of compliance for climb performance for proposed § 23.230 should address ice accretion effects on propeller performance on airplanes certified for flight in icing.

xii. Removal of Subpart E Current Regulations

The following current regulations are considered duplicative of part 35 and would be removed from subpart E: § 23.905(b)—duplicative of § 35.5, Propeller ratings and operation limitations; § 23.905(c)—duplicative of § 35.22, Feathering propellers; § 23.905(d)—duplicative of §§ 35.21, 35.23, 35.42 and 35.43; and § 23.905(e)(g) and (h)—duplicative of § 35.7, Features and characteristics.

6. Subpart F—Equipment

a. General Discussion

The proposed changes to subpart F would consolidate the current rules into new performance-based standards and allow for use of new technologies once consensus standards are developed that could be used as a means of compliance.The FAA believes the proposed part 23 requirements would maintain the current level of safety while staying relevant for new future technologies. The prescriptive design solutions in the current rules are often not relevant to new technology requiring special conditions, exemptions, and ELOS findings. The rate of new technology development and adoption has increased dramatically in the last decade. As a result, airplane systems with new features and capabilities are rapidly becoming available. The FAA believes that removing the prescriptive design solutions, which are based on outdated or existing technology, while focusing on the safety intent of the rule and maintaining design solutions as a documented means of compliance would enable the adoption of newer technologies.

The FAA also believes the current part 23 regulatory prescriptive structure does not effectively address the safety continuum, particularly the low performance end of the continuum. Recent part 23 amendments have increasingly focused on high-performance, complex airplanes. These stricter requirements have also been applied to the low-performance airplanes even though their risk in the safety continuum is lower. This has created an unintended barrier to new safety enhancing technology in low-performance airplanes.

b. Specific Discussion of Changes

i. Proposed § 23.1300, Airplane Level Systems Requirements

Proposed § 23.1300 would require equipment and systems that are required for an airplane to operate safely, be designed and installed to meet the level of safety applicable to the certification and performance levels of the airplane, and to perform their intended function throughout the operating and environmental limits specified by an applicant. Proposed § 23.1300 would mandate that non-required airplane equipment and systems, considered separately and in relation to other systems, be designed and installed so their operation or failure would not have an adverse effect on the airplane or its occupants.

Proposed § 23.1300 would capture the safety intent found in portions of current §§ 23.1301, Function and installation; 23.1303, Flight and navigation instruments; 23.1305, Powerplant instruments; 23.1307, Miscellaneous equipment; 23.1309, Equipment, systems, and installations; 23.1311, Electronic display instrument systems; 23.1321, Arrangement and visibility; 23.1323, Airspeed indicating system, 23.1325, Static pressure system; 23.1327, Magnetic direction indicator; 23.1329, Automatic pilot system; 23.1335, Flight director systems; 23.1337, Powerplant instruments installation; 23.1351, Electrical Systems and Equipment—General; 23.1353, Storage battery design and installation; and 23.1361, Master switch arrangement.

The current requirements can be traced back to CAR 3, specifically CAR 3.651, 3.652, 3.655, 3.661, 3.662, 3.663, 3.665, 3.666, 3.667, 3.669, 3.670, 3.671, 3.672, 3.673, 3.674, 3.681, 3.682, 3.686, 3.687, and 3.683. These requirements, including § 23.1311, which does not have a corresponding rule in CAR 3, were based on the technology and design solutions available at the time of their adoption. Although these requirements are appropriate for traditional systems found in airplanes designed to these assumptions, they lack the flexibility to adopt current and anticipated technologies and design capabilities. The FAA wants to facilitate the use of systems in new airplanes that reduce pilot workload and enhance safety. The FAA proposes the use of performance-based language that maintains the level of safety achieved with the current requirements for traditionally designed airplanes but also allows for alternative system designs in the future.

Proposed § 23.1300(a) would address equipment and systems required to operate safely. Required equipment may be defined by other parts such as part 91 or part 135, by other sections of this part such as equipment necessary for flight into known icing, or other requirements placed on the Type Certificate Data Sheet (TCDS) such as a working autopilot for single pilot operations. The FAA proposes in § 23.1300(b) that non-required equipment may be installed because it offers some benefit and its failure or use would not result in a reduction in safety of the airplane or for its occupants from the base aircraft if the system was not installed. This proposed section would contain general requirements for the environmental qualifications of installed equipment, and would require installed equipment to perform its intended function over its defined environmental range. This would mean that the equipment should have the same environmental qualification as requested for the useful range of the airplane.

Proposed § 23.1300(b) would not mandate that non-required equipment and systems function properly during all airplane operations once in service, provided all potential failure conditions do not effect safe operation of the airplane. The equipment or system would have to function in the manner expected by the manufacturer's operating manual for the equipment or system. An applicant's statement of intended function would have to be sufficiently specific and detailed so that the FAA could evaluate whether the system was appropriate for the intended function.

ii. Proposed § 23.1305, Function and Installation

Proposed § 23.1305 would require that each item of installed equipment perform its intended function, be installed according to limitations specified for that equipment, and the equipment be labeled, if applicable, due to size, location, or lack of clarity as to its intended function, as to its identification, function or operating limitations, or any combination of these factors. Proposed § 23.1305 would require a discernable means of providing system operating parameters required to operate the airplane, including warnings, cautions, and normal indications to the responsible crewmember. Proposed § 23.1305 would require information concerning an unsafe system operating condition be provided in a clear and timely manner to the crewmember responsible for taking corrective action.

Proposed § 23.1305 would capture the safety intent found in portions of the current §§ 23.671, Control systems-General; 23.672, Stability augmentation and automatic and power-operated systems; 23.673, Primary flight controls; 23.675, Stops; 23.679, Control system locks; 23.685(d), Control system details; 23.691(c), Artificial stall barrier system; 23.1361, Master switch arrangement; and 23.1365(a) and (b), Electric cables and equipment; 23.1301, Function and installation; 23.1303, Flight and navigation instruments; 23.1305, Powerplant instruments; 23.1309, Equipment, systems, and installations; 23.1322, Warning, caution, and advisory lights; 23.1323, Airspeed indicating system; 23.1326, Pitot heat indication systems; 23.1327, Magnetic direction indicator; 23.1329, Automatic pilot system; 23.1331, Instruments using a power source; 23.1335, Flight director systems; 23.1337, Powerplant instruments installation; 23.1351, Electrical Systems and Equipment—General; 23.1353, Storage battery design and installation; 23.1365, Electric cables and equipment; 23.1367, Switches; 23.1416, Pneumatic de-icer boot system. The current requirements can be traced to CAR 3, specifically, CAR 3.651, 3.652, 3.655, 3.663, 3.666, 3.667, 3.668, 3.669, 3.670, 3.671, 3.672, 3.673, 3.674, 3.675, 3.681, 3.682, 3.683, 3.686, 3.687, 3.693, 3.694, 3.696, 3.697, 3.700, 3.712, and 3.726. These requirements, including §§ 23.1322, 23.1326, and 23.1441, which did not have corresponding rules in CAR 3, were based on the technology and design solutions available at the time of their adoption. Although these requirements are appropriate for traditional systems and designs found in airplanes designed to these assumptions, they lack the flexibility to adopt current and anticipated technologies and design capabilities. The FAA wants to facilitate the use of systems in new airplanes that reduce pilot workload and enhance safety. The FAA proposes the use of performance-based language that maintains the safety requirements for traditionally designed airplanes, but also allows for alternative system designs.

The equipment or system would have to function in the manner expected by the manufacturer's operating manual for the equipment or system. An applicant's statement of intended function would have to be sufficiently specific and detailed so that the FAA could evaluate whether the system was appropriate for the intended function. The equipment should function when installed as intended by the manufacturer's instructions. The intent is for an applicant to define proper functionality and to propose an acceptable means of compliance.

Proposed § 23.1305(a) would require that equipment be installed under prescribed limitations. Therefore, if an equipment manufacturer specified any allowable installation requirements, the installer would stay within the limitations or substantiate the new limits. The proposed requirement that the equipment be labeled as to its identification, function or operating limitations, or any combination of these factors, if applicable, would apply to the manufacturer of the equipment, not to the installer.

Proposed § 23.1305 would require that information concerning an unsafe system operating condition be provided to the flightcrew. Microprocessing units that monitor parameters and warn of system problems have already been incorporated in some airplanes and are used by other industries, including the automobile and nuclear energy fields. Pilots may not monitor gauges as they used to; instead, they could rely on warnings and alerts. The FAA does not propose to allow simple on-off failure lights to replace critical trend displays. Warning systems would need to be sophisticated enough to read transients and trends, when appropriate, and give useful warning to the flightcrew.

iii. Proposed § 23.1310, Flight, Navigation, and Powerplant Instruments

Proposed § 23.1310 would require installed systems to provide the flightcrew member who sets or monitors flight parameters for the flight, navigation, and powerplant information necessary to do so during each phase of flight. Proposed § 23.1310 would require this information include parameters and trends, as needed for normal, abnormal, and emergency operation, and limitations, unless an applicant showed the limitation would not be exceeded in all intended operations. Proposed § 23.1310 would prohibit indication systems that integrate the display of flight or powerplant parameters to operate the airplane or are required by the operating rules of this chapter, from inhibiting the primary display of flight or powerplant parameters needed by any flightcrew member in any normal mode of operation. Proposed § 23.1310 would require these indication systems be designed and installed so information essential for continued safe flight and landing would be available to the flightcrew in a timely manner after any single failure or probable combination of failures.

Proposed § 23.1310 would capture the safety intent of current §§ 23.1303, Flight and navigation instruments; 23.1305, Powerplant instruments; 23.1307, Miscellaneous equipment; 23.1311, Electronic display instrument systems; 23.1321, Arrangement and visibility; 23.1323, Airspeed indicating system; 23.1331, Instruments using a power source; and 23.1337, Powerplant instruments installation. The current requirements can be traced to CAR 3, specifically, CAR 3.655, 3.661, 3.662, 3.675, 3.663, 3.668, 3.670, 3.671, 3.672, 3.673, and 3.674. These requirements, including § 23.1311, which did not have a corresponding rule in CAR 3, were based on the technology and design solutions available at the time of their adoption. Although these requirements are appropriate for traditional systems and designs found in airplanes designed to these assumptions, they lack the flexibility to adopt current and anticipated technologies and design capabilities. Furthermore, the FAA proposes to remove prescriptive requirements from the rule that historically provided standardization for primary flight instruments and controls. The FAA still believes this standardization is important for traditionally designed airplane instrumentation. Accordingly, to reduce the potential for pilot error, the reliance on standards accepted by the Administrator would maintain standardization for traditional systems.

The proposed regulations would require applicants to use a means of compliance based on consensus standards or other means accepted by the Administrator. However, new technology is already being approved that does not meet the traditional installation requirements and guidance. At the same time, this technology is proving equivalent or better than the traditional technology.[25] Furthermore, the FAA believes that new systems, displays, and controls have the potential to reduce pilot workload with a direct safety benefit. By removing prescriptive requirements for the rules and allowing alternatives, the industry would be able to develop and certify safety-enhancing technology faster.

Proposed § 23.1310 would not require limitations that could not be exceeded due to system design or physical properties to be shown because they would be useless information and result in clutter of the displays. Additionally, the FAA proposes removing the

[25] See Accident and GA Safety reports from NTSB, AOPA Safety Foundation, and the General Aviation Joint Steering Committee (GA–JSC) over the past 10 years.

prescriptive design requirement in current § 23.1311 for the installation of secondary indicators. The safety intent is that a single failure or likely multiple failures would not result in the lack of all critical flight data. The design and installation of flight critical information should be such that the pilot could still fly partial panel after probable failures. The prescriptive redundancy requirements for installed secondary indicators have been too restrictive for airplanes limited to VFR operations. This has caused several applicants to request an ELOS finding from current § 23.1311(a)(5).

The safety intent of § 23.1311 is to provide crewmembers the ability to obtain the information necessary to operate the airplane safely in flight. Traditionally, the minimum was prescribed as airspeed, altimeter, and magnetic direction. The corresponding CAR 3 rule is 3.655. The regulation is redundant with the operating rules, specifically, §§ 91.205 and 135.149, as well as providing prescriptive design solutions that were assumed to achieve an acceptable level of safety. The prescriptive solutions precluded finding more effective or more economical paths to providing acceptable safety. Proposed § 23.1310 would maintain the safety intent of the current rule.

The FAA proposes consolidating the safety intent of current § 23.1305, Powerplant instruments, into proposed § 23.1310, Flight, Navigation, and Powerplant Instruments. The safety intent of § 23.1305 is to provide crewmembers the ability to obtain the information necessary to operate the airplane and powerplant safely in flight. Traditionally, the minimum was prescribed, such as oil pressure, oil temperature, and oil quantity for all airplanes. The corresponding rules in CAR 3 are 3.655 and 3.675. Some of the regulation was redundant with the operating rules as well as providing prescriptive design solutions that were assumed to achieve an acceptable level of safety based on an assumption of powerplant types. The prescriptive solutions precluded finding more effective or more economical paths to providing acceptable safety. Additionally, they do not facilitate adoption of new technologies such as electric powered airplanes. The proposed § 23.1310, Flight, Navigation, and Powerplant Instruments, would maintain the safety intent of the current rule.

iv. Proposed § 23.1315, Equipment, Systems, and Installation

Proposed § 23.1315 would require an applicant to examine the design and installation of airplane systems and equipment, separately and in relation to other airplane systems and equipment, for any airplane system or equipment whose failure or abnormal operation has not been specifically addressed by another requirement in this part. Proposed § 23.1315 would require an applicant to determine if a failure of these systems and equipment would prevent continued safe flight and landing and if any other failure would significantly reduce the capability of the airplane or the ability of the flightcrew to cope with adverse operating conditions. Proposed § 23.1315 would require an applicant to design and install these systems and equipment, examined separately and in relation to other airplane systems and equipment, such that each catastrophic failure condition is extremely improbable, each hazardous failure condition is extremely remote, and each major failure condition was remote. Proposed § 23.1315 would capture the safety intent found in portions of current §§ 23.691(g), Artificial stall barrier system; 23.729(f), Landing gear extension and retraction system; 23.735(d), Brakes; 23.1309, Equipment, systems, and installations; 23.1323, Airspeed indicating system; 23.1325, Static pressure system; 23.1329, Automatic pilot system; 23.1331, Instruments using a power source; 23.1337, Powerplant instruments installation; 23.1335, Flight director systems; 23.1353, Storage battery design and installation, 23.1357, Circuit protective devices; 23.1431, Electronic equipment; 23.1441(b), Oxygen equipment and supply; 23.1450(b), Chemical oxygen generators; 23.1451, Fire protection for oxygen equipment; and 23.1453, Protection of oxygen equipment from rupture. The current requirements can be traced to CAR 3, specifically, 3.652, 3.663, 3.665, 3.667, 3.668, 3.670, 3.671, 3.672, 3.673, 3.674, and 3.683. The foundation of the current § 23.1309 was derived from CAR 3.652, which stated that ''each item of equipment, which is essential to the safe operation of the airplane, shall be found by the Administrator to perform adequately the functions for which it is to be used . . .''. At that time, the airworthiness requirements were based on single-fault or fail-safe concepts. Due to the increased use of airplanes certificated under part 23 in the 1970s for all-weather operation, and a pilot's increased reliance on installed avionic systems and equipment, § 23.1309, amendment 23–14 (38 FR 31816, November 19, 1973), was issued to provide an acceptable level of safety for such equipment, systems, and installations. Section 23.1309 introduced two main concepts: multiple failure combinations as well as a single failure had to be considered and there must be an inverse relationship between the likelihood of occurrence and the severity of consequences. The premise was that more severe consequences should happen less often.

In addition to specific part 23 design requirements, proposed § 23.1315 requirements would apply to any equipment or system installed in the airplane. This proposed section addresses general requirements and is not intended to supersede any specific requirements contained in other part 23 sections. Proposed § 23.1315 would not apply to the performance or flight characteristics requirements of subpart B, and structural loads and strength requirements of subpart C and D. However, it would apply to systems that complied with subpart B, C, D, and E requirements. As an example, proposed § 23.1315 would not apply to an airplane's inherent stall characteristics, but would apply to a stick pusher system installed to attain stall compliance. Both current § 23.1309 and proposed § 23.1315 rules are not intended to add requirements to specific rules in part 23, but to account for the added complexity of integration and new technologies.

This proposed regulation would require an engineering safety analysis to identify possible failures, interactions, and consequences, and would require an inverse relationship between the probability of failures and the severity of consequences. This would be accomplished by requiring all of the airplane's systems to be reviewed to determine if the airplane was dependent upon a system function for continued safe flight and landing and if a failure of any system on the airplane would significantly reduce the ability of the flightcrew to cope with the adverse operating condition. If the design of the airplane included systems that performed such functions, the systems would be required to meet standards that establish that maximum allowable probability of that failure. Section 23.1315 would impose qualitative, rather than quantitative probabilities of occurrence. As the FAA determined which quantitative values satisfied the proposed performance standards, it would share that information in FAA guidance or documented means of compliance appropriate to the certification levels of proposed § 23.5.

v. Proposed § 23.1320, Electrical and Electronic System Lightning Protection

Proposed § 23.1320 would require, for an airplane approved for IFR operations, that each electrical or electronic system that performed a function, the failure of which would prevent the continued safe flight and landing of the airplane, be designed and installed such that the airplane level function continues to perform during and after the time the airplane is exposed to lightning. Proposed § 23.1320 would also require these systems automatically recover normal operation of that function in a timely manner after the airplane is exposed to lightning, unless the system's recovery conflicts with other operational or functional requirements of the system.

Proposed § 23.1320 would require each electrical and electronic system that performed a function, the failure of which would reduce the capability of the airplane or the ability of the flightcrew to respond to an adverse operating condition, be designed and installed such that the function recovers normal operation in a timely manner after the airplane is exposed to lightning.

Proposed § 23.1320 would capture the safety intent of current § 23.1306, Electrical and electronic system lightning protection. The original adoption of the rule, first introduced as part of § 23.1309, was justified because there was an increased use of small airplanes in all-weather operations with an increasing reliance on complex systems and equipment in the modern, complex, high-performance airplanes.

The FAA wants to facilitate the use of systems in new airplanes that reduce pilot workload and enhance safety. The current requirement that all aircraft regardless of their design or operational limitations meet the same requirements for lightning regardless of the potential threat has been burdensome for the traditional VFR-only airplane designs. Proposed § 23.1320 would cover the airplanes with the greatest threat of lightning. In addition, the proposed language clarifies that the failure consequence of interest is at the airplane system level, which allows credit for design and installation architecture.

vi. Proposed § 23.1325, High-Intensity Radiated Fields (HIRF) Protection

Proposed § 23.1325 would require that electrical and electronic systems that perform a function whose failure would prevent the continued safe flight and landing of the airplane, be designed and installed such that the airplane level function is not adversely affected during and after the time the airplane is exposed to the HIRF environment. Proposed § 23.1325 would also require that these systems automatically recover normal operation of that function in a timely manner after the airplane is exposed to the HIRF environment, unless the system's recovery conflicts with other operational or functional requirements of the system. Proposed § 23.1325, High-Intensity Radiated Fields (HIRF) protection, would incorporate the safety intent of current § 23.1308, High-intensity Radiated Fields (HIRF) protection.

Before § 23.1308, amendment 23–57 (72 FR 44016, August 6, 2007), the requirements for HIRF protection were found in § 23.1309. The adoption of § 23.1308 was justified because there was an increased use of complex systems and equipment, including engine and flight controls, in small airplanes. These systems are more susceptible to the adverse effects of operation in the HIRF environment.

The electromagnetic HIRF environment results from the transmission of electromagnetic energy from radar, radio, television, and other ground-based, ship-borne, or airborne radio frequency transmitters. The HIRF environment changes as the number and types of transmitters change. During the 1990's, extensive studies were conducted to define the environment that then existed. The FAA codified this environment in amendment 23–57 in appendix J to part 23—HIRF Environments and Equipment HIRF Test Levels.

Proposed § 23.1325 would require the applicant to address the HIRF environment expected in service instead of solely relying on the HIRF environment codified in appendix J. The current appendix J to part 23 would become a means of compliance as the accepted expected HIRF environment, until other levels were accepted by the Administrator. This would allow the test levels to match the current threat as the environment changes over time. Additionally, the proposed language would clarify that the failure consequence of interest is at the airplane level, which allows credit for design and installation architecture.

vii. Proposed § 23.1330, System Power Generation, Storage, and Distribution

Proposed § 23.1330(a) would require that the power generation, storage, and distribution for any system be designed and installed to supply the power required for operation of connected loads during all likely operating conditions. Also, proposed § 23.1330(b) would require the design installation ensure no single failure or malfunction would prevent the system from supplying the essential loads required for continued safe flight and landing. Proposed § 23.1330 would also require the design and installation have enough capacity to supply essential loads, should the primary power source fail, for at least 30 minutes for airplanes certificated with a maximum altitude of 25,000 feet or less, and at least 60 minutes for airplanes certificated with a maximum altitude over 25,000 feet.

Proposed § 23.1330 would capture the safety intent of the current §§ 23.1310, Power source capacity and distribution; 23.1351, General; 23.1353, Storage battery design and installation; and 23.1357, Circuit protective devices. The intent is to ensure airplane power generation and the related distribution systems are designed for adequate capacity and safe operation under anticipated use and in the event of a failure or malfunction.

viii. Proposed § 23.1335, External and Cockpit Lighting

Proposed § 23.1335 would require an applicant to design and install all lights to prevent adverse effects on the performance of flightcrew duties. Proposed § 23.1335 would require position and anti-collision lights, if installed, to have the intensities, flash rate, colors, fields of coverage, and other characteristics to provide sufficient time for another aircraft to avoid a collision. Proposed § 23.1335 would require position lights, if installed, to include a red light on the left side of the airplane, a green light on the right side of the airplane, spaced laterally as far apart as practicable, and a white light facing aft, located on an aft portion of the airplane or on the wing tips.

Proposed § 23.1335 would require that an applicant design and install any taxi and landing lights, if required by operational rules, so they provide sufficient light for night operations. For seaplanes or amphibian airplanes, this section would also require riding lights to provide a white light visible in clear atmospheric conditions. Airplanes moored or maneuvering on water are by mairtime law considered watercraft; therefore, riding lights are required for seaplanes and amphibians during water operations.

To encourage the installation of internal and external lighting systems with new safety enhancing technology and streamline the certification process, the FAA proposes removing most of the current prescriptive requirements and the detailed means of compliance for these requirements from current part 23.

The current prescriptive requirements would be replaced with performance-based requirements. The FAA expects that current means of compliance would continue to be used for the traditional airplane designs under part 23.

Required lighting for the operation requested by an applicant would have to be installed and approved as part of the type design. The current rule requires that interior and exterior lighting function as intended without causing any safety hazard in normal operation. The proposed rule would require external lighting to make each airplane visible at night at a distance allowing each pilot to maneuver in sufficient time to avoid collision. The current rule specifies a specific amount of light illumination accounting for airframe obstructions. The FAA proposes removing this specified location and amount of illumination because it is more appropriate as means of compliance. The FAA does not consider small obstructions caused by airplane structure to be a safety issue.

This section would capture the safety intent of current §§ 23.1381, Instrument lights, paragraph (c); 23.1383, Taxi and landing lights, paragraphs (a), (b) and (c); 23.1385, Position light system installation, paragraphs (a), (b) and (c); 23.1387, Position light dihedral angles; 23.1389, position light distribution and intensities; 23.1391, Minimum intensities in the horizontal plane of position lights; 23.1393, Minimum intensities in any vertical plane of position lights; 23.1395, Maximum intensities in overlapping beams of position lights; 23.1397, color specifications; 23.1399, Riding light; and 23.1401, Anticollision light system, paragraphs (a), (a)(1), (b), (c), (d), (e), and (f).

ix. Proposed § 23.1400, Safety Equipment

Proposed § 23.1400 would require safety and survival equipment, required by the operating rules of this chapter, to be reliable, readily accessible, easily identifiable, and clearly marked to identify its method of operation.

The FAA proposes requirements for safety equipment needed for emergency landings and ditching when required by operational rules, and removal of the duplicative rules that are found in current part 23. Required safety equipment would have to be installed, located, and accessible for use in an emergency, and secured against emergency landing accelerations. The proposed rule would require safety, ditching, and survival equipment, be reachable, plainly marked for operation, and not be damaged in survivable emergency landings.

This section would capture the safety intent of current §§ 23.1411, Safety equipment—General, paragraphs (a) and (b)(1); and 23.1415; Ditching equipment, paragraphs (a), (c), and (d).

x. Proposed § 23.1405, Flight in Icing Conditions

Proposed § 23.1405 would require an applicant to demonstrate its ice protection system would provide for safe operation, if certification for flight in icing conditions is requested. Proposed § 23.1405 would also require these airplanes to be protected from stalling when the autopilot is operating in a vertical mode. Proposed § 23.1405 would require this demonstration be conducted in atmospheric icing conditions specified in part 1 of appendix C to part 25 of this chapter, and any additional icing conditions for which certification is requested.

Proposed § 23.1405 would capture the safety intent of current § 23.775(a) Windshields and windows, and § 23.1419, Ice protection. Proposed § 23.1405 would also increase safety by adding icing conditions beyond those specified in the current § 23.1419. The proposed § 23.1405 would only apply to airplanes seeking certification for flight in icing. The current § 23.1419 only applies to airplanes seeking certification for flight in icing; however, ice protection systems can be certified without certification for flight in icing.

The current ice protection system requirements in § 23.1419(a) would be captured in proposed § 23.1405(a)(1). The proposed rule would require an applicant to show systems are adequate in the icing conditions for which certification is requested. As in the current rule, ice protection systems would have to be shown to be adequate in the icing conditions of appendix C to part 25. Freezing drizzle and freezing rain icing conditions are optional icing conditions in which the airplane may be certificated to operate. These icing conditions, which the FAA added to appendix O to part 25 in amendment 25–140, are not being defined in proposed § 23.230. The FAA determined that the definition of these optional icing conditions is more appropriate as a means of compliance. Ice crystal conditions are added to this proposal for certain air data probes to harmonize with EASA requirements.

The Part 23 Icing ARC recommendations on activation and operation of ice protection systems would be used as a means of compliance to proposed § 23.1405(a)(1). This proposal would satisfy the intent of NTSB Safety Recommendations A–07–14 and A–07–15.

Proposed § 23.1405(a)(2) is the Part 23 Icing ARC recommendation for airplanes certified under part 23 in icing and is based on NTSB safety recommendation A–10–12. The target for this proposed rule is older airplanes adding an autopilot for first time, modifying certain autopilots on airplanes with a negative service history in icing, or significant changes that affect performance or flight characteristics. Proposed § 23.1405 would require, under the changed product rule, to add proposed § 23.1405(a)(2) to the certification basis without requiring the remainder of § 23.1405 for certain autopilot modifications. For new airplanes, a stall warning system that complies with proposed § 23.230 would comply with proposed § 23.1405(a)(2). The vertical mode is a prescriptive requirement to limit the applicability. Simple autopilots such as a wing leveler would not be affected by this requirement. Numerous icing accidents have shown that unrecognized airspeed loss can occur with autopilots in altitude hold mode or vertical speed mode. Demonstration, as a means of compliance, may include design and/or analysis and does not mean natural icing flight tests are required.

xi. Proposed § 23.1410, Pressurized System Elements

Proposed § 23.1410 would require the minimum burst pressure of—

- Hydraulic systems be at least 2.5 times the design operating pressure with the proof pressure at least 1.5 times the maximum operating pressure;
- Pressurization system elements be at least 2.0 times, and proof pressure be at least 1.5 times, the maximum normal operating pressure; and
- Pneumatic system elements be at least 3.0 times, and proof pressure be at least 1.5 times, the maximum normal operating pressure.

Additionally, this proposed section would also require that other pressurized system elements have pressure margins that take into account system design and operating conditions.

This section would capture the safety intent of current §§ 23.1435, Hydraulic system, paragraphs (a)(4) and (b); 23.1437, Accessories for multiengine airplanes; and 23.1438, Pressurization and pneumatic systems, paragraphs (a) and (b).

xii. Proposed § 23.1457, Cockpit Voice Recorders

The FAA is not proposing to revise current § 23.1457 because amendment

23–58 (73 FR 12542, March 7, 2008) and corrected on July 9, 2009 (74 FR 32799), was written to standardize the cockpit voice recorder rules to address the NTSB's recommendations (70 FR 9752, February 28, 2005). The FAA agrees with NTSB recommendation numbers A–96–89, A–96–171, A–99–18, and parts of A–99–16 and A–99–17 and believes changing the current rule to remove prescriptive requirements could hinder the conduct of future accident investigations and be detrimental to aviation accident investigations.

xiii. Proposed § 23.1459, Flight Data Recorders

The FAA is not making any substantive changes to the current § 23.1459 because amendment 23–58 (73 FR 12541, March 7, 2008) was written to standardize the flight data recorder rules to address the NTSB's recommendations. The FAA agrees with NTSB recommendation numbers A–96–89, A–96–171, A–99–18, and parts of numbers A–99–16 and A–99–17 and believes changing the current rule to remove prescriptive requirements could hinder the conduct of future accident investigations and be detrimental to aviation safety. Proposed § 23.1459(a)(1), however, is amended to revise current references to §§ 23.1323, Airspeed indicating system; 23.1325, Static pressure system; and 23.1327, Magnetic direction indicator, as those sections are not contained in this NPRM.

xiv. Current Subpart F Regulations Relocated to Other Proposed Subparts

The requirement currently in § 23.1419(a) to comply with subpart B requirements to show safe operating capability is moved to proposed § 23.230 as recommended by the Part 23 Icing ARC and Part 23 Reorganization ARC.

Ice protection of engine inlets would move to proposed § 23.940, Powerplant ice protection. The Part 23 Reorganization ARC had proposed that § 23.1405 include these requirements, as well as heated pitot probe requirements for IFR airplanes. The FAA decided to separate them since compliance with proposed §§ 23.940 and 23.1300 would be required for all airplanes, whereas compliance with § 23.1405 would be optional. The FAA wants to avoid potential confusion on TCDS interpretation as to whether an airplane is certified for flight in icing.

The requirements currently in § 23.1381, Instrument lights, paragraphs (a) and (b) would be relocated to proposed § 23.1500, Flightcrew Interface. The requirements currently in § 23.1411, Safety equipment—General, paragraph (b)(2) would be relocated to proposed § 23.600, Emergency conditions.

xv. Removal of Subpart F of the Current Regulations

When the FAA evaluated the current regulations, it determined that the prescriptive icing requirements in §§ 23.1323, Airspeed indicating system, and 23.1325, Static pressure system, would be means of compliance to proposed § 23.1405(a)(1). The current requirement for a heated pitot probe or an equivalent means on an IFR certified and a flight in icing conditions airplane in current § 23.1323(d) would become a means of compliance for proposed § 23.1300.

The part 23 re-write ARC had recommended that proposed § 23.1405 include the requirement for a heated pitot probe on an IFR certified airplane, but the FAA determined this would be better addressed on a performance standard under proposed § 23.1300, because proposed § 23.1405 would only apply to icing certified airplanes. High altitude mixed phase and ice crystal conditions for certain high-performance airplanes, and ice protection requirements for stall warning and angle of attack would be means of compliance. The proposed standard would harmonize with EASA requirements.

Current § 23.1416 would be removed since the requirements for proper inflation and annunciation of operation of pneumatic boots would be covered on a performance basis in proposed §§ 23.1300 and 23.1305. This would reflect that all types of ice protection systems have annunciation requirements, and would eliminate unnecessary annunciations. The Part 23 Icing ARC recommended this approach.

The analysis required in the current § 23.1419(a), and all the requirements in the current § 23.1419(b) and (c), would become means of compliance to proposed 1405(a) and would be removed.

Current § 23.1419(d) requires a means to detect critical ice accretions, including night lighting. The Part 23 Icing ARC had proposed a new § 23.1403 to replace these ice detection requirements, which would also address the SLD detection required by proposed § 23.230. These ice detection requirements are more appropriately addressed as a means of compliance to accommodate new technology. For example, visual ice accretion detection as a means to activate ice protection systems is no longer necessary on some designs, examples being primary ice detection systems and icing conditions detection systems. However, there would remain a requirement for pilots to detect severe ice accretions, and this would be addressed in proposed § 23.230(b).

When the FAA evaluated the current regulations, it determined that the prescriptive requirements in §§ 23.1323, Airspeed indicating system; 23.1325, Static pressure system; 23.1327, Magnetic direction indicator; 23.1329, Automatic pilot system; 23.1335, Flight director systems; 23.1337, Powerplant instruments installation; 23.1353, Storage battery design and installation; and 23.1357, Circuit protective devices, would be covered on a performance basis by proposed §§ 23.1300; 23.1305; 23.1310; and 23.1315.

Current § 23.1401, Anticollision light system, paragraph (a)(2) would be removed as introductory material. Current § 23.1415, ditching equipment, paragraph (b) would be removed but could serve as a means of compliance. The current §§ 23.1435, Hydraulic systems, paragraphs, (a), (a)(1), (a)(2), (a)(3), and (c); 23.1438, Pressurization and pneumatic systems, paragraph (c), would be removed as prescriptive design and means of compliance. Current § 23.1443, Minimum mass flow of supplemental oxygen, paragraph (d) would be removed as a definition. Current § 23.1445, paragraph (e) would be removed as redundant to current § 91.211, paragraph (a)(3).

7. Subpart G—Flightcrew Interface and Other Information

a. General Discussion

The FAA proposes to expand subpart G to address not only current operating limitations and information, but also the concept of flightcrew interface. Based on current technologies, the FAA anticipates that new airplanes will heavily rely on automation and systems that require new and novel pilot or flightcrew interface. The FAA is proposing to address the pilot interface issues found in subparts D and F with proposed § 23.1500. Otherwise, subpart G retains the safety requirements from the current rules without change. Refer to appendix 1 of this preamble for a cross-reference table detailing how the current regulations are addressed in the proposed part 23 regulations.

b. Specific Discussion of Changes

i. Proposed § 23.1500, Flightcrew Interface

Proposed § 23.1500 would require the pilot compartment and its equipment to allow the pilot(s) to perform their duties, including taxi, takeoff, climb, cruise, descent, approach, and landing; and perform any maneuvers within the operating envelope of the airplane, without excessive concentration, skill, alertness, or fatigue. Proposed § 23.1500 would also require an applicant to install flight, navigation, surveillance, and powerplant controls and displays so qualified flightcrew could monitor and perform all tasks associated with the intended functions of systems and equipment in order to make the possibility that a flightcrew error could result in a catastrophic event highly unlikely. Proposed § 23.1500 would capture the safety intent of current part 23 rules that are directly related to the pilot or flightcrew interface with the airplane. Interfaces include controls, displays, and visibility requirements.

Current and anticipated technologies that affect how the pilot interfaces with the airplane are expected to expand faster than other technologies. The FAA believes that significant safety improvements can result from the evolution of how the pilot interfaces with the airplane. Pilot workload is a major factor in causing accidents, but it is almost impossible to connect workload-related mistakes to an accident after the accident has happened. Evidence from large airplane accidents, where we have recorded data as well as research, points to the importance of the pilot interface and associated mistakes as causal factors in aircraft accidents. The smart use of automation and phase-of-flight-based displays could reduce pilot workload and increase pilot awareness.

The converse is also true. Equipment is becoming available faster than manufacturers and the FAA can evaluate it. Determining the safety risks and recognizing the safety benefits of new technology available to the pilot is important. For this reason, the proposed language addresses the safety issues of the current §§ 23.699, Wing flap position indicator; 23.745 Nose/Tail wheel steering, 23.1303, Flight and navigation instruments, paragraph (g)(3); 23.1321, Arrangement and visibility, paragraphs (a),(b),(d), and (e); 23.1311, Electronic display instrument systems, paragraphs (a)(6) and (7); 23.771, Pilot compartment, paragraph (a), 23.773(a) Pilot compartment view, 23.777, Cockpit controls; 23.779, Motion and effect of cockpit controls; and 23.781, Cockpit control knob shape; are addressed in proposed § 23.1500(a) and (b). The proposed language would allow the FAA to rapidly evaluate new equipment for concentration, skill, alertness, and fatigue against pilot workload as is current practice. More importantly, the FAA would remove the prescriptive requirements from the current rules to allow for alternative approaches to pilot interface that would reduce pilot workload or increase safety.

ii. Proposed § 23.1505, Instrument Markings, Control Markings, and Placards

Proposed § 23.1505 would require each airplane to display in a conspicuous manner any placard and instrument marking necessary for operation. Proposed § 23.1505 would also require an applicant to clearly mark each cockpit control, other than primary flight controls, as to its function and method of operation and include instrument marking and placard information in the AFM. The consolidation of these sections appears large, but many of these sections contain one prescriptive requirement that, in many cases, is based on traditional airplanes, instruments, and equipment.

iii. Proposed § 23.1510, Airplane Flight Manual

Proposed § 23.1510 would require an applicant to furnish an AFM with each airplane that contains the operating limitations and procedures, performance information, loading information, and any other information necessary for the operation of the airplane.

The proposed rules capture the prescriptive list of information that is considered necessary for the operation of the traditional airplanes. The current rules contain very prescriptive and detailed information. Furthermore, that level of detail assumes a traditional airplane configuration and operation. The FAA proposes to remove this detail from the rule because it is more appropriate as means of compliance. Currently, the majority of airplanes certificated under part 23 already use an industry standard to develop their AFMs—General Aviation Manufactures Association Specification 1, Specification for Pilot's Operating Handbook.[26] The FAA already accepts this industry standard for many airplanes certificated under part 23 because it includes the information that is currently required in part 23. The FAA believes that allowing alternative approaches to information would facilitate new technology integration into airplanes certified under part 23.

The proposed § 23.1510(d) would capture the safety intent of the current §§ 23.1505, Airspeed limitations, thru 23.1527, Maximum operating altitude, specific to operating limitations and other limitations and information necessary for safe operation.

[26] See *www.regulations.gov* (Docket #FAA–2015–1621).

iv. Proposed § 23.1515, Instructions for Continued Airworthiness

Proposed § 23.1515 would require an applicant to prepare Instructions for Continued Airworthiness in accordance with proposed appendix A to this part, that are acceptable to the Administrator, prior to the delivery of the first airplane or issuance of a standard certification of airworthiness, whichever occurs later. This proposed section would capture the current § 23.1529 without change. The FAA proposes renaming Appendix G to Part 23—Instructions for Continued Airworthiness, to Appendix A to Part 23—Instructions for Continued Airworthiness.

8. Appendices to Part 23

a. General Discussion

Many of the appendices to part 23 contain information that the FAA believes would be more appropriate as a means of compliance, with the exception of Appendix G to Part 23–Instructions for Continued Airworthiness. Appendices A, B, C, D, E, F, H, and J would be removed and appendix G would be renamed Appendix A—Instructions for Continued Airworthiness.

b. Specific Discussion of Changes

i. Proposed Appendix A to Part 23—Instructions for Continued Airworthiness

The FAA proposes renaming Appendix G to Part 23—Instructions for Continued Airworthiness, as Appendix A to Part 23—Instructions for Continued Airworthiness.

ii. Removal of Appendices to Part 23

Appendix A to Part 23—Simplified Design Load Criteria. The FAA proposes to remove this appendix because the content is more appropriate for inclusion in methods of compliance.

Appendix B to Part 23—[Reserved]. The FAA proposes to remove this appendix because it has been reserved since amendment 23–42. There is no reason to include this appendix in the proposed revision to part 23.

Appendix C to Part 23—Basic Landing Conditions. The FAA proposes to remove this appendix because the content is more appropriate for inclusion in methods of compliance.

Appendix D to Part 23—Wheel Spin-Up and Spring-Back Loads. The FAA proposes to remove this appendix because the content is more appropriate for inclusion in methods of compliance.

Appendix E to Part 23—[Reserved]. The FAA proposes to remove this appendix because the current appendix is reserved and contains no information.

Appendix F to Part 23—Test Procedure. The FAA proposes to remove this appendix because this is purely a means of showing compliance for materials that must comply with self-extinguishing flammability requirements.

Appendix H to Part 23—Installation of an Automatic Power Reserve (APR) System. The FAA proposes to remove this appendix because the FAA believes that the detailed and prescriptive language of appendix H is more appropriate as means of compliance.

Appendix I to Part 23—Seaplane Loads. The FAA proposes to remove this appendix because the content is more appropriate for inclusion in methods of compliance.

Appendix J to Part 23—HIRF Environments and Equipment HIRF Test Levels. The accepted HIRF environment is codified as appendix J to part 23—HIRF Environments and Equipment HIRF Test Levels. The proposed language in § 23.1325 would revise this to the expected HIRF environment. The current appendix J to part 23 would remain an accepted expected HIRF environment until the Administrator accepted other levels. Any new expected HIRF environment would be found in FAA guidance material or other standards accepted by the Administrator. This would allow the certification requirement to match the current threat agreed to over time. Additionally, the proposed language would clarify that the failure consequence of interest is at the airplane level, which allows credit for design and installation architecture.

B. Miscellaneous Amendments (§§ 21.9, 21.17, 21.24, 21.35, 21.50, 21.101, 35.1, 35.37, 91.205, 91.313, 91.323, 91.531, 121.310, 135.169, and Appendix E to Part 43)

1. Production of Replacement and Modification Articles (§ 21.9)

The FAA proposes amending § 21.9 by adding paragraph (a)(7) to provide applicants with an alternative method to obtain FAA approval to produce replacement and modification articles that are reasonably likely to be installed on type certificated aircraft. We also propose to revise paragraphs (b) and (c) to specify these articles would be suitable for use in a type certificated product. These proposed changes would allow an applicant to submit production information for a specific article, but would not require the producer of the article to apply for approval of the article's design or obtain approval of its quality system. Accordingly, approval to produce a modification or replacement article under proposed § 21.9(a)(7) would not constitute a production approval as defined in § 21.1(b)(6). The FAA intends to limit use of this procedure to articles whose improper operation or failure would not cause a hazard. Approval would be granted to the applicant on a case-by-case basis, specific to the installation proposed, accounting for potential risk and considering the safety continuum.

2. Designation of Applicable Regulations (§ 21.17)

The FAA proposes amending § 21.17, by removing the reference to § 23.2, because this section would be deleted. The requirements in § 23.2 are currently addressed in the operational rules. Since § 23.2 is a retroactive rule, it is appropriate for the requirement to be in the operating rules. As a result, the FAA also proposes amending § 91.205 by revising paragraphs (b)(13) and (b)(14) to ensure removing this requirement would not have any effect on the existing fleet.

3. Issuance of Type Certificate: Primary Category Aircraft (§ 21.24)

The FAA proposes amending § 21.24 by revising paragraph (a)(1)(i) to modify the phrase as defined by § 23.49 to include reference to amendment 23–62 (76 FR 75736, December 2,2011), effective on January 31, 2012. This revision is necessary to maintain a complete definition of stall speed in this section, as the current § 23.49 would be removed from the proposed rule.

4. Flight Tests (§ 21.35)

The FAA proposes amending § 21.35 by revising paragraph (b)(2) to delete the reference to reciprocating engines and expanding the exempted airplanes to include all low-speed part 23 airplanes 6,000 pounds or less. This proposed change would align the requirements for function and reliability testing with the proposed changes in part 23 that do not distinguish between propulsion types. This change would allow the FAA flexibility to address new propulsion types based on the changes to part 23.

5. Instructions for Continued Airworthiness and Manufacturer's Maintenance Manuals Having Airworthiness Limitations Sections (§ 21.50)

The FAA proposes amending § 21.50(b) to reference § 23.1515 rather than § 23.1529. This change is editorial and would align with the proposed part 23 numbering convention.

6. Designation of Applicable Regulations (§ 21.101)

The FAA proposes amending § 21.101 by removing the reference to § 23.2 as this section is proposed to be deleted and is addressed in the operating rules, and to refer to the proposed part 23 certification levels in paragraph (c). The current 6,000-pound reference would be augmented by the inclusion of simple airplanes, certification level 1 low-speed airplanes, and certification level 2 low-speed airplanes, in order to align the current rules with the proposed part 23 certification levels.

Additionally, the FAA recognizes that it may be impractical for airplanes certified under part 23, amendment 23–62, or prior amendments, to move up to the latest amendment for modifications. Section 21.101 would not be revised to address this circumstance, as this section allows for certification at a lower amendment level if meeting the current amendment is impractical. This current provision would allow for compliance to the certification requirements at amendment 23–62 or earlier when compliance to the latest amendment of part 23 was determined by the FAA to be impractical.

7. Applicability (§ 35.1)

The FAA proposes amending § 35.1 by replacing the reference to § 23.907 with proposed § 23.905(c).

8. Fatigue Limits and Evaluation (§ 35.37)

The FAA proposes amending § 35.37 by replacing the reference to § 23.907 with proposed § 23.905(c).

9. Altimeter System Test and Inspection (Appendix E to Part 43)

The FAA proposes amending appendix E to part 43 by revising paragraph (a)(2) to conform with proposed part 23 changes. This proposed change would affect owners and operators of part 23 certificated airplanes in controlled airspace under instrument flight rules who must comply with § 91.411. Concurrent with this rule change, AC 43–6, Altitude Reporting Equipment and Transponder System Maintenance and Inspection Practices, would be revised to include a static pressure system proof test acceptable to the Administrator. Additionally, while reviewing appendix E to part 43, paragraph (a)(2), we noted that it remains silent on parts 27 and 29 rotorcraft and Civil Air Regulations certificated aircraft. The static pressure system proof test in AC 43–6 ensures the accuracy needed to meet § 91.411 requirements.

10. Powered Civil Aircraft With Standard Category U.S. Airworthiness Certificates: Instrument and Equipment Requirements (§ 91.205)

The FAA proposes amending § 91.205 by revising paragraphs (b)(13) and (b)(14) to include the potential for allowing other approved restraint systems. Additionally, paragraph (b)(14) refers to § 23.561(b)(2), which would be retitled in the proposed revision for structural strength limits and would be addressed in the means of compliance. Section 91.205(b)(16) would be deleted and incorporated into (b)(14) with no additional requirements. The part 23 proposal would delete references to utility and acrobatic categories, as they would be incorporated into the normal categories that would be redefined into performance-based standards.

11. Restricted Category Civil Aircraft: Operating Limitations (§ 91.313)

The FAA proposes amending § 91.313(g) to include the potential for allowing other approved restraint systems. Additionally, paragraph (g) includes a regulatory reference to § 23.561(b)(2), which would be retitled in the proposed revision as § 23.600, which would be accompanied by accepted means of compliance. Approval for a shoulder harness or restraint system, therefore, would require withstanding the static inertia loads specified in § 23.600 during emergency conditions.

12. Increased Maximum Certification Weights for Certain Airplanes Operated in Alaska (§ 91.323)

The FAA proposes amending § 91.323 by removing reference to § 23.337 because this section would be revised and consolidated with other structural requirements. The relevant prescriptive requirement(s) maneuvering load factors found in § 23.337 would be added to the regulation in § 91.323(b)(3).

13. Second in Command Requirements (§ 91.531)

The FAA proposes amending § 91.531(1) and (3) to incorporate the new risk and performance levels proposed in this NPRM. The FAA proposes deleting the reference to utility, acrobatic, and commuter categories in part 23. Other divisions would be used to define levels of certification for normal category airplanes. This proposed amendment would ensure airplanes certificated in the commuter category in the past and airplanes certificated in the future under the proposed part 23 airworthiness and performance levels would be addressed in this rule.

14. Additional Emergency Equipment (§ 121.310)

The FAA proposes amending § 121.310(b)(2)(iii) to reflect the reference to § 23.811(b), effective June 16, 1994. This would be an update to the reference for conformity only. This amendment would make no change to the requirements of the rule.

15. Additional Airworthiness Requirements (§ 135.169)

The FAA proposes amending § 135.169(b) by deleting the terms, ''reciprocating-engine or turbopropeller-powered''. The current rule limits operation under this part to reciprocating-engine or turbopropeller-powered small airplanes. By amending the paragraph as proposed, other small airplanes, regardless of propulsion type and including turbojet-powered, would potentially be considered for certification under this part.

The FAA also proposes to allow a small airplane in normal category, in § 135.169(b)(8), to operate within the rules governing commuter and on demand operations. This action would be necessary as a result of the proposed part 23 rules which would sunset the commuter category for newly type certificated airplanes and create a normal category, certification level 4 airplane as equivalent to the commuter category by applying to 10–19 passengers. This proposed amendment would allow for the consideration of the new category airplane and to ensure a continued higher level of safety for commercial operations. Because of the ground-breaking nature of the part 23 proposals, the associated adjustment to performance-based airworthiness standards in future airplane designs and manufacturing, and the myriad of potential possibilities for attaining a means of compliance for airplane type certification, the FAA proposes to require the new normal category certification level 4 airplanes to meet the current airworthiness and performance standards of the commuter category found in part 23 thru amendment 23–62. These standards are envisioned to remain as requirements for the new normal category certification level 4 airplanes into the near-term future, but not the long-term. It is intended that once the new part 23 requirements have proven successful with the new normal category certification levels 1, 2, and 3 airplanes, the FAA would reconsider normal category certification level 4 airplanes for part 135 commercial operations.

VII. Regulatory Notices and Analyses

A. Regulatory Evaluation Summary

Changes to Federal regulations must undergo several economic analyses. First, Executive Order 12866 and Executive Order 13563 direct 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) Would have benefits that justify its costs, (2) would not be an an economically ''significant regulatory action'' as defined in section 3(f) of Executive Order 12866, (3) would be ''significant'' as defined in DOT's Regulatory Policies and Procedures; (4) would have a significant positive economic impact on 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.

1. Total Benefits and Costs of This Rule

The following table shows the estimated benefits and costs of the proposed rule. The major factors driving the expected costs of this proposal are the additional training tasks, database development, and documentation to

FAA and industry part 23 certification engineers. Benefits consist of safety benefits from preventing stall and spin accidents and savings from reducing the number of special conditions, exemptions, and equivalent levels of safety. If the proposed rule saves only one human life by improving stall characteristics and stall warnings, that alone would result in benefits outweighing the costs.

ESTIMATED BENEFITS AND COSTS FROM 2017 TO 2036

[2014 $ Millions]

	Costs	Safety benefits + cost savings = total benefits
Total	$3.9	$19.6 + $12.6 = $32.2.
Present value	$3.9	$6.2 + $5.8 = $12.0.

2. Who is potentially affected by this rule?

The proposal would affect U.S. manufacturers and operators of new part 23 type certificated airplanes.

3. Assumptions

The benefit and cost analysis for the regulatory evaluation is based on the following factors/assumptions:

- The analysis is conducted in constant dollars with 2014 as the base year.
- The final rule would be effective in 2017.
- The primary analysis period for costs and benefits extends for 20 years, from 2017 through 2036. This period was selected because annual costs and benefits will have reached a steady state by 2036.
- Future part 23 type certifications and deliveries are estimated from historical part 23 type certifications and deliveries.
- Costs for the new part 23 type certifications forecasted in the ''Fleet Discussion'' section of the regulatory evaluation would occur in year 1 of the analysis interval.
- Airplane deliveries from the forecasted part 23 type certificates would start in year 5 of the analysis interval.
- The FAA uses a seven percent discount rate for the benefits and costs as prescribed by OMB in Circular A–4.
- The baseline for estimating the costs and benefits of the proposed rule would be part 23, through amendment 62.
- The FAA estimates 335 FAA part 23 certification engineers would require additional training as a result of this proposal. The FAA assumes that the same number of industry part 23 certification engineers would also require additional training as a result of this proposal.
- The FAA estimates that this proposal would add 16 hours of training to FAA and industry part 23 certification engineers.
- Since this training program would be on-line, we estimate no travel costs for the engineers.
- FAA pay-band tables and the Bureau of Labor Statistics (BLS) determine the hourly wages used to estimate the costs to the FAA and applicants.
- Using the U.S. Department of Transportation guidance, the wage multiplier for employee benefits is 1.17.[27]

4. Benefits of This Rule

The major safety benefit of this proposed rule is to add stall characteristics and stall warnings that would result in airplane designs that are more resistant to depart controlled flight inadvertently. The largest number of accidents for small airplanes is a stall or departure-based LOC in flight. This proposal would also have cost savings by streamlining the certification process and encouraging new and innovative technology. Streamlining the certification process would reduce the issuance of special conditions, exemptions, and equivalent level of safety findings.

5. Costs of This Rule

The proposed rules major costs are the engineer training costs and the certification database creation costs. Additional costs would also accrue from the proposed controllability and stall sections that would increase scope over current requirements and manual upgrade costs.

In the following table, we summarize the total estimated compliance costs by category. The FAA notes that since we assumed that all costs occurred in Year 1 of the analysis interval, the 2014-dollar costs equal the present value costs.

TOTAL COST SUMMARY BY CATEGORY

Type of cost	Total costs (2014$) and P.V.
§ 23.200 Controllability	$276,939
§ 23.215 Stall characteristics, stall warning, and spins	500,000
Engineer Training Costs	1,149,418
Certification Database Costs	1,293,750
Manual Upgrade Costs	700,000
Total Costs	3,920,106

*These numbers are subject to rounding error.

B. Initial 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.

The FAA believes that this proposed rule could have a significant economic impact on a substantial number of entities because we believe that this rule could enable the creation of new part 23 type certificates and new manufacturers. The FAA has been working with U.S. and foreign small aircraft manufacturers since 2007 to review the life cycle of part 23 airplanes and determine what needed improvement.

The purpose of this analysis is to provide the reasoning underlying the FAA determination.

[27] On January 30, 2014, the DOT published a memo on ''Estimating Total Costs of Compensation Based on Wage Rates or Salaries.'' The memo directs the FAA that when a rule requires incremental hours per existing employee, the wage/salary multiplier is of smaller magnitude because not all categories of employer provided benefits increase with additional hours worked by an individual employee.

Under Section 603(b) of the RFA, the initial analysis must address:

- Description of reasons the agency is considering the action;
- Statement of the legal basis and objectives for the proposed rule;
- Description of the record keeping and other compliance requirements of the proposed rule;
- All federal rules that may duplicate, overlap, or conflict with the proposed rule;
- Description and an estimated number of small entities to which the proposed rule will apply; and
- Describe alternatives considered.

1. Reasons Why the Rule Is Being Proposed

The FAA proposes this action to amend the airworthiness standards for new part 23 type certificated airplanes to reflect the current needs of the small airplane industry, accommodate future trends, address emerging technologies, and enable the creation of new part 23 manufacturers and new type certificated airplanes. The proposed changes to part 23 are necessary to eliminate the current workload of exemptions, special conditions, and equivalent levels of safety findings necessary to certificate new part 23 airplanes. These proposed part 23 changes would also promote safety by enacting new regulations for controllability and stall standards and promote new technologies in part 23 airplanes.

2. Statement of the Legal Basis and Objectives

The *FAMRA* required the Administrator, in consultation with the aviation industry, to assess the aircraft certification and approval process. In addition, the *SARA* directs the FAA to create performance-based regulations for small airplanes and provide for the use of industry developed consensus standards to allow flexibility in the certification of new technology.

Accordingly, this proposed rule would amend Title 14 of the Code of Federal Regulations to revise the airworthiness standards for small airplanes by removing current prescriptive design requirements and replacing those requirements with risk and performance-based airworthiness standards.

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 performance-based safety standards for the design of normal category airplanes.

3. Projected Reporting, Recordkeeping and Other Requirements

The FAA expects no more than minimal new reporting and recordkeeping compliant requirements would result from this proposed rule because the prescriptive nature of part 23 would be in other FAA approved documents where future technology can readily be adopted into the regulatory framework. The FAA requests comment regarding the anticipated reduction in paperwork and recordkeeping burdens that may result from this revision.

4. Overlapping, Duplicative, or Conflicting Federal Rules

The proposed rule would not overlap, duplicate, or conflict with existing federal rules.

5. Estimated Number of Small Firms Potentially Impacted

Under the RFA, the FAA must determine whether a proposed or final 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.[28]

There are seven U.S. owned aircraft manufacturers who delivered part 23 airplanes in the 1998–2013 analysis interval. These manufacturers are Adam, American Champion, Cessna, Hawker Beechcraft, Maule, Quest, and Sino-Swearingen.

Using information provided by the Internet filings and news reports, manufacturers that are subsidiary businesses of larger businesses, manufacturers that are foreign owned, and businesses with more than 1,500 employees were eliminated from the list of small entities. Cessna and Hawker Beechcraft are businesses with more than 1,500 employees. For the remaining businesses, we obtained company revenue and employment from the above sources.

The base year for the final rule is 2014. Although the FAA forecasts traffic and air carrier fleets, we cannot determine either the number of new entrants or who will be in the part 23 airplane manufacturing business in the future. Therefore, we use current U.S. part 23 airplane manufacturers' revenue and employment in order to determine the number of small entities this proposed rule would affect.

The methodology discussed above resulted in the following list of five U.S. part 23 airplane manufacturers, with less than 1,500 employees.

Manufacturer	Number of employees	Annual revenue
Part 23 Manufacturer 1	2	$110,000
Part 23 Manufacturer 2	65	7,000,000
Part 23 Manufacturer 3	75	35,000,000
Part 23 Manufacturer 4	175	34,000,000
Part 23 Manufacturer 5	2	97,000

From this list of small entity U.S. airplane manufacturers, there are three manufacturers currently producing part 23 reciprocating engine airplanes; only one manufacturer producing turboprops and only one producing turbojets. The single manufacturer producing a part 23 turbojet has not delivered an airplane since 2009 and is still working on

[28] 13 CFR 121.201, Size Standards Used to Define Small Business Concerns, Sector 48–49 Transportation, Subsector 481 Air Transportation.

acquiring the means to start up its production line again. One of the manufacturers producing a part 23 reciprocating engine airplane has not delivered an airplane since 2007 and is working on acquiring the means to start up their production line again. The FAA is not aware that either of these manufacturers is considering a new airplane for part 23 type certification in the future and therefore this proposed rulemaking would most likely not add costs to these two manufacturers because the proposed rule only affects new part 23 type certificates.

For the remaining two reciprocating engine part 23 airplane manufacturers, their last type certificates were issued in 1961 and 1970. The 1961 type certificate was issued for the only airplane this manufacturer produces and the manufacturer with the 1970 type certificate produces one other airplane that was type certificated in 1941. The last small entity manufacturer produces only turboprop airplanes and it started delivering airplanes in 2007. Again, the FAA is not aware that any of these manufacturers is considering a new airplane for part 23 type certification in the future and therefore this proposed rulemaking would most likely not add costs for it.

While this rulemaking may enable the creation of new manufacturers, the FAA is not aware of any new small entity part 23 manufacturers who want a type certification in the future for a new part 23 airplane. However, by simplifying and lowering the costs for certification of new small airplanes, barriers to entry may be lowered and thus new manufacturers may emerge.

6. Cost and Affordability for Small Entities

In 2009, a joint FAA/industry team finalized the Part 23 CPS. This proposed rulemaking resulted from this study by the recommendation to use consensus standards to supplement the regulatory language. Since then, the FAA and the part 23 industry have worked together to develop common part 23 airplane certification requirements for this rulemaking. In 2011, with the Part 23 CPS as a foundation, the FAA formed the Part 23 Reorganization ARC. The ARC consisted of large and small entity domestic and international businesses. We contacted the part 23 airplane manufacturers, the ARC, and GAMA for specific cost estimates for each section change for the rule and they all believe that this proposed rule would have a minimal cost impact on their operations and in many cases, would have significant cost savings by streamlining the part 23 type certification process. Many of the ARC members collaborated and provided a joint cost estimate for the proposed rule.

The ARC has informed us that the proposed rule would save the manufacturers design time for the certification of part 23 airplanes by reducing the number of exemptions, equivalent level of safety findings and special conditions required to incorporate new and future technology into their new airplane certifications. The proposed rule would also require manuals to be updated and database development. We expect these updates to be minimal and request commen on these anticipated costs and overall reduction in paperwork burden.

The ARC has also informed us that every other section of this proposed rule would be cost-neutral since the majority of the prescriptive requirements in part 23 would be moved from part 23. The FAA expects that these current requirements would form the basis for consensus standards that would be used as a means of compliance to the proposed performance based regulations.

The FAA expects this proposed rule could have a positive economic impact to small entities because it would enable new businesses to produce new part 23 type certificated airplanes while maintaining a safe operating environment in the NAS. This proposal is based on the ARC's recommendations and would allow for the use of consensus standards that have been developed in partnership with industry. Therefore, the FAA believes that this proposed rule could have a positive significant economic impact on a substantial number of entities.

7. Alternative Analysis

a. Alternative 1

The FAA would continue to issue special conditions, exemptions, and equivalent level of safety findings to certificate part 23 airplanes. As this approach would not follow congressional direction, we choose not to continue with the status quo.

b. Alternative 2

The FAA would continue to enforce the current regulations that affect stall and controllability. The FAA rejected this alternative because the accident rate for part 23 airplanes identified a safety issue that had to be addressed.

c. Alternative 3

The FAA notes that a multi-engine part 23 aircraft manufacturer could decide it wants to comply with § 23.200(b) by making the airplane capable of climbing after a critical loss by installing larger engines. But this is a very expensive alternative that would raise certification costs and operating costs and we believe that part 23 aircraft manufacturers would not make the airplane capable of climbing after a critical loss by installing larger engines.

The FAA solicits comments regarding this determination.

C. International Trade Impact Assessment

The Trade Agreements Act of 1979 (Pub. L. 96–39), as amended by the Uruguay Round Agreements Act (Pub. L. 103–465), prohibits Federal agencies from establishing standards or engaging in related activities that create unnecessary obstacles to the foreign commerce of the United States. Pursuant to these Acts, the establishment of standards is not considered an unnecessary obstacle to the foreign commerce of the United States, so long as the standard has a legitimate domestic objective, such as the protection of safety, and does not operate in a manner that excludes imports that meet this objective. 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 proposed rule and determined that the standards are necessary for aviation safety and would not create unnecessary obstacles to the foreign commerce of the United States.

D. Unfunded Mandates Assessment

Title II of the Unfunded Mandates Reform Act of 1995 (Pub. L. 104–4) requires each Federal agency to prepare a written statement assessing the effects of any Federal mandate in a proposed or final agency rule that may result in an expenditure of $100 million or more (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 $155.0 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.

E. Paperwork Reduction Act

The Paperwork Reduction Act of 1995 (44 U.S.C. 3507(d)) requires that the FAA consider the impact of paperwork and other information collection burdens imposed on the public. The information requirements for aircraft certification are covered by existing OMB No. 2120–0018. Burdens associated with special conditions, ELOS, and exemptions are not quantified in this collection because the need to seek relief under one of these options is dependent on each applicant and is difficult to quantify. It is expected that this rulemaking would reduce the number of special conditions, ELOS, and exemptions filed, thus reducing paperwork and processing time for both the FAA and industry. It would also maintain the fundamental safety requirements from the current part 23 regulations but allow more flexibility in airplane designs, faster adoption of safety enhancing technology, and reduce the regulatory cost burden. To estimate savings driven by this change, the FAA counted the special conditions, ELOS, and exemption applications submitted to the FAA for part 23 aircraft between 2012 and 2013 and divided the number by two years for an average of 47 applications per year.[29] The ARC report offered a similar average of 37 applications per year.[30] Additionally, the FAA counted the number of pages per application for all 47 applications to obtain an average number of pages per application. For special conditions, there were approximately 21 pages, 16 pages for an exemption, and 15 pages per ELOS application. The FAA assumes that the applicant and each FAA office that reviews the application spend 8 hours on research, coordination, and review per page. The ARC also noted ''an ELOS finding or exemption can take the FAA between 4 to 12 months to develop and approve. The applicant spends roughly the same amount of time as the FAA in proposing what they need and responding to FAA questions for SC, exemption, or ELOS.'' [31]

The number of applications is multiplied by the number of pages and by the hourly wage for the applicant and different FAA offices to account for the cost to the FAA and the applicant. The estimated hourly wage is $74.10 for a Small Airplane Directorate employee,[32] $50.75 for an Aircraft Certificate Office employee,[33] and $60.58 for an engineer [34] employed by the applicant. Annual cost equals the sum of the associated costs of special conditions, exemptions, plus equivalent level of safety. Yearly cost totals roughly $502,469 for the Small Airplane Directorate, $344,172 for Aircraft Certificate Offices, and $410,823 for the applicants. Tables 1, 2, and 3 show cost by office and applicant as well as by special condition, exemption, and ELOS.

TABLE 1—SAVINGS FROM SPECIAL CONDITIONS (SC) *

Part 23 Section	Average number of SC (2012–2013)	Average number of pages	FAA SAD		FAA ACO		Applicant	
			Man-hours	Savings	Man-hours	Savings	Man-hours	Savings
143	0.5	20.8	83	$6,165	83	$4,223	83	$5,040
171	0.5	20.8	83	6,165	83	4,223	83	5,040
173	0.5	20.8	83	6,165	83	4,223	83	5,040
175	0.5	20.8	83	6,165	83	4,223	83	5,040
177	0.5	20.8	83	6,165	83	4,223	83	5,040
251	0.5	20.8	83	6,165	83	4,223	83	5,040
361	1	20.8	166	12,330	166	8,445	166	10,081
562	1	20.8	166	12,330	166	8,445	166	10,081
572	0.5	20.8	83	6,165	83	4,223	83	5,040
573	0.5	20.8	83	6,165	83	4,223	83	5,040
574	0.5	20.8	83	6,165	83	4,223	83	5,040
613	0.5	20.8	83	6,165	83	4,223	83	5,040
627	0.5	20.8	83	6,165	83	4,223	83	5,040
629	1.5	20.8	250	18,495	250	12,668	250	15,121
901	1	20.8	166	12,330	166	8,445	166	10,081
939	0.5	20.8	83	6,165	83	4,223	83	5,040
951	1	20.8	166	12,330	166	8,445	166	10,081
961	1	20.8	166	12,330	166	8,445	166	10,081
973	1	20.8	166	12,330	166	8,445	166	10,081
977	1.5	20.8	250	18,495	250	12,668	250	15,121
1141	0.5	20.8	83	6,165	83	4,223	83	5,040
1301	0.5	20.8	83	6,165	83	4,223	83	5,040
1305	1	20.8	166	12,330	166	8,445	166	10,081
1308	0.5	20.8	83	6,165	83	4,223	83	5,040
1309	1	20.8	166	12,330	166	8,445	166	10,081
1329	0.5	20.8	83	6,165	83	4,223	83	5,040
1337	0.5	20.8	83	6,165	83	4,223	83	5,040
1521	1	20.8	166	12,330	166	8,445	166	10,081
1557	1	20.8	166	12,330	166	8,445	166	10,081
3Pt Restraint with Airbag	0.5	20.8	83	6,165	83	4,223	83	5,040
Inflatable Restraint	0.5	20.8	83	6,165	83	4,223	83	5,040
Electronic Engine Controls	0.5	20.8	83	6,165	83	4,223	83	5,040

[29] *https://my.faa.gov/org/linebusiness/avs/offices/air/tools/cert.html.*

[30] A report from the 14 CFR part 23 Reorganization Aviation Rulemaking Committee to the Federal Aviation Administration; Recommendation for increasing the safety of small general aviation airplanes certificated to 14 CFR part 23, June 5, 2013, Table 7.1—Special Conditions, Exemptions, Equivalent Safety Findings, Page 55.

[31] Ibid., 54.

[32] 2014 FAA Bay Band, Average K Band Salary (Rest of the U.S.) plus wage multiplier for benefits *https://employees.faa.gov/org/staffoffices/ahr/program_policies/policy_guidance/hr_policies/hrpm/comp/comp_ref/2014payadjustment/.*

[33] 2014 FAA Bay Band, Average I Band Salary (Rest of the U.S.) plus wage multiplier for benefits *https://employees.faa.gov/org/staffoffices/ahr/program_policies/policy_guidance/hr_policies/hrpm/comp/comp_ref/2014payadjustment/.*

[34] National Occupational Employment and Wage Estimates United States, May 2014; Aerospace Engineer mean hourly wage, NAIC code 17–2011 plus wage multiplier for benefits *http://www.bls.gov/oes/current/oes_nat.htm#17-0000.* A more detailed discussion is provided in the ''Costs'' section below.

TABLE 1—SAVINGS FROM SPECIAL CONDITIONS (SC) *—Continued

Part 23 Section	Average number of SC (2012–2013)	Average number of pages	FAA SAD		FAA ACO		Applicant	
			Man-hours	Savings	Man-hours	Savings	Man-hours	Savings
Fuel Jettisoning	0.5	20.8	83	6,165	83	4,223	83	5,040
Load Alleviation System	0.5	20.8	83	6,165	83	4,223	83	5,040
Side Facing Seat with Airbag	0.5	20.8	83	6,165	83	4,223	83	5,040
Totals	24.5	728	4077	302,080	4077	206,914	4077	246,983

* These numbers are subject to rounding error.

TABLE 2—SAVINGS FROM EXEMPTIONS *

Part 23 Section	Average number exemptions (2012–2013)	Average number of pages	FAA SAD		FAA ACO		Applicant	
			Man-hours	Savings	Man-hours	Savings	Man-hours	Savings
1359	0.5	15.6	62.4	$4,624	62	$3,167	62	$3,780
1549	0.5	15.6	62.4	4,624	62	3,167	62	3,780
177	0.5	15.6	62.4	4,624	62	3,167	62	3,780
49	1	15.6	124.8	9,247	125	6,334	125	7,561
562	1	15.6	124.8	9,247	125	6,334	125	7,561
1419	0.5	15.6	62.4	4,624	62	3,167	62	3,780
Totals	4	94	499	36,989	499	25,336	499	30,243

* These numbers are subject to rounding error.

TABLE 3—SAVINGS FROM EQUIVALENT LEVEL OF SAFETY (ELOS) *

Part 23 Section	Average number ELOS (2012–2013)	Average number of pages	FAA SAD		FAA ACO		Applicant	
			Man-hours	Savings	Man-hours	Savings	Savings	Man-hours
145	1	14.9	119.2	$8,832	119	$6,050	119	$7,221
207	1	14.9	119.2	8,832	119	6,050	119	7,221
672	0.5	14.9	59.6	4,416	60	3,025	60	3,611
777	1.5	14.9	178.8	13,249	179	9,075	179	10,832
779	0.5	14.9	59.6	4,416	60	3,025	60	3,611
781	1.5	14.9	178.8	13,249	179	9,075	179	10,832
807	0.5	14.9	59.6	4,416	60	3,025	60	3,611
815	0.5	14.9	59.6	4,416	60	3,025	60	3,611
841	1	14.9	119.2	8,832	119	6,050	119	7,221
973	0.5	14.9	59.6	4,416	60	3,025	60	3,611
1092	0.5	14.9	59.6	4,416	60	3,025	60	3,611
1145	1	14.9	119.2	8,832	119	6,050	119	7,221
1305	1.5	14.9	178.8	13,249	179	9,075	179	10,832
1311	0.5	14.9	59.6	4,416	60	3,025	60	3,611
1353	0.5	14.9	59.6	4,416	60	3,025	60	3,611
1357	0.5	14.9	59.6	4,416	60	3,025	60	3,611
1397	0.5	14.9	59.6	4,416	60	3,025	60	3,611
1401	0.5	14.9	59.6	4,416	60	3,025	60	3,611
1419	0.5	14.9	59.6	4,416	60	3,025	60	3,611
1443	0.5	14.9	59.6	4,416	60	3,025	60	3,611
1505	0.5	14.9	59.6	4,416	60	3,025	60	3,611
1545	0.5	14.9	59.6	4,416	60	3,025	60	3,611
1549	2.5	14.9	298	22,081	298	15,125	298	18,054
Totals	19	343	2205	163,400	2205	111,923	2205	133,597

* These numbers are subject to rounding error.

Using these yearly cost estimates, over 20 years $25.1 million in man-hours would be spent on applying for and processing special conditions, exemptions, and ELOS. However under the proposed rule, the FAA believes that the need to demonstrate compliance through special conditions, exemptions, or ELOS would largely be eliminated. Instead new products will simply need to demonstrate compliance by following consensus standards acceptable to the Administrator, or by submitting their own novel demonstrations of compliance. As a conservative estimate, the FAA estimates that special conditions, exemptions, and ELOS would be reduced by half for a savings to the FAA and applicant of roughly $12.6 million ($5.8 million present value). Savings by year is shown in the chart below. The FAA asks for comment regarding the amount of reduction in the alternative means of compliance.

In addition to this savings, there would also be additional paperwork burden associated with proposed § 23.200. As proposed, this provision could result in a change to a limitation or a performance number in the flight manual, which would reqire an update to the training courseware or flight manual. Industry believes that this proposed change could cost from $100,000 to $150,000. Therefore, the FAA uses $125,000 (($100,000 + $150,000)/2) as an average cost for this proposed change.

There would also be additional paperwork associated with this requirement that is not part of the costs discussed above. The FAA estimates the paperwork costs for these proposed provisions by multiplying the number of hours the FAA estimates for each page of paperwork, by the number of pages for the training courseware, or flight manual, by the hourly rate of the person responsible for the update. The Small Aircraft Directorate of the FAA provided average hourly times and the number of additional pages of paperwork the proposal would add. The FAA estimates that this section would add a total of four pages to the training courseware and flight manual. The FAA also estimates that it would take a part 23 certification engineer eight hours to complete the one page required for each new type certification. The eight hours to complete a page includes the research, coordination, and review each document requires. Therefore, the FAA estimates the total paperwork costs for proposed controllability section would be about $1,939 (8 hours * 4 pages * $60.58 per hour) in 2014 dollars.

The FAA is expecting part 23 airplane manufacturers to update their engineering procedures manuals to reflect the changes from this proposed rulemaking. However, most of the engineering procedures manuals are not written around the requirements of part 23, but around the requirements of part 21. Since the part 23 changes would have minimal impact on the part 21 requirements, there should be little change in the engineering procedures manuals. Conversations with industry indicate that there may need to be some changes to the engineering manuals to describe how the accepted means of compliance must be related to the regulations. Depending on the complexity of each company's manual, industry estimates that these changes could run from about $50,000 up to $200,000. This would be a one-time cost per new type certification.

Since the FAA is unable to determine the complexity of each company's manual, we assume that the manufacturers of the two new part 23 reciprocating engine airplane type certifications, discussed in the ''Fleet Discussion'' section of the regulatory impact analysis, would spend $50,000 to make the changes to the engineering manual. We also assume that the one new part 23 turboprop airplane certification and the two new part 23 turbojet airplane certifications, discussed in the ''Fleet Discussion'' section, would use the more complex and costly approach of $200,000.

The FAA notes that either the simple approach or the more complex approach to updating the manuals could also either take place in-house or could be contracted out to a consultant.

Table 4 shows the total costs for the proposed changes to the controllability section.

TABLE 4—ESTIMATE COSTS FOR UPDATING ENGINEERING MANUALS

[2014 $]

Airplane	Number of estimated new type certificates	Simple approach	Complex approach	Total
Recip	2	$50,000	$0	$100,000
Turboprop	1	0	200,000	200,000
Turbojet	2	0	200,000	400,000
Total				700,000

* These numbers are subject to rounding error.

F. International Compatibility and Cooperation

In keeping with U.S. obligations under the Convention on International Civil Aviation, it is FAA policy to conform to 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 the following differences with these proposed regulations. The ICAO Standards for small airplanes use weight and propulsion to differentiate between some requirements. The proposed regulations use certification levels and performance to differentiate between some requirements. Furthermore, part 23 will still allow the certification of airplanes up to 19,000 pounds. If this proposal is adopted, the FAA intends to file these differences with ICAO. Executive Order (EO) 13609, Promoting International Regulatory Cooperation, (77 FR 26413, May 4, 2012) promotes international regulatory cooperation to meet shared challenges involving health, safety, labor, security, environmental, and other issues and reduce, eliminate, or prevent unnecessary differences in regulatory requirements. The FAA has analyzed this action under the policy and agency responsibilities of Executive Order 13609, Promoting International Regulatory Cooperation. The agency has determined that this action would eliminate differences between U.S. aviation standards and those of other CAAs by aligning the revised part 23 standards with the new CS–23 standards that are being developed concurrently by EASA. Several other CAAs are participating in this effort and intend to either adopt the new part 23 or CS–23 regulations or revise their airworthiness standards to align with these new regulations.

The Part 23 Reorganization ARC included participants from several foreign CAAs and international members from almost every GA manufacturer of both airplanes and avionics. It also included several Light-Sport Aircraft manufacturers who are interested in certificating their products using the airworthiness standards contained in part 23. The rulemaking and means of compliance documents are international efforts. Authorities from Europe, Canada, Brazil, China, and New Zealand all are working to produce similar rules. These rules, while not identical, are intended to allow the use of the same set of industry developed means of compliance. Industry has told that FAA that it is very costly to address the differences that some contrived means of compliance imposes. If there is substantial agreement between the major CAAs to use the same industry means of compliance document, then U.S. manufactures expect a significant saving for exporting their products.

Furthermore, this project is a harmonization project between the FAA and EASA.

EASA has worked a parallel rulemaking program for CS–23. The FAA provided comments to the EASA A–NPA The EASA and other authorities will have an opportunity to comment on this NPRM when it is published. These efforts will allow the FAA, EASA and other authorities to work toward a harmonized set of regulations when the final rules are published.

G. Environmental Analysis

FAA Order 1050.1F 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 rulemaking action qualifies for the categorical exclusion identified in paragraph 5–6.6 and involves no extraordinary circumstances.

H. Regulations Affecting Intrastate Aviation in Alaska

Section 1205 of the FAA Reauthorization Act of 1996 (110 Stat. 3213) requires the Administrator, when modifying 14 CFR 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 GA airworthiness standards, 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.

VIII. Executive Order Determination

A. Executive Order 13132, Federalism

The FAA has analyzed this proposed rule under the principles and criteria of Executive Order 13132, Federalism. The agency has determined that this action would not have a substantial direct effect on the States, or the relationship between the Federal 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.

B. Executive Order 13211, Regulations That Significantly Affect Energy Supply, Distribution, or Use

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

IX. Additional Information

A. Comments Invited

The FAA invites interested persons to participate in this rulemaking by submitting written comments, data, or views. The agency also invites 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, commenters should send only one copy of written comments, or if comments are filed electronically, commenters should submit only one time.

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

Proprietary or Confidential Business Information: Commenters should not file proprietary or confidential business information in the docket. Such information must be sent or delivered directly to the person identified in the **FOR FURTHER INFORMATION CONTACT** section of this document, and marked as proprietary or confidential. If submitting information on a disk or CD–ROM, mark the outside of the disk or CD–ROM, and identify electronically within the disk or CD–ROM the specific information that is proprietary or confidential.

Under 14 CFR 11.35(b), if the FAA is aware of proprietary information filed with a comment, the agency does not place it in the docket. It is held in a separate file to which the public does not have access, and the FAA places a note in the docket that it has received it. If the FAA receives a request to examine or copy this information, it treats it as any other request under the Freedom of Information Act (5 U.S.C. 552). The FAA processes such a request under Department of Transportation procedures found in 49 CFR part 7.

B. Availability of Rulemaking Documents

An electronic copy of rulemaking documents may be obtained from 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.gpo.gov/fdsys/*.

Copies may also be obtained 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. Commenters must identify the docket or notice number of this rulemaking.

All documents the FAA considered in developing this proposed rule, including economic analyses and technical reports, may be accessed from the Internet through the Federal eRulemaking Portal referenced in item (1) above.

Appendix 1 to the Preamble—Current to Proposed Regulations Cross-Reference Table

The below cross-reference table is intended to permit easy access from proposed to current regulations. The preamble is organized topical, section-by-section, proposed to current regulations. This table should assist the reader in following the section discussions contained in the preamble.

Current section	Title	Proposed section	Proposed title
Subpart A—General			
23.1	Applicability	23.1	Applicability.
23.2	Special retroactive requirements		—Deleted—
23.3	Airplane categories	23.5	Certification of normal category airplanes.
		23.10	Accepted means of compliance.
Subpart B—Flight			
23.21	Proof of compliance	23.100	Weight and center of gravity.
23.23	Load distribution limits	23.100	Weight and center of gravity.
23.25	Weight limits	23.100	Weight and center of gravity.
23.29	Empty weight and corresponding center of gravity.	23.100	Weight and center of gravity.
23.31	Removable ballast	23.100	Weight and center of gravity.
23.33	Propeller speed and pitch limits	23.900	Powerplant installation.
23.45	Performance—General	23.105	Performance.
23.49	Stalling speed	23.110	Stall Speed.
23.51	Takeoff speeds	23.115	Takeoff performance.
23.53	Takeoff performance	23.115	Takeoff performance.
23.55	Accelerate-stop distance	23.115	Takeoff performance.
23.57	Takeoff path	23.115	Takeoff performance.
23.59	Takeoff distance and takeoff run	23.115	Takeoff performance.
23.61	Takeoff flight path	23.115	Takeoff performance.
23.63	Climb: General	23.120	Climb.
23.65	Climb: All engines operating	23.120	Climb.
23.66	Takeoff climb: one engine inoperative	23.125	Climb.
23.67	Climb: One engine inoperative	23.120	Climb.
23.69	Enroute climb/descent	23.125	Climb.
23.71	Glide: single engine airplanes	23.125	Climb.
23.73	Reference landing approach speed	23.130	Landing.
23.75	Landing distance	23.130	Landing.
23.77	Balked landing	23.120	Climb.
23.141	Flight Characteristics—General	23.200	Controllability.
23.143	Controllability and Maneuverability—General.	23.200	Controllability.
23.145	Longitudinal control	23.200	Controllability.
23.147	Directional and lateral control	23.200	Controllability.
23.149	Minimum control speed	23.200	Controllability.
23.151	Acrobatic maneuvers	23.200	Controllability.
23.153	Control during landings	23.200	Controllability.
23.155	Elevator control force in maneuvers	23.200	Controllability.
23.157	Rate of roll	23.200	Controllability.
23.161	Trim	23.205	Trim.
23.171	Stability—General	23.210	Stability.
23.173	Static longitudinal stability	23.210	Stability.
23.175	Demonstration of static longitudinal stability	23.210	Stability.
23.177	Static directional and lateral stability	23.210	Stability.
23.179	Instrument stick force measurements	23.210	Stability.
23.181	Dynamic stability	23.210	Stability.
23.201	Wings level stall	23.215	Stall characteristics, stall warning, and spins.
23.203	Turning Flight and accelerated turning stalls.	23.215	Stall characteristics, stall warning, and spins.
23.207	Stall Warning	23.215	Stall characteristics, stall warning, and spins.
23.221	Spinning	23.215	Stall characteristics, stall warning, and spins.
23.231	Longitudinal stability and control	23.220	Ground handling.
23.233	Directional stability and control	23.220	Ground handling.
23.235	Operation on unpaved surfaces	23.220	Ground handling.
23.237	Operation on water	23.220	Ground handling.
23.239	Spray characteristics	23.220	Ground handling.
23.251	Vibration and buffeting	23.225	Vibration, buffeting, and high-speed characteristics.
23.253	High speed characteristics	23.225	Vibration, buffeting, and high-speed characteristics.
23.255	Out of trim characteristics	23.225	Vibration, buffeting, and high-speed characteristics.
		23.230	Performance and flight characteristics requirements for flight in icing conditions.

Current section	Title	Proposed section	Proposed title
Subpart C—Structure			
23.301	Loads	23.310, 23.330	Structural design loads, Limit and ultimate loads.
(a)		23.330	Limit and ultimate loads.
(b)		23.310	Structural design loads.
(c)		23.310	Structural design loads.
(d)		23.310	Structural design loads.
23.302	Canard or tandem wing configurations	23.310	Structural design loads.
23.303	Factors of safety	23.330	Limit and ultimate loads.
23.305	Strength and deformation	23.400	Structural strength.
		23.305	Interaction of systems and structures.
23.307	Proof of structure	23.400	Structure strength.
23.321	Flight Loads—General	23.310	Structural design loads.
(a)		23.310	Structural design loads.
(b)		23.300	Structural design envelope.
(c)		23.300	Structural design envelope.
23.331	Symmetrical flight conditions	23.310	Structural design loads.
23.333	Flight envelope	23.300	Structural design envelope.
(a)		23.300	Structural design envelope.
(b)		23.300	Structural design envelope.
(c)		23.315	Flight load conditions.
(d)		23.300	Structural design envelope.
23.335	Design airspeeds	23.300	Structural design envelope.
23.337	Limit maneuvering load factors	23.300	Flight load conditions.
(a)		23.300	Structural design envelope.
(b)		23.300	Structural design envelope.
(c)		Means of Compliance.	
23.341	Gust load factors	23.315	Flight load conditions.
23.343	Design fuel loads	23.300	Structural design envelope.
(a)		23.300	Structural design envelope.
(b)		23.300	Structural design envelope.
(c)		Means of Compliance.	
23.345	High lift devices	23.325	Component loading conditions.
23.347	Unsymmetrical flight loads	23.315	Flight load conditions.
23.349	Rolling conditions	23.315	Flight load conditions.
23.351	Yawing conditions	23.315	Flight load conditions.
23.361	Engine torque	23.325	Component loading conditions.
23.363	Side load on engine mount	23.325	Component loading conditions.
23.365	Pressurized cabin loads	23.325	Flight load conditions.
(e)		23.405	Structural durability.
23.367	Unsymmetrical loads due to engine failure	23.315	Flight load conditions.
23.369	Rear lift truss	Means of Compliance.	
23.371	Gyroscopic and aerodynamic loads	23.325	Component loading conditions.
23.373	Speed control devices	23.325	Component loading conditions.
23.391	Control surface loads	23.325	Component loading conditions.
23.393	Loads parallel to hinge line	23.325	Component loading conditions.
23.395	Control system loads	23.325	Component loading conditions.
23.397	Limit control forces and torques	23.325	Component loading conditions.
23.399	Dual control system	23.325	Component loading conditions.
23.405	Secondary control system	23.325	Component loading conditions.
23.407	Trim tab effects	23.325	Component loading conditions.
23.409	Tabs	23.325	Component loading conditions.
23.415	Ground gust conditions	23.325	Component loading conditions.
23.421	Balancing loads	Means of Compliance.	
23.423	Maneuvering loads	23.315	Flight load conditions.
23.425	Gust loads	23.315	Flight load conditions.
23.427	Unsymmetrical loads due to engine failure	23.315	Flight load conditions.
23.441	Maneuvering loads	23.315	Flight load conditions.
23.443	Gust loads	23.315	Flight load conditions.
23.445	Outboard fins or winglets	Means of Compliance.	
23.455	Ailerons	23.325	Component loading conditions.
23.459	Special devices	23.325	Component loading conditions.
23.471	Ground Loads—General	23.320	Ground and water load conditions.
23.473	Ground load conditions and assumptions	23.320	Ground and water load conditions.
23.477	Landing gear arrangement	23.320	Ground and water load conditions.
23.479	Level landing conditions	23.320	Ground and water load conditions.
23.481	Tail down landing conditions	23.320	Ground and water load conditions.
23.483	One-wheel landing conditions	23.320	Ground and water load conditions.
23.485	Side load conditions	23.320	Ground and water load conditions.
23.493	Braked roll conditions	23.320	Ground and water load conditions.
23.497	Supplementary conditions for tail wheels	23.320	Ground and water load conditions.
23.499	Supplementary conditions for nose wheels	23.320	Ground and water load conditions.
23.505	Supplementary conditions for skiplanes	23.320	Ground and water load conditions.

Current section	Title	Proposed section	Proposed title
23.507	Jacking loads	23.320	Ground and water load conditions.
23.509	Towing loads	23.320	Ground and water load conditions.
23.511	Ground load: unsymmetrical loads on multiple-wheel units.	23.320	Ground and water load conditions.
23.521	Water load conditions	23.320	Ground and water load conditions.
23.523	Design weights and center of gravity positions.	23.320	Ground and water load conditions.
23.525	Application of loads	23.320	Ground and water load conditions.
23.527	Hull and main float load factors	23.320	Ground and water load conditions.
23.529	Hull and main float landing conditions	23.320	Ground and water load conditions.
23.531	Hull and main float takeoff conditions	23.320	Ground and water load conditions.
23.533	Hull and main float bottom pressures	23.320	Ground and water load conditions.
23.535	Auxiliary float loads	23.320	Ground and water load conditions.
23.537	Seawing loads	23.320	Ground and water load conditions.
23.561	Emergency Landing Conditions—General	23.600	Emergency conditions.
23.562	Emergency landing dynamic conditions	23.600	Emergency conditions.
23.571	Metallic pressurized cabin structures	23.405	Structural durability.
23.572	Metallic wing, empennage, and associated structures.	23.405	Structural durability.
23.573	Damage tolerance and fatigue evaluation of structure.	23.405	Structural durability.
23.574	Metallic damage tolerance and fatigue evaluation of commuter category airplanes.	23.405	Structural durability.
23.575	Inspections and other procedures	23.405	Structural durability.
Subpart D—Design and Construction			
23.601	General	23.500	Structural design.
23.603	Materials and workmanship	23.500	Structural design.
23.605	Fabrication methods	23.510	Materials and processes.
23.607	Fasteners	23.505	Protection of structure.
23.609	Protection of Structure	23.505	Protection of structure.
23.611	Accessibility	23.505	Protection of structure.
23.613	Material strength properties and design values.	23.510	Materials and processes.
23.619	Special factors	23.515	Special factors of safety.
23.621	Casting factors	23.515	Special factors of safety.
23.623	Bearing factors	23.515	Special factors of safety.
23.625	Fitting factors	23.515	Special factors of safety.
23.627	Fatigue strength	23.405	Structural durability.
23.629	Flutter	23.410	Aeroelasticity.
23.641	Proof of strength	Means of Compliance.	
23.651	Proof of strength	Means of Compliance.	
23.655	Installation	Means of Compliance.	
23.657	Hinges	23.515	Special factors of safety.
23.659	Mass balance	23.315	Flight load conditions.
23.671	Control Surfaces—General.		
(a)		23.500	Structural design.
(b)		23.1305	Function and installation.
23.672	Stability augmentation and automatic and power-operated systems.	23.1305	Function and installation.
23.673	Primary flight controls	23.1305	Function and installation.
23.675	Stops	23.1305	Function and installation.
23.677	Trim systems.		
(a)		23.700	Flight control systems.
(b)		23.700	Flight control systems.
(c)		23.410	Aeroelasticity.
(d)		23.700	Flight control systems.
23.679	Control system locks	23.1305	Function and installation.
23.681(a)	Limit load static tests	23.325(b)	Component loading conditions.
23.681(b)	Limit load static tests	23.515	Special factors of safety.
23.683	Operation tests	23.500(d)	Structural design.
23.685(a), (b), (c)	Control system details	23.500(d)	Structural design.
23.685(d)	Control system details	23.1305	Function and installation.
23.687	Spring devices	23.410 and 23.500	Aeroelasticity and Structural design.
23.689	Cable systems.		
(a)		23.700	Flight control systems.
(b)		23.325(b), 23.500(d)	Component loading conditions, Structural design.
(c)		23.325(b), 23.500(d)	Component loading conditions, Structural design.
(d)		23.325(b), 23.500(d)	Component loading conditions, Structural design.

Current section	Title	Proposed section	Proposed title
(e)		23.325(b), 23.500(d)	Component loading conditions, Structural design.
(f)		23.700	Flight control systems.
23.691	Artificial stall barrier system.		
(a)		23.700	Flight control systems.
(b)		23.700	Flight control systems.
(c)		23.1305	Function and installation.
(d)		23.700	Flight control systems.
(e)		23.700	Flight control systems.
(f)		23.700	Flight control systems.
(g)		23.1315	Equipment, systems and Installations.
23.693	Joints	23.515	Special factors of safety.
23.697	Wing flap controls.		
(a)		23.700	Flight control systems.
(b) and (c)		23.200	Controllability.
23.699	Wing flap position indicator	23.1500	Flightcrew interface.
23.701	Flap interconnection	Means of Compliance.	
23.703	Takeoff warning system.		
(a)		23.700	Flight control systems.
(b)		23.700	Flight control systems.
(c)		Definition.	
23.721	General	23.910	Powerplant installation hazard assessment.
23.723	Shock absorption tests	Means of Compliance.	
23.725	Limit drop tests	Means of Compliance.	
23.726	Ground load dynamic tests	Means of Compliance.	
23.727	Reserve energy absorption drop tests	Means of Compliance.	
23.729	Landing gear extension and retraction system.		
(a)		23.705	Landing gear systems.
(b)		23.705	Landing gear systems.
(c)		23.705	Landing gear systems.
(d)		Means of Compliance.	
(e)		23.705	Landing gear systems.
(f)		23.1315	Equipment, systems and installation.
(g)		Means of Compliance.	
23.731	Wheels	23.705	Landing gear systems.
23.733	Tires.		
(a)		23.705	Landing gear systems.
(b)		Means of Compliance.	
(c)		Means of Compliance.	
23.735	Brakes	23.705.	
(a)		23.705	Landing gear systems.
(1)		Means of Compliance.	
(2)		Means of Compliance.	
(b)		23.705	Landing gear systems.
(c)		Means of Compliance.	
(d)		1315	Equipment, systems and installation.
(e)		705	Landing gear systems.
(1)		Means of Compliance.	
(2)		Means of Compliance.	
23.737	Skis	23.705	Landing gear systems.
23.745	Nose/Tail wheel steering	23.1500	Flightcrew interface.
23.751	Main float buoyancy.		
(a)		710	Buoyancy for seaplanes and amphibians.
(b)		Means of Compliance.	
23.753	Main float design	23.320	Ground and water load conditions.
23.755	Hulls	23.710	Buoyancy for seaplanes and amphibians.
23.757	Auxiliary floats	23.710	Buoyancy for seaplanes and amphibians.
23.771	Pilot compartment.		
(a)		23.1500	Flightcrew interface.
(b)		755	Occupant physical environment.
(c)		755	Occupant physical environment.
23.773	Pilot compartment view.		
(a)		1500	Flightcrew interface.
(b)		23.755	Occupant physical environment.
23.775	Windshields and windows.		
(a), (b), (c), (d)		23.755	Occupant physical environment.
(e)		Means of Compliance.	
(f)		23.1405	Flight in icing conditions.
(g)		Means of Compliance.	
(h)		23.755	Occupant physical environment.
23.777	Cockpit controls	23.1500	Flightcrew interface.
23.779	Motion and effect of cockpit controls	23.1500	Flightcrew interface.
23.781	Cockpit control knob shape	23.1500	Flightcrew interface.

Current section	Title	Proposed section	Proposed title
23.783	Doors.		
(a), (b), (c), (d)		23.750	Means of egress and emergency exits.
(e), (f), (g)		Means of Compliance.	
23.785	Seats, berths, litters, safety belts, and shoulder harnesses.	23.515 and 23.600	Special factors of safety, Emergency landing conditions.
23.787	Baggage and cargo compartments	23.600(e)	Emergency landing conditions.
23.791	Passenger information signs	23.755	Occupant physical environment.
23.803	Emergency evacuation.		
(a)		23.750	Means of egress and emergency exits.
(b)		Means of Compliance.	
23.805	Flightcrew emergency exits	23.750	Means of egress and emergency exits.
23.807	Emergency exits.		
(a)(3), (b)(1), (c), (d)(1), (d)(4).		Means of Compliance.	
Balance of 23.807		23.750	Means of egress and emergency exits.
23.811	Emergency exit marking	23.750	Means of egress and emergency exits.
23.812	Emergency lighting	23.750	Means of egress and emergency exits.
23.813	Emergency exit access.		
(a)		23.750	Means of egress and emergency exits.
(b)		Means of Compliance.	
CS–VLA 853		23.750	Means of egress and emergency exits.
23.815	Width of aisle	23.750	Means of egress and emergency exits.
23.831	Ventilation	23.755	Occupant physical environment.
23.841(a), (b)(6), (c) ,(d).	Pressurized cabins	23.755	Occupant physical environment.
(b)(1) through (5) and (7).		Means of Compliance.	
23.843	Pressurization tests	23.755	Occupant physical environment.
23.851	Fire extinguishers.		
(a) and (b)		23.800	Fire protection outside designated fire zones.
(c)		Means of Compliance.	
23.853	Passenger and crew compartment interiors.		
(a)		23.800	Fire protection outside designated fire zones.
(b)(c) and (d)(1)(2).		Means of Compliance.	
(d)(3)(i), (d)(3)(iii), (d)(3)(iv).		23.800	Fire protection outside designated fire zones.
(e)		23.800	Fire protection outside designated fire zones.
(f)		23.800	Fire protection outside designated fire zones.
23.855	Cargo and baggage compartment fire protection.	23.800	Fire protection outside designated fire zones.
23.856	Thermal/acoustic insulation materials	23.800	Fire protection outside designated fire zones.
23.859	Combustion heater fire protection.		
(a)		23.800	Fire protection outside designated fire zones.
(b) thru (i)		Means of Compliance.	
23.863	Flammable fluid fire protection.		
(a) and (d)		23.800	Fire protection outside designated fire zones.
(b) and (c)		Means of Compliance	Fire protection outside designated fire zones.
23.865	Fire protection of flight controls, engine mounts, and other flight structure.	23.805	Fire protection in designated fire zones.
23.867	Electrical bonding and protection against lightning and static electricity.		
(a) and (c)		23.810	Lightning protection of structure.
(b)		23.1320	Electrical and electronic system lightning protection.
23.871	Leveling means	Means of Compliance.	
Subpart E—Powerplant			
23.901	Installation	23.900(c)	Powerplant Installation.
(a), (b), (f)		23.900(b).	
(c)		23.900(b).	
(d) and (e)		23.900(b)	Note: In addition to 900(b) these rules are covered under Part 33.63, 76, 77 and 78.
23.903	Engines.		

Current section	Title	Proposed section	Proposed title
(a)		23.900(c).	
(a)(2)		23.940(b)	Powerplant ice protection.
(b)(c)		23.910 and 23.920	Powerplant installation hazard assessment; Reversing systems.
(b)(1)		23.405(d)	Structural durability.
(d) thru (g)		23.925	Powerplant operational characteristics.
23.904	Automatic power reserve system	23.915	Automatic power control systems.
23.905	Propellers.		
(a)		23.910(a)	Powerplant installation hazard assessment.
(b), (d), (g)			Note: Intent covered under part 35.
(c)		23.905	Propeller installation.
(e)		23.940	Powerplant ice protection.
(f)		23.905	Propeller installation.
(h)		23.910	Powerplant installation hazard assessment.
23.907	Propeller vibration and fatigue		Note: Intent covered under part 35.
23.909	Turbocharger systems.		
(a) and (c)		23.900	Powerplant installation.
(b), (d), (e)		23.910	Powerplant installation hazard assessment.
23.925	Propeller clearance	23.905(c)	Installation.
23.929	Engine installation ice protection	23.940	Powerplant ice protection.
23.933	Reversing systems	23.920.	
(a)		23.920	Reversing systems.
(b)		23.920	Reversing systems.
23.934	Turbojet and turbofan engine thrust reverser systems tests.	23.920	Note: In addition to § 23.920, this rule is covered under § 33.97.
23.937	Turbopropeller-drag limiting systems	23.920.	
(a)		23.920	Reversing systems.
(b)		23.920	Reversing systems.
23.939	Powerplant operating characteristics	23.925	In addition to 925 this rule is covered under Part 33, subpart D and F—Block Tests.
23.943	Negative acceleration	23.925	Operational characteristics.
23.951	Fuel System—General	23.930(a)(3).	
(a) and (b)		23.930(a)(3)	Fuel systems.
(c)		23.930(a)(3).	
(d)		23.930(a)(3)	Intent covered under Part 34.
23.953	Fuel system independence	23.930	Fuel systems.
23.954	Fuel system lightning protection	23.930	Fuel systems.
23.955	Fuel flow	23.930	Fuel systems.
23.957	Flow between interconnected tanks	23.930(a)(7)	Fuel systems.
(a)		23.930(a)(7).	
(b)		23.930(a)(7).	
23.959	Unusable fuel supply	23.930(c)	Hazard assessment.
23.961	Fuel system hot weather operation	23.930(a)(3)	Fuel systems.
23.963	Fuel tank: general.		
(a), (d), (e)		23.930(b)(4)	Fuel systems.
(b) and (c)		23.930(b)(6).	
23.965	Fuel tank tests	23.930(b)(1).	
23.967	Fuel tank installation	23.930(b)(6).	
23.969	Fuel tank expansion space	23.930(b)(6).	
23.971	Fuel tank sump	23.930(b)(6).	
23.973	Fuel tank filler connection	23.930(b)(6).	
23.975	Fuel tank vents and carburetor vapor vents	23.930(b)(6).	
(a)(1)		23.940	Powerplant ice protection.
23.977	Fuel tank outlet	23.930(b)(6)	Fuel systems.
23.979	Pressure fueling systems	23.930(d).	
(a) and (b)		23.930(d)	Fuel systems.
(c) and (d)		23.930(d)	Hazard assessment.
23.991	Fuel pumps	23.930(a)(8).	
(a), (b), (c)		23.930(a)(8)	Fuel systems.
(d)		23.910	Powerplant installation hazard assessment.
23.993	Fuel system lines and fittings	23.930.	
23.994	Fuel system components	23.930(a)(7)	Hazard assessment.
23.995	Fuel valves and controls	23.930(d).	
(a)		23.930(d)	Powerplant installation.
(b) thru (g)		23.930(d).	
23.997	Fuel strainer or filter	23.930(a).	
(a) thru (d)		23.930(a)(6)	Fuel systems.
(e)		23.950	Powerplant ice protection.
23.999	Fuel system drains	23.930(a)(4)	Fuel systems.
23.1001	Fuel jettisoning system	23.930(b)(5).	
(a)		23.930(b)(5)	Fuel systems.
(b) thru (g)		23.930(b)(5).	
(h)		23.910	Powerplant installation hazard assessment.
23.1011	General	23.935	Intent covered under Part 33.

Current section	Title	Proposed section	Proposed title
23.1013	Oil tanks	23.935(b)(1)	Intent covered under Part 33.
23.1015	Oil tank tests	23.935(b)(1)	Intent covered under Part 33.
23.1017	Oil lines and fittings	23.935(b)(1)	Intent covered under Part 33.
23.1019	Oil strainer or filter	23.935(b)(2)	Intent covered under Part 33.
23.1021	Oil system drains	23.935(b)(2)	Intent covered under Part 33.
23.1023	Oil radiators	23.935(b)(1)	Intent covered under Part 33.
23.1027	Propeller feathering system	23.935(b)(2)	Hazard assessment.
23.1041	Cooling—General	23.940(a)	Intent covered under Part 33.
23.1043	Cooling tests	23.940(a)	Intent covered under Part 33.
23.1045	Cooling test procedures for turbine engine powered airplanes.	23.940(a)	Intent covered under Part 33.
23.1047	Cooling test procedures for reciprocating engine powered airplanes.	23.940(a)	Intent covered under Part 33.
23.1061	Installation	23.940(b)	Intent covered under Part 33.
23.1063	Coolant tank tests	23.940(b)	Intent covered under Part 33.
23.1091	Air induction system	23.945(a)	Intent covered under Part 33.
23.1093	Induction system icing protection	23.940	Powerplant ice protection.
23.1095	Carburetor deicing fluid flow rate	23.940	Powerplant ice protection.
23.1097	Carburetor deicing fluid system capacity	23.940	Powerplant ice protection.
23.1099	Carburetor deicing fluid system detail design.	23.940	Powerplant ice protection.
23.1101	Induction air preheater design	23.935.	
(a)		23.935	Powerplant induction and exhaust systems.
(b) and (c)		23.935.	
23.1103	Induction system ducts	23.935	Powerplant induction and exhaust systems.
23.1105	Induction system screens	23.935.	
23.1107	Induction system filters	23.935	Powerplant induction and exhaust systems.
23.1109	Turbocharger bleed air system	23.910.	
23.1111	Turbine engine bleed air system	23.910.	
(a) and (c)		23.910	Hazard assessment.
(b)		23.910.	
23.1121	Exhaust System—General	23.935.	
(a) thru (g)		23.935	Powerplant induction and exhaust systems.
(h)		23.910	Hazard assessment.
23.1123	Exhaust system	23.910	Hazard assessment.
23.1125	Exhaust heat exchangers	23.910.	
(a)		23.910	Hazard assessment.
(b)		23.910.	
23.1141	Powerplant controls: general (a)(c)(g)	23.1505(b).	
	(b)(d)(e) and (f)	23.910	Powerplant installation hazard assessment.
23.1142	Auxiliary power unit controls	23.1500(b).	
23.1143	Engine controls	23.1500(b).	
23.1145	Ignition switches	23.1500(b).	
23.1147	Mixture controls	23.1500(b).	
23.1149	Propeller speed and pitch controls	23.1500(b).	
23.1153	Propeller feathering controls	23.1500(b).	
23.1155	Turbine engine reverse thrust and propeller pitch settings below the flight regime.	23.910 and 23.1500(b)	Hazard assessment.
23.1157	Carburetor air temperature controls	23.1500(b).	
23.1163	Powerplant accessories	23.910(a)	Powerplant installation hazard assessment.
(a), (c), (e)		23.910(a).	
(b) and (d)		23.910(a).	
23.1165	Engine ignition systems	Means of Compliance.	
23.1181	Designated fire zones: regions included	23.1000(a)	Powerplant fire protection.
23.1182	Nacelle areas behind firewalls	23.1000(b).	
23.1183	Lines, fittings, and components	23.1000(b).	
23.1189	Shutoff means	23.1000(c).	
23.1191	Firewalls	23.1000(d).	
(a) thru (e), (g), (h).		23.1000(d).	
(f)		23.910	Powerplant installation hazard assessment.
23.1192	Engine accessory compartment diaphragm	23.1000(d).	
23.1193	Cowling and nacelle	23.1000(d).	
(a) thru (e)		23.1000(d).	
(f) and (g)		23.1000(d)	Hazard assessment.
23.1195	Fire extinguishing systems	23.1000(e).	
23.1197	Fire extinguishing agents	23.1000(e).	
23.1199	Extinguishing agent containers	23.1000(e).	
23.1201	Fire extinguishing system materials	23.1000(e).	
(a)		23.1000(e)	Hazard assessment.
(b)		23.1000(e).	
23.1203	Fire detector system	23.1000(f).	
(a), (d), (e)		23.1000(f).	
(b) and (c)		23.1000(f)	Hazard assessment.

Current section	Title	Proposed section	Proposed title
		Subpart F—Equipment	
23.1301	Function and installation.		
(a)		23.1300(a) and 23.1305(a)	Airplane level systems requirements; Function and installation.
(b)		23.1305(a)(3)	Function and installation.
(c)		23.1305(a)(2)	Function and installation.
23.1303	Flight and navigation instruments	23.1300, 23.1310, 23.1305(b) and (c), and 23.1330(c).	Airplane level systems requirements; Flight, navigation, and powerplant instruments; Function and installation; System power generation, storage, and distribution.
23.1305	Powerplant instruments	23.1300, 23.1310 and 23.1305(c).	Airplane level systems requirements; Flight, navigation, and powerplant instruments; Function and installation.
23.1306	Electrical and electronic system lightning protection.	23.1320	Electrical and electronic system lightning protection.
23.1307	Miscellaneous equipment	23.1300 and 23.1310	Airplane level systems requirements; Flight, navigation, and powerplant instruments.
23.1308	High-Intensity Radiated Fields (HIRF) protection.	23.1325	High-intensity Radiated Fields (HIRF) protection.
23.1309	Equipment, systems, and installations	23.1315	Equipment, systems, and installations.
(a)(1)		23.1300(a)	Airplane level systems requirements.
(a)(2)		23.1300(b)	Airplane level systems requirements.
(b)			—Deleted—.
(c)		23.1315(b)	Equipment, systems, and installations.
(b)		23.1305(c)	Function and installation.
23.1310	Power source capacity and distribution	23.1330	System power generation, storage, and distribution.
23.1311	Electronic display instrument systems	23.1300 and 23.1310	Airplane level systems requirements; Flight, navigation, and powerplant instruments.
23.1321	Arrangement and visibility	23.1300 and 23.1310	Airplane level systems requirements; Flight, navigation, and powerplant instruments.
23.1322	Warning, caution, and advisory lights	23.1305(b) and (c)	Flight, navigation, and powerplant instruments.
23.1323	Airspeed indicating system	23.1300, 23.1305, 23.1310, and 1315.	Airplane level systems requirements; Function and installation; Flight, navigation, and powerplant instruments; and Equipment, systems, and installations.
(d)		23.1405	Flight in icing conditions.
23.1325	Static pressure system	23.1300, 23.1310, and 23.1315	Airplane level systems requirements; Flight, navigation, and powerplant instruments; and Equipment, systems, and installations.
(b)(3) and (g)		1405	Flight in icing conditions.
23.1326	Pitot heat indication systems	23.1305	Function and installation.
23.1327	Magnetic direction indicator	23.1300, 23.1305 and 23.1310	Airplane level systems requirements; Function and installation; Flight, navigation, and powerplant instruments.
23.1329	Automatic pilot system	23.1300, 23.1305 and 23.1315	Airplane level systems requirements; Function and installation; Equipment, systems, and installations.
(a)		23.1300 and 23.1315	Airplane level systems requirements; Equipment, systems, and installations.
(b)		23.700 and 23.1500	Flight control systems; Flightcrew interface.
(c)		23.1305	Function and installation.
(d)		23.700 and 23.1500	Flight control systems; Flightcrew interface.
(e), (f), (g)		23.1300 and 23.1315	Airplane level systems requirements; Equipment, systems, and installations.
(h)		23.1305	Function and installation.
23.1331	Instruments using a power source.		
(a)		23.1305(c)	Function and installation.
(b)		23.1315(b) and 23.1330(b)	Equipment, systems, and installations; System power generation, storage, and distribution.
(c)		23.1310(b)	Flight, navigation, and powerplant instruments.
23.1335	Flight director systems	23.1300, 23.1305, 23.1315, and 23.1500.	Airplane level systems; Function and installation; Equipment systems and installations; and Flightcrew interface.
23.1337	Powerplant instruments installation.		
(a)		23.800(g)	Fire protection outside designated fire zones.
		23.930	Fuel systems.
(b)		23.1305(c) and (d)	Function and installation.

Current section	Title	Proposed section	Proposed title
		23.1310(a)	Flight, navigation, and powerplant instruments.
		23.1315(b)	Equipment, systems, and installations.
(c)		23.1315(b)	Equipment, systems, and installations.
(d)		23.1305(c)	Function and installation.
		23.1310(a)	Flight, navigation, and powerplant instruments.
23.1351	Electrical Systems—General	23.1300	Airplane level systems requirements.
		23.1305	Function and installation.
		23.1315	Equipment, systems, and installations.
		23.1330	System power generation, storage, and distribution.
23.1353	Storage battery design and installation	23.1300	Airplane level systems requirements.
		23.1305	Function and installation.
		23.1315	Equipment, systems, and installations.
		23.1330	System power generation, storage, and distribution.
23.1357	Circuit protective devices	23.1300	Airplane level systems requirements.
		23.1305	Function and installation.
		23.1315	Equipment, systems, and installations.
		23.1330	System power generation, storage, and distribution.
23.1359	Electrical system fire protection.		
(a)		Means of Compliance.	
(b)		805	Flammability in designated fire zones.
(c)		800	Fire protection outside designated fire zones.
23.1361	Master switch arrangement	23.1300 and 23.1305	Airplane level systems requirements; Function and installation.
23.1365	Electrical cables and equipment	23.1305	Function and installation.
(b)		23.805	Flammability in designated fire zones.
(a), (c) thru (f)		Means of Compliance.	
23.1367	Switches.		
(a) and (b)		23.1305	Function and installation.
(c) and (d)		23.1500	Flightcrew interface.
23.1381	Instrument lights.		
(a) and (b)		23.1500	Flightcrew interface.
(c)		23.1335	External and cockpit lighting.
23.1383(a), (b), (c).	Taxi and landing lights	23.1335	External and cockpit lighting.
(d)	Taxi and landing lights	23.800	Fire protection outside designated fire zones.
23.1385(a), (b), (c).	Position light system installation	23.1335	External and cockpit lighting.
(d)	Position light system installation	23.800	Fire protection outside designated fire zones.
23.1387	Position light system dihedral angles	23.1335	External and cockpit lighting.
23.1389	Position light distribution and intensities	23.1335	External and cockpit lighting.
23.1391	Minimum intensities in the horizontal plane of position lights.	23.1335	External and cockpit lighting.
23.1393	Minimum intensities in any vertical plane of position lights.	23.1335	External and cockpit lighting.
23.1395	Maximum intensities in overlapping beams of position lights.	23.1335	External and cockpit lighting.
23.1397	Color specifications	23.1335	External and cockpit lighting.
23.1399	Riding light	23.1335	External and cockpit lighting.
23.1401	Anticollision light system.		
(a), (a)(1)		23.1335	External and cockpit lighting.
(a)(2)		Means of Compliance.	
(b) thru (f)		23.1335	External and cockpit lighting.
23.1411	Safety Equipment-General.		
(a), (b)(1)		23.1400	Safety equipment.
(b)(2)		23.600	Emergency conditions.
23.1415	Ditching equipment	23.1400	Safety equipment.
(a), (c), (d)		23.1400	Safety equipment.
(b)		Means of Compliance.	
23.1416	Pneumatic de-icer boot system	23.1300	Airplane level systems requirements.
		23.1305	Function and installation.
23.1419	Ice protection	23.230	Flight in icing conditions.
		23.1405	Performance and flight characteristics requirements for flight in icing conditions.
23.1431	Electronic equipment	23.1315	Equipment, systems and installations.
23.1435	Hydraulic systems.		
(a)(4) and (b)		23.1410	Pressurized system elements.

Current section	Title	Proposed section	Proposed title
(a), (a)(1) through (3), (c).		Means of Compliance.	
23.1437	Accessories for multiengine airplanes	23.1410	Pressurized system elements.
23.1438	Pressurization and pneumatic systems.		
(a), (b)		23.1410	Pressurized system elements.
(c)		Means of Compliance.	
		23.1410(e)	Pressurized system elements.
23.1441	Oxygen equipment and supply.		
(a)		Means of Compliance.	
(b)		23.1315	Equipment, systems and installation.
(c), (d), (e)		23.755	Occupant physical environment.
23.1443(a), (b), (c).	Minimum mass flow of supplemental oxygen.	23.755	Occupant physical environment.
(d)		Definition.	
23.1445	Oxygen distribution system	23.755	Occupant physical environment.
23.1447	Equipment standards for oxygen dispensing units.		
(a), (b), (c), (d), (f)		23.755	Occupant physical environment.
(e)		Means of Compliance.	
23.1449	Means for determining use of oxygen	23.755	Occupant physical environment.
23.1450	Chemical oxygen generators.		
(a)		Means of Compliance.	
(b)		23.1315	Equipment, systems and installation.
(c)		23.1505	Instrument markings, control markings, and placards.
23.1451	Fire protection for oxygen equipment	23.1315	Equipment, systems and installation.
23.1453	Protection of oxygen equipment from rupture.	23.1315	Equipment, systems and installation.
23.1457	Cockpit voice recorders	23.1457	No Change.
23.1459	Flight recorders.		
(a)(1)		23.1459	Flight data recorders.
(a)(2) thru (d)		23.1459	No Change.
23.1461	Equipment containing high energy rotors	23.755	Occupant physical environment.
Subpart G—Operating Limitations and Information			
23.1501	General	23.1505	Instrument markings, control markings, and placards.
23.1505	Airspeed limitations	23.1505	Instrument markings, control markings, and placards.
23.1507	Operating maneuvering speed	23.1505	Instrument markings, control markings, and placards.
23.1511	Flap extended speed	23.1505	Instrument markings, control markings, and placards.
23.1513	Minimum control speed	23.1505	Instrument markings, control markings, and placards.
23.1519	Weight and center of gravity	23.1505	Instrument markings, control markings, and placards.
23.1521	Powerplant limitations	23.1505	Instrument markings, control markings, and placards.
23.1522	Auxiliary power unit limitations	23.1505	Instrument markings, control markings, and placards.
23.1523	Minimum flight crew	23.1505	Instrument markings, control markings, and placards.
23.1524	Maximum passenger seating configuration	23.1505	Instrument markings, control markings, and placards.
23.1525	Kinds of operation	23.1300	Airplane level system requirements.
		23.1505	Instrument markings, control markings, and placards.
23.1527	Maximum operating altitude	23.1505	Instrument markings, control markings, and placards.
23.1529	Instructions for continued airworthiness	23.1515	Instructions for continued airworthiness.
23.1541	Marking and Placards—General	23.1505	Instrument markings, control markings, and placards.
23.1543	Instrument marking: general	23.1505	Instrument markings, control markings, and placards.
23.1545	Airspeed indicator	23.1505	Instrument markings, control markings, and placards.
23.1547	Magnetic direction indicator	23.1505	Instrument markings, control markings, and placards.
23.1549	Powerplant and auxiliary power unit instruments.	23.1505	Instrument markings, control markings, and placards.
23.1551	Oil quantity indicator	23.1505	Instrument markings, control markings, and placards.

Current section	Title	Proposed section	Proposed title
23.1553	Fuel quantity indicator	23.1505	Instrument markings, control markings, and placards.
23.1555	Control markings	23.1505	Instrument markings, control markings, and placards.
23.1557	Miscellaneous marking and placards	23.1505	Instrument markings, control markings, and placards.
23.1559	Operating limitations placard	23.1505	Instrument markings, control markings, and placards.
23.1561	Safety equipment	23.1505	Instrument markings, control markings, and placards.
23.1563	Airspeed placards	23.1505	Instrument markings, control markings, and placards.
23.1567	Flight maneuver placard	23.1505	Instrument markings, control markings, and placards.
23.1581	Airplane Flight Manual and Approved Manual Material—General.	23.1510	Airplane flight manual.
23.1583	Operating limitations	23.1510	Airplane flight manual.
23.1585	Operating procedures	23.1510	Airplane flight manual.
23.1587	Performance information	23.1510	Airplane flight manual.
23.1589	Loading information	23.1510	Airplane flight manual.
Appendix A	Simplified Design Load Criteria	Means of Compliance.	
Appendix B	[Reserved]		—Deleted—
Appendix C	Basic Landing Conditions	Means of Compliance.	
Appendix D	Wheel Spin-Up and Spring-Back Loads	Means of Compliance.	
Appendix E	[Reserved]		—Deleted—
Appendix F	Test Procedure	Means of Compliance.	
Appendix G	Instructions for Continued Airworthiness	Appendix A	Instructions for Continued Airworthiness.
Appendix H	Installation of An Automatic Power Reserve (APR) System.	Means of Compliance.	
Appendix I	Seaplane Loads	Means of Compliance.	
Appendix J	HIRF Environments and Equipment HIRF Test Levels.	Means of Compliance.	

Appendix 2 to the Preamble—Abbreviations and Acronyms Frequently Used in This Document

AD Airworthiness Directive
AFM Airplane Flight Manual
ARC Aviation Rulemaking Committee
ASTM ASTM International
CAA Civil Aviation Authority
CAR Civil Aviation Regulations
Cf Confer (to identify a source or a usage citation for a word or phrase)
CPS Certification Process Study
CS Certification Specification
CS–VLA Certification Specification—Very Light Aeroplanes
EASA European Aviation Safety Agency
ELOS Equivalent Level of Safety
FR Federal Register
GA General Aviation
HIRF High-Intensity Radiated Field
IFR Instrument Flight Rules
KCAS Knots Calibrated Airspeeds
LOC Loss of Control
NPRM Notice of Proposed Rulemaking
NTSB National Transportation Safety Board
OMB Office of Management and Budget
SAE SAE International
SLD Supercooled Large Droplet
TCDS Type Certificate Data Sheet
V_A Design Maneuvering Speed
V_C Design Cruising Speed
V_D Design Dive Speed
V_{MC} Minimum Control Speed
V_{MO}/M_{MO} Maximum Operating Limit Speed
VFR Visual Flight Rules
V_{SO} Stalling speed or the minimum steady flight speed in the landing configuration

List of Subjects

14 CFR Part 21

Aircraft, Aviation safety, Recording and recordkeeping requirements.

14 CFR Part 23

Aircraft, Aviation Safety, Signs and symbols.

14 CFR Part 35

Aircraft, Aviation safety.

14 CFR Part 43

Aircraft, Aviation safety, Reporting and recordkeeping requirements.

14 CFR Part 91

Air traffic control, Aircraft, Airmen, Airports, Aviation safety, Reporting and recordkeeping requirements.

14 CFR Part 121

Aircraft, Airmen, Aviation safety, Reporting and recordkeeping requirements.

14 CFR Part 135

Aircraft, Airmen, Aviation safety, Reporting and recordkeeping requirements.

The Proposed Amendment

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

PART 21—CERTIFICATION PROCEDURES FOR PRODUCTS AND ARTICLES

■ 1. The authority citation for part 21 is revised to read as follows:

Authority: 42 U.S.C. 7572; 49 U.S.C. 106(f), 106(g), 40105, 40113, 44701–44702, 44704, 44707, 44709, 44711, 44713, 44715, 45303.

■ 2. In § 21.9, revise paragraphs (a)(5), (a)(6), (b), and (c) introductory text, and add paragraph (a)(7) to read as follows:

§ 21.9 Replacement and modification articles.

(a) * * *

(5) Produced by an owner or operator for maintaining or altering that owner or operator's product;

(6) Fabricated by an appropriately rated certificate holder with a quality system, and consumed in the repair or alteration of a product or article in

accordance with part 43 of this chapter; or

(7) Produced in any other manner approved by the FAA.

(b) Except as provided in paragraphs (a)(1), (a)(2) and (a)(7) of this section, a person who produces a replacement or modification article for sale may not represent that part as suitable for installation on a type-certificated product.

(c) Except as provided in paragraphs (a)(1), (a)(2) and (a)(7) of this section, a person may not sell or represent an article as suitable for installation on an aircraft type-certificated under § 21.25(a)(2) or § 21.27 unless that article—

* * * * *

■ 3. In § 21.17, revise paragraph (a) introductory text to read as follows:

§ 21.17 Designation of applicable regulations.

(a) Except as provided in §§ 25.2, 27.2, 29.2, and in parts 26, 34, and 36 of this subchapter, an applicant for a type certificate must show that the aircraft, aircraft engine, or propeller concerned meets—

* * * * *

■ 4. In § 21.24, revise paragraph (a)(1)(i) to read as follows:

§ 21.24 Issuance of type certificate: primary category aircraft.

(a) * * *

(1) * * *

(i) Is unpowered; is an airplane powered by a single, naturally aspirated engine with a 61-knot or less V_{so} stall speed as defined in § 23.49 of this chapter, at amendment 23–62, effective on Jan 31, 2012; or is a rotorcraft with a 6-pound per square foot main rotor disc loading limitation, under sea level standard day conditions;

* * * * *

■ 5. In § 21.35, revise paragraph (b)(2) to read as follows:

§ 21.35 Flight tests.

* * * * *

(b) * * *

(2) For aircraft to be certificated under this subchapter, except gliders, and except for low-speed airplanes, as defined in part 23 of this chapter, of 6,000 pounds or less maximum weight that are to be certificated under part 23 of this chapter, to determine whether there is reasonable assurance that the aircraft, its components, and its equipment are reliable and function properly.

* * * * *

■ 6. In § 21.50, revise paragraph (b) to read as follows:

§ 21.50 Instructions for continued airworthiness and manufacturer's maintenance manuals having airworthiness limitations sections.

* * * * *

(b) The holder of a design approval, including either a type certificate or supplemental type certificate for an aircraft, aircraft engine, or propeller for which application was made after January 28, 1981, must furnish at least one set of complete Instructions for Continued Airworthiness to the owner of each type aircraft, aircraft engine, or propeller upon its delivery, or upon issuance of the first standard airworthiness certificate for the affected aircraft, whichever occurs later. The Instructions for Continued Airworthiness must be prepared in accordance with §§ 23.1515, 25.1529, 25.1729, 27.1529, 29.1529, 31.82, 33.4, 35.4, or part 26 of this subchapter, or as specified in the applicable airworthiness criteria for special classes of aircraft defined in § 21.17(b), as applicable. If the holder of a design approval chooses to designate parts as commercial, it must include in the Instructions for Continued Airworthiness a list of commercial parts submitted in accordance with the provisions of paragraph (c) of this section. Thereafter, the holder of a design approval must make those instructions available to any other person required by this chapter to comply with any of the terms of those instructions. In addition, changes to the Instructions for Continued Airworthiness shall be made available to any person required by this chapter to comply with any of those instructions.

* * * * *

■ 7. In § 21.101 revise paragraphs (b) introductory text, and (c) to read as follows:

§ 21.101 Designation of applicable regulations.

* * * * *

(b) Except as provided in paragraph (g) of this section, if paragraphs (b)(1), (2), or (3) of this section apply, an applicant may show that the change and areas affected by the change comply with an earlier amendment of a regulation required by paragraph (a) of this section, and of any other regulation the FAA finds is directly related. However, the earlier amended regulation may not precede either the corresponding regulation incorporated by reference in the type certificate, or any regulation in §§ 25.2, 27.2, or § 29.2 of this chapter that is related to the change. The applicant may show compliance with an earlier amendment of a regulation for any of the following:

* * * * *

(c) An applicant for a change to an aircraft (other than a rotorcraft) of 6,000 pounds or less maximum weight, to a non-turbine rotorcraft of 3,000 pounds or less maximum weight, to a simple, to a level 1 low speed, or to a level 2 low speed airplane may show that the change and areas affected by the change comply with the regulations incorporated by reference in the type certificate. However, if the FAA finds that the change is significant in an area, the FAA may designate compliance with an amendment to the regulation incorporated by reference in the type certificate that applies to the change and any regulation that the FAA finds is directly related, unless the FAA also finds that compliance with that amendment or regulation would not contribute materially to the level of safety of the product or would be impractical.

* * * * *

■ 8. Revise part 23 to read as follows:

PART 23—AIRWORTHINESS STANDARDS: NORMAL CATEGORY AIRPLANES

Authority: 49 U.S.C. 106(f), 106(g), 40113, 44701–44702, 44704, Pub. L. 113–53, 127 Stat. 584 (49 U.S.C. 44704) note.

Subpart A—General

§ 23.1 Applicability and definitions.

(a) This part prescribes airworthiness standards for the issuance of type certificates, and changes to those certificates, for airplanes in the normal category.

(b) For the purposes of this part, the following definitions apply:

(1) *Continued safe flight and landing* means an airplane is capable of continued controlled flight and landing, possibly using emergency procedures, without requiring exceptional pilot skill or strength. Upon landing, some airplane damage may occur as a result of a failure condition.

(2) *Designated fire zone* means a zone where catastrophic consequences from fire in that zone must be mitigated by containing the fire in that zone.

(3) *Empty weight* means the weight of the airplane with fixed ballast, unusable fuel, full operating fluids, and other fluids required for normal operation of airplane systems.

§ 23.5 Certification of normal category airplanes.

(a) Certification in the normal category applies to airplanes with a passenger-seating configuration of 19 or less and a maximum certificated takeoff weight of 19,000 pounds or less.

(b) Airplane certification levels are:

(1) Level 1—for airplanes with a maximum seating configuration of 0 to 1 passengers.

(2) Level 2—for airplanes with a maximum seating configuration of 2 to 6 passengers.

(3) Level 3—for airplanes with a maximum seating configuration of 7 to 9 passengers.

(4) Level 4—for airplanes with a maximum seating configuration of 10 to 19 passengers.

(c) Airplane performance levels are:

(1) Low speed—for airplanes with a V_C or $V_{MO} \leq 250$ Knots Calibrated Airspeed (KCAS) (and $M_{MO} \leq 0.6$).

(2) High speed—for airplanes with a V_C or $V_{MO} > 250$ KCAS (or $M_{MO} > 0.6$).

(d) Simple—Simple is defined as a level 1 airplane with a V_C or $V_{MO} \leq 250$ KCAS (and $M_{MO} \leq 0.6$), a $V_{SO} \leq 45$ KCAS and approved only for VFR operations.

(e) Airplanes not certified for aerobatics may be used to perform any maneuver incident to normal flying, including—

(1) Stalls (except whip stalls); and

(2) Lazy eights, chandelles, and steep turns, in which the angle of bank is not more than 60 degrees.

(f) Airplanes certified for aerobatics may be used to perform maneuvers without limitations, other than those limitations necessary to avoid damage or injury.

§ 23.10 Accepted means of compliance.

(a) An applicant must show the FAA how it will demonstrate compliance with this part using a means of compliance, which may include consensus standards, accepted by the Administrator.

(b) A person requesting acceptance of a means of compliance must provide the means of compliance to the FAA in a form and manner specified by the Administrator.

Subpart B—Flight

Performance

§ 23.100 Weight and center of gravity.

(a) The applicant must determine weights and centers of gravity that provide limits for the safe operation of the airplane.

(b) The applicant must show compliance with each requirement of this subpart at each combination of weight and center of gravity within the airplane's range of loading conditions using tolerances acceptable to the Administrator.

(c) The condition of the airplane at the time of determining its empty weight and center of gravity must be well defined and easily repeatable.

§ 23.105 Performance data.

(a) Unless otherwise prescribed, an airplane must meet the performance requirements of this subpart in—

(1) Still air and standard atmospheric conditions at sea level for all airplanes; and

(2) Ambient atmospheric conditions within the operating envelope for—

(i) Level 1 high-speed and level 2 high-speed airplanes; and

(ii) Levels 3 and 4 airplanes.

(b) Unless otherwise prescribed, the applicant must develop the performance data required by this subpart for the following conditions:

(1) Airport altitudes from sea level to 10,000 feet (3,048 meters); and

(2) Temperatures from standard to 30° Celsius above standard or the maximum ambient atmospheric temperature at which compliance with propulsion cooling requirements in climb is shown, if lower.

(c) The procedures used for determining takeoff and landing distances must be executable consistently by pilots of average skill in atmospheric conditions expected to be encountered in service.

(d) Performance data determined in accordance with paragraph (b) of this section must account for losses due to atmospheric conditions, cooling needs, and other demands on power sources.

§ 23.110 Stall speed.

The applicant must determine the airplane stall speed or the minimum steady flight speed for each flight configuration used in normal operations, including takeoff, climb, cruise, descent, approach, and landing. Each determination must account for the most adverse conditions for each flight configuration with power set at idle or zero thrust.

§ 23.115 Takeoff performance.

(a) The applicant must determine airplane takeoff performance accounting for—

(1) Stall speed safety margins;

(2) Minimum control speeds; and

(3) Climb gradients.

(b) For all airplanes, takeoff performance includes the determination of ground roll and initial climb distance to 50 feet (15 meters) above the takeoff surface.

(c) For levels 1, 2, and 3 high-speed multiengine airplanes, multiengine airplanes with a maximum takeoff weight greater than 12,500 pounds and level 4 multiengine airplanes, takeoff performance includes a determination the following distances after a sudden critical loss of thrust:

(1) Accelerate-stop;

(2) Ground roll and initial climb to 50 feet (15 meters) above the takeoff surface; and

(3) Net takeoff flight path.

§ 23.120 Climb requirements.

The applicant must demonstrate the following minimum climb performance out of ground effect:

(a) With all engines operating and in the initial climb configuration—

(1) For levels 1 and 2 low speed airplanes, a climb gradient at sea level of 8.3 percent for landplanes and 6.7 percent for seaplanes and amphibians; and

(2) For levels 1 and 2 high-speed airplanes and all level 3 airplanes, a climb gradient at takeoff of 4 percent.

(b) After a critical loss of thrust on multiengine airplanes—

(1) For levels 1and 2 low-speed airplanes that do not meet single engine crashworthiness requirements, a 1.5 percent climb gradient at a pressure altitude of 5,000 feet (1,524 meters) in the cruise configuration;

(2) For levels 1 and 2 high-speed airplanes, and level 3 low-speed airplanes, a 1 percent climb gradient at 400 feet (122 meters) above the takeoff surface with the landing gear retracted and flaps in the takeoff configuration;

(3) For level 3 high-speed airplanes and all level 4 airplanes, a 2 percent climb gradient at 400 feet (122 meters) above the takeoff surface with the landing gear retracted and flaps in the approach configuration;

(4) At sea level for level 1 and level 2 low-speed airplanes; and

(5) At the landing surface for all other airplanes.

(c) For a balked landing, a climb gradient of 3 percent with—

(1) Takeoff power on each engine;

(2) Landing gear extended; and

(3) Flaps in the landing configuration.

§ 23.125 Climb information.

(a) The applicant must determine climb performance—

(1) For all single engine airplanes;

(2) For level 3 multiengine airplanes, following a critical loss of thrust on takeoff in the initial climb configuration; and

(3) For all multiengine airplanes, during the enroute phase of flight with all engines operating and after a critical loss of thrust in the cruise configuration.

(b) For single engine airplanes, the applicant must determine the glide performance of the airplane after a complete loss of thrust.

§ 23.130 Landing.

The applicant must determine the following, for standard temperatures at each weight and altitude within the operational limits for landing:

(a) The distance, starting from a height of 50 feet (15 meters) above the landing surface, required to land and come to a stop, or for water operations, reach a speed of 3 knots.

(b) The approach and landing speeds, configurations, and procedures, which allow a pilot of average skill to meet the landing distance consistently and without causing damage or injury.

Flight Characteristics

§ 23.200 Controllability.

(a) The airplane must be controllable and maneuverable, without requiring exceptional piloting skill, alertness, or strength, within the operating envelope—

(1) At all loading conditions for which certification is requested;

(2) During low-speed operations, including stalls;

(3) With any probable flight control or propulsion system failure; and

(4) During configuration changes.

(b) The airplane must be able to complete a landing without causing damage or serious injury, in the landing configuration at a speed of V_{REF} minus 5 knots using the approach gradient equal to the steepest used in the landing distance determination.

(c) For levels 1 and 2 multiengine airplanes that cannot climb after a critical loss of thrust, V_{MC} must not exceed V_{S1} or V_{S0} for all practical weights and configurations within the operating envelope of the airplane.

(d) If the applicant requests certification of an airplane for aerobatics, the applicant must demonstrate those aerobatic maneuvers for which certification is requested and determine entry speeds.

§ 23.205 Trim.

(a) The airplane must maintain longitudinal, lateral, and directional trim under the following conditions:

(1) For levels 1, 2, and 3 airplanes, in cruise, without further force upon, or movement of, the primary flight controls or corresponding trim controls by the pilot, or the flight control system.

(2) For level 4 airplanes in normal operations, without further force upon, or movement of, the primary flight controls or corresponding trim controls by the pilot, or the flight control system.

(b) The airplane must maintain longitudinal trim under the following conditions:

(1) Climb.

(2) Level flight.

(3) Descent.

(4) Approach.

(c) Residual forces must not fatigue or distract the pilot during likely emergency operations, including a critical loss of thrust on multiengine airplanes.

§ 23.210 Stability.

(a) Airplanes not certified for aerobatics must—

(1) Have static longitudinal, lateral, and directional stability in normal operations;

(2) Have dynamic short period and combined lateral-directional stability in normal operations; and

(3) Provide stable control force feedback throughout the operating envelope.

(b) No airplane may exhibit any divergent longitudinal stability characteristic so unstable as to increase the pilot's workload or otherwise endanger the airplane and its occupants.

§ 23.215 Stall characteristics, stall warning, and spins.

(a) The airplane must have controllable stall characteristics in straight flight, turning flight, and accelerated turning flight with a clear and distinctive stall warning that provides sufficient margin to prevent inadvertent stalling.

(b) Levels 1 and 2 airplanes and level 3 single-engine airplanes, not certified for aerobatics, must not have a tendency to inadvertently depart controlled flight.

(c) Airplanes certified for aerobatics must have controllable stall characteristics and the ability to recover within one and one-half additional turns after initiation of the first control action from any point in a spin, not exceeding six turns or any greater number of turns for which certification is requested, while remaining within the operating limitations of the airplane.

(d) Spin characteristics in airplanes certified for aerobatics must not result in unrecoverable spins—

(1) With any use of the flight or engine power controls; or

(2) Due to pilot disorientation or incapacitation.

§ 23.220 Ground and water handling characteristics.

(a) For airplanes intended for operation on land or water, the airplane must have controllable longitudinal and directional handling characteristics during taxi, takeoff, and landing operations.

(b) For airplanes intended for operation on water, the following must be established and included in the Airplane Flight Manual (AFM):

(1) The maximum wave height at which the aircraft demonstrates compliance to paragraph (a) of this section. This wave height does not constitute an operating limitation.

(2) Any necessary water handling procedures.

§ 23.225 Vibration, buffeting, and high-speed characteristics.

(a) Vibration and buffeting, for operations up to V_D/M_D, must not interfere with the control of the airplane or cause fatigue to the flightcrew. Stall warning buffet within these limits is allowable.

(b) For high-speed airplanes and all airplanes with a maximum operating altitude greater than 25,000 feet (7,620 meters) pressure altitude, there must be no perceptible buffeting in cruise configuration at 1g and at any speed up to V_{MO}/M_{MO}, except stall buffeting.

(c) For high-speed airplanes, the applicant must determine the positive maneuvering load factors at which the onset of perceptible buffet occurs in the cruise configuration within the operational envelope. Likely inadvertent excursions beyond this boundary must not result in structural damage.

(d) High-speed airplanes must have recovery characteristics that do not result in structural damage or loss of control, beginning at any likely speed up to V_{MO}/M_{MO}, following—

(1) An inadvertent speed increase; and

(2) A high-speed trim upset.

§ 23.230 Performance and flight characteristics requirements for flight in icing conditions.

(a) If an applicant requests certification for flight in icing conditions as specified in part 1 of appendix C to part 25 of this chapter and any additional atmospheric icing conditions for which an applicant requests certification, the applicant must demonstrate the following:

(1) Compliance with each requirement of this subpart, except those applicable to spins and any that must be demonstrated at speeds in excess of—

(i) 250 knots CAS;

(ii) V_{MO} or M_{MO}; or

(iii) A speed at which the applicant demonstrates the airframe will be free of ice accretion.

(2) The stall warning for flight in icing conditions and non-icing conditions is the same.

(b) If an applicant requests certification for flight in icing conditions, the applicant must provide a means to detect any icing conditions for which certification is not requested and demonstrate the aircraft's ability to avoid or exit those conditions.

(c) The applicant must develop an operating limitation to prohibit intentional flight, including takeoff and landing, into icing conditions for which the airplane is not certified to operate.

Subpart C—Structures

§ 23.300 Structural design envelope.

The applicant must determine the structural design envelope, which describes the range and limits of airplane design and operational parameters for which the applicant will show compliance with the requirements of this subpart. The applicant must account for all airplane design and operational parameters that affect structural loads, strength, durability, and aeroelasticity, including:

(a) Structural design airspeeds and Mach numbers, including—

(1) The design maneuvering airspeed, V_A, which may be no less than the airspeed at which the airplane will stall at the maximum design maneuvering load factor;

(2) The design cruising airspeed, V_C or M_C, which may be no less than the maximum speed expected in normal operations;

(3) The design dive airspeed, V_D or M_D, which is the airspeed that will not be exceeded by inadvertent airspeed increases when operating at V_C or M_C;

(4) Any other design airspeed limitations required for the operation of high lift devices, landing gear, and other equipment or devices; and

(5) For level 4 airplanes, a rough air penetration speed, V_B.

(b) Design maneuvering load factors not less than those, which service history shows, may occur within the structural design envelope.

(c) Inertial properties including weight, center of gravity, and mass moments of inertia, accounting for—

(1) All weights from the airplane empty weight to the maximum weight; and

(2) The weight and distribution of occupants, payload, and fuel.

(d) Range of motion for control surfaces, high lift devices, or other moveable surfaces, including tolerances.

(e) All altitudes up to the maximum altitude.

§ 23.305 Interaction of systems and structures.

For airplanes equipped with systems that affect structural performance, either directly or as a result of failure or malfunction, the applicant must account for the influence and failure conditions of these systems when showing compliance with the requirements of this subpart.

Structural Loads

§ 23.310 Structural design loads.

The applicant must:

(a) Determine structural design loads resulting from any externally or internally applied pressure, force, or moment which may occur in flight, ground and water operations, ground and water handling, and while the airplane is parked or moored.

(b) Determine the loads required by paragraph (a) of this section at all critical combinations of parameters, on and within the boundaries of the structural design envelope.

(c) The magnitude and distribution of these loads must be based on physical principles and may be no less than service history shows will occur within the structural design envelope.

§ 23.315 Flight load conditions.

The applicant must determine the structural design loads resulting from the following flight conditions:

(a) Vertical and horizontal atmospheric gusts where the magnitude and gradient of these gusts are based on measured gust statistics.

(b) Symmetric and asymmetric maneuvers.

(c) For canted lifting surfaces, vertical and horizontal loads acting simultaneously resulting from gust and maneuver conditions.

(d) For multiengine airplanes, failure of the powerplant unit which results in the most severe structural loads.

§ 23.320 Ground and water load conditions.

The applicant must determine the structural design loads resulting from the following ground and water operations:

(a) For airplanes intended for operation on land—taxi, takeoff, landing, and ground handling conditions occurring in normal and adverse attitudes and configurations.

(b) For airplanes intended for operation on water—taxi, takeoff, landing, and water handling conditions occurring in normal and adverse attitudes and configurations in the most severe sea conditions expected in operation.

(c) Jacking and towing conditions.

§ 23.325 Component loading conditions.

The applicant must determine the structural design loads acting on:

(a) Each engine mount and its supporting structure resulting from engine operation combined with gusts and maneuvers.

(b) Each flight control and high lift surface, their associated system and supporting structure resulting from—

(1) The inertia of each surface and mass balance attachment;

(2) Gusts and maneuvers;

(3) Pilot or automated system inputs;

(4) System induced conditions, including jamming and friction; and

(5) Ground operations, including downwind taxi and ground gusts.

(c) A pressurized cabin resulting from the pressurization differential—

(1) From zero up to the maximum relief valve setting combined with gust and maneuver loads;

(2) From zero up to the maximum relief valve setting combined with ground and water loads if the airplane may land with the cabin pressurized; and

(3) At the maximum relief valve setting multiplied by 1.33, omitting all other loads.

§ 23.330 Limit and ultimate loads.

Unless special or other factors of safety are necessary to meet the requirements of this subpart, the applicant must determine—

(a) The limit loads, which are equal to the structural design loads; and

(b) The ultimate loads, which are equal to the limit loads multiplied by a 1.5 factor of safety.

Structural Performance

§ 23.400 Structural strength.

The applicant must demonstrate that the structure will support:

(a) Limit loads without—

(1) Interference with the operation of the airplane; and

(2) Detrimental permanent deformation.

(b) Ultimate loads.

§ 23.405 Structural durability.

(a) The applicant must develop and implement procedures to prevent structural failures due to foreseeable causes of strength degradation, which could result in serious or fatal injuries, loss of the airplane, or extended periods of operation with reduced safety margins. The Instructions for Continued Airworthiness must include procedures developed under this section.

(b) If a pressurized cabin has two or more compartments separated by bulkheads or a floor, the applicant must design the structure for a sudden release of pressure in any compartment that has a door or window, considering failure of the largest door or window opening in the compartment.

(c) For airplanes with maximum operating altitude greater than 41,000 feet, the procedures developed for compliance to paragraph (a) of this section must be capable of detecting damage to the pressurized cabin structure before the damage could result in rapid decompression that would result in serious or fatal injuries.

(d) The airplane must be capable of continued safe flight and landing with structural damage caused by high-energy fragments from an uncontained engine or rotating machinery failure.

§ 23.410 Aeroelasticity.

(a) The airplane must be free from flutter, control reversal, and divergence—

(1) At all speeds within and sufficiently beyond the structural design envelope;

(2) For any configuration and condition of operation;

(3) Accounting for critical degrees of freedom; and

(4) Accounting for any critical failures or malfunctions.

(b) The applicant must establish and account for tolerances for all quantities that affect flutter.

Design

§ 23.500 Structural design.

(a) The applicant must design each part, article, and assembly for the expected operating conditions of the airplane.

(b) Design data must adequately define the part, article, or assembly configuration, its design features, and any materials and processes used.

(c) The applicant must determine the suitability of each design detail and part having an important bearing on safety in operations.

(d) The control system must be free from jamming, excessive friction, and excessive deflection when—

(1) The control system and its supporting structure are subjected to loads corresponding to the limit airloads;

(2) The primary controls are subjected to the lesser of the limit airloads or limit pilot forces; and

(3) The secondary controls are subjected to loads not less than those corresponding to maximum pilot effort.

§ 23.505 Protection of structure.

(a) The applicant must protect each part of the airplane, including small parts such as fasteners, against deterioration or loss of strength due to any cause likely to occur in the expected operational environment.

(b) Each part of the airplane must have adequate provisions for ventilation and drainage.

(c) For each part that requires maintenance, preventive maintenance, or servicing, the applicant must incorporate a means into the aircraft design to allow such actions to be accomplished.

§ 23.510 Materials and processes.

(a) The applicant must determine the suitability and durability of materials used for parts, articles, and assemblies, the failure of which could prevent continued safe flight and landing. The applicant must account for the effects of likely environmental conditions expected in service.

(b) The methods and processes of fabrication and assembly used must produce consistently sound structures. If a fabrication process requires close control to reach this objective, the applicant must perform the process under an approved process specification.

(c) Except as provided in paragraphs (f) and (g) of this section, the applicant must select design values that ensure material strength with probabilities that account for the criticality of the structural element. Design values must account for the probability of structural failure due to material variability.

(d) If material strength properties are required, a determination of those properties must be based on sufficient tests of material meeting specifications to establish design values on a statistical basis.

(e) If thermal effects are significant on an essential component or structure under normal operating conditions, the applicant must determine those effects on allowable stresses used for design.

(f) Design values, greater than the minimums specified by this section, may be used, where only guaranteed minimum values are normally allowed, if a specimen of each individual item is tested before use to determine that the actual strength properties of that particular item will equal or exceed those used in the design.

(g) An applicant may use other material design values if approved by the Administrator.

§ 23.515 Special factors of safety.

(a) The applicant must determine a special factor of safety for any critical design value that is—

(1) Uncertain;

(2) Used for a part, article, or assembly that is likely to deteriorate in service before normal replacement; or

(3) Subject to appreciable variability because of uncertainties in manufacturing processes or inspection methods.

(b) The applicant must determine a special factor of safety using quality controls and specifications that account for each—

(1) Structural application;

(2) Inspection method;

(3) Structural test requirement;

(4) Sampling percentage; and

(5) Process and material control.

(c) The applicant must apply any special factor of safety in the design for each part of the structure by multiplying each limit load and ultimate load by the special factor of safety.

Structural Occupant Protection

§ 23.600 Emergency conditions.

(a) The airplane, even when damaged in an emergency landing, must protect each occupant against injury that would preclude egress when—

(1) Properly using safety equipment and features provided for in the design;

(2) The occupant experiences ultimate static inertia loads likely to occur in an emergency landing; and

(3) Items of mass, including engines or auxiliary power units (APUs), within or aft of the cabin, that could injure an occupant, experience ultimate static inertia loads likely to occur in an emergency landing.

(b) The emergency landing conditions specified in paragraph (a) of this section, must—

(1) Include dynamic conditions that are likely to occur with an impact at stall speed, accounting for variations in aircraft mass, flight path angle, flight pitch angle, yaw, and airplane configuration, including likely failure conditions at impact; and

(2) Not exceed established human injury criteria for human tolerance due to restraint or contact with objects in the airplane.

(c) The airplane must have seating and restraints for all occupants. The airplane seating, restraints, and cabin interior must account for likely flight and emergency landing conditions.

(d) Each occupant restraint system must consist of a seat, a method to restrain the occupant's pelvis and torso, and a single action restraint release. For all flight and ground loads during normal operation and any emergency landing conditions, the restraint system must perform its intended function and not create a hazard that could cause a secondary injury to an occupant. The restraint system must not prevent occupant egress or interfere with the operation of the airplane when not in use.

(e) Each baggage and cargo compartment must—

(1) Be designed for its maximum weight of contents and for the critical load distributions at the maximum load factors corresponding to the flight and ground load conditions determined under this part;

(2) Have a means to prevent the contents of the compartment from becoming a hazard by impacting occupants or shifting; and

(3) Protect any controls, wiring, lines, equipment, or accessories whose damage or failure would affect operations.

Subpart D—Design and Construction

§ 23.700 Flight control systems.

(a) The applicant must design airplane flight control systems to:

(1) Prevent major, hazardous, and catastrophic hazards, including—

(i) Failure;

(ii) Operational hazards;

(iii) Flutter;

(iv) Asymmetry; and

(v) Misconfiguration.

(2) Operate easily, smoothly, and positively enough to allow normal operation.

(b) The applicant must design trim systems to:

(1) Prevent inadvertent, incorrect, or abrupt trim operation.

(2) Provide a means to indicate—

(i) The direction of trim control movement relative to airplane motion;

(ii) The trim position with respect to the trim range;

(iii) The neutral position for lateral and directional trim; and

(iv) For all airplanes, except simple airplanes, the range for takeoff for all applicant requested center of gravity ranges and configurations.

(3) Except for simple airplanes, provide control for continued safe flight and landing when any one connecting or transmitting element in the primary flight control system fails.

(4) Limit the range of travel to allow safe flight and landing, if an adjustable stabilizer is used.

(c) For an airplane equipped with an artificial stall barrier system, the system must—

(1) Prevent uncommanded control or thrust action; and

(2) Provide for a preflight check.

(d) For level 3 high-speed and all level 4 airplanes, an applicant must install a takeoff warning system on the airplane unless the applicant demonstrates the airplane, for each configuration, can takeoff at the limits of the trim and flap ranges.

§ 23.705 Landing gear systems.

(a) For airplanes with retractable landing gear:

(1) The landing gear and retracting mechanism, including the wheel well doors, must be able to withstand operational and flight loads.

(2) The airplane must have—

(i) A positive means to keep the landing gear extended;

(ii) A secondary means of extension for landing gear that cannot be extended using the primary means;

(iii) A means to inform the pilot that each landing gear is secured in the extended and retracted positions; and

(iv) Except for airplanes intended for operation on water, a warning to the pilot if the thrust and configuration is selected for landing and the landing gear is not fully extended and locked.

(3) If the landing gear bay is used as the location for equipment other than the landing gear, that equipment must be designed and installed to avoid damage from tire burst and from items that may enter the landing gear bay.

(b) The design of each landing gear wheel, tire, and ski must account for critical loads, including those experienced during landing and rejected takeoff.

(c) A reliable means of stopping the airplane must provide kinetic energy absorption within the airplane's design specifications for landing.

(d) For levels 3 and 4 multiengine airplanes, the braking system must provide kinetic energy absorption within the airplane's design specifications for rejected takeoff.

§ 23.710 Buoyancy for seaplanes and amphibians.

Airplanes intended for operations on water, must—

(a) Provide buoyancy of 80 percent in excess of the buoyancy required to support the maximum weight of the airplane in fresh water; and

(b) Have sufficient watertight compartments so the airplane will stay afloat at rest in calm water without capsizing if any two compartments of any main float or hull are flooded.

Occupant System Design Protection

§ 23.750 Means of egress and emergency exits.

(a) The airplane cabin exit design must provide for evacuation of the airplane within 90 seconds in conditions likely to occur following an emergency landing. Likely conditions exclude ditching for all but levels 3 and 4 multiengine airplanes.

(b) Each exit must have a means to be opened from both inside and outside the airplane, when the internal locking mechanism is in the locked and unlocked position. The means of opening must be simple, obvious, and marked inside and outside the airplane.

(c) Airplane evacuation paths must protect occupants from serious injury from the propulsion system.

(d) Each exit must not be obstructed by a seat or seat back, unless the seat or seat back can be easily moved in one action to clear the exit.

(e) Airplanes certified for aerobatics must have a means to egress the airplane in flight.

(f) Doors, canopies, and exits must be protected from opening inadvertently in flight.

§ 23.755 Occupant physical environment.

(a) The applicant must design the airplane to—

(1) Allow clear communication between the flightcrew and passengers;

(2) Provide a clear, sufficiently undistorted external view to enable the flightcrew to perform any maneuvers within the operating limitations of the airplane;

(3) Protect the pilot from serious injury due to high energy rotating failures in systems and equipment; and

(4) Protect the occupants from serious injury due to damage to windshields, windows, and canopies.

(b) For level 4 airplanes, each windshield and its supporting structure directly in front of the pilot must—

(1) Withstand, without penetration, the impact equivalent to a two-pound bird when the velocity of the airplane is equal to the airplane's maximum approach flap speed; and

(2) Allow for continued safe flight and landing after the loss of vision through any one panel.

(c) The airplane must provide each occupant with air at a breathable pressure, free of hazardous concentrations of gases and vapors, during normal operations and likely failures.

(d) If an oxygen system is installed in the airplane, it must include—

(1) A means to allow the flightcrew to determine the quantity of oxygen available in each source of supply on the ground and in flight;

(2) A means to determine whether oxygen is being delivered; and

(3) A means to permit the flightcrew to turn on and shut off the oxygen supply at any high-pressure source in flight.

(e) If a pressurization system is installed in the airplane, it must include—

(1) A warning if an unsafe condition exists; and

(2) A pressurization system test.

Fire and High Energy Protection

§ 23.800 Fire protection outside designated fire zones.

Outside designated fire zones:

(a) The following materials must be self-extinguishing—

(1) Insulation on electrical wire and electrical cable;

(2) For levels 1, 2, and 3 airplanes, materials in the baggage and cargo compartments inaccessible in flight; and

(3) For level 4 airplanes, materials in the cockpit, cabin, baggage, and cargo compartments.

(b) The following materials must be flame resistant—

(1) For levels 1, 2 and 3 airplanes, materials in each compartment accessible in flight; and

(2) Any electrical cable installation that would overheat in the event of circuit overload or fault.

(c) Thermal acoustic materials, if installed, must not be a flame propagation hazard.

(d) Sources of heat that are capable of igniting adjacent objects must be shielded and insulated to prevent such ignition.

(e) For level 4 airplanes, each baggage and cargo compartment must—

(1) Be located where a fire would be visible to the pilots, or equipped with a fire detection system and warning system; and

(2) Be accessible for the manual extinguishing of a fire, have a built-in fire extinguishing system, or be constructed and sealed to contain any fire within the compartment.

(f) There must be a means to extinguish any fire in the cabin such that—

(1) The pilot, while seated, can easily access the fire extinguishing means; and

(2) For levels 3 and 4 airplanes, passengers have a fire extinguishing means available within the passenger compartment.

(g) Each area where flammable fluids or vapors might escape by leakage of a fluid system must—

(1) Be defined; and

(2) Have a means to make fluid and vapor ignition, and the resultant hazard, if ignition occurs, improbable.

(h) Combustion heater installations must be protected from uncontained fire.

§ 23.805 Fire protection in designated fire zones.

Inside designated fire zones:

(a) Flight controls, engine mounts, and other flight structures within or adjacent to those zones must be capable of withstanding the effects of a fire.

(b) Engines must remain attached to the airplane in the event of a fire or electrical arcing.

(c) Terminals, equipment, and electrical cables used during emergency procedures must be fire-resistant.

§ 23.810 Lightning protection of structure.

(a) For airplanes approved for instrument flight rules, no structural failure preventing continued safe flight and landing may occur from exposure to the direct effects of lightning.

(b) Airplanes approved only for visual flight rules must achieve lightning protection by following FAA accepted design practices.

Subpart E—Powerplant

§ 23.900 Powerplant installation.

(a) For the purpose of this subpart, the airplane powerplant installation must include each component necessary for propulsion, affects propulsion safety, or provides auxiliary power to the airplane.

(b) The applicant must construct and arrange each powerplant installation to account for likely hazards in operation and maintenance.

(c) Except for simple airplanes, each aircraft power unit must be type certificated.

§ 23.905 Propeller installation.

(a) Except for simple airplanes, each propeller must be type certificated.

(b) Each pusher propeller must be marked so that it is conspicuous under daylight conditions.

(c) Each propeller installation must account for vibration and fatigue.

§ 23.910 Powerplant installation hazard assessment.

The applicant must assess each powerplant separately and in relation to other airplane systems and installations to show that a failure of any powerplant system component or accessory will not—

(a) Prevent continued safe flight and landing;

(b) Cause serious injury that may be avoided; and

(c) Require immediate action by crewmembers for continued operation of any remaining powerplant system.

§ 23.915 Automatic power control systems.

A power or thrust augmentation system that automatically controls the power or thrust on the operating powerplant, must—

(a) Provide indication to the flightcrew when the system is operating;

(b) Provide a means for the pilot to deactivate the automatic function; and

(c) Prevent inadvertent deactivation.

§ 23.920 Reversing systems.

The airplane must be capable of continued safe flight and landing under any available reversing system setting.

§ 23.925 Powerplant operational characteristics.

(a) The powerplant must operate at any negative acceleration that may occur during normal and emergency operation, within the airplane operating limitations.

(b) The pilot must have the capability to stop and restart the powerplant in flight.

(c) The airplane must have an independent power source for restarting each powerplant following an in-flight shutdown.

§ 23.930 Fuel system

(a) Each fuel system must—

(1) Provide an independent fuel supply to each powerplant in at least one configuration;

(2) Avoid ignition from unplanned sources;

(3) Provide the fuel required to achieve maximum power or thrust plus a margin for likely variables, in all temperature and altitude conditions within the airplane operating envelope;

(4) Provide a means to remove the fuel from the airplane;

(5) Be capable of retaining fuel when subject to inertia loads under expected operating conditions; and

(6) Prevent hazardous contamination of the fuel supply.

(b) Each fuel storage system must—

(1) Withstand the loads and pressures under expected operating conditions;

(2) Provide a means to prevent loss of fuel during any maneuver under operating conditions for which certification is requested;

(3) Prevent discharge when transferring fuel;

(4) Provide fuel for at least one-half hour of operation at maximum continuous power or thrust; and

(5) Be capable of jettisoning fuel if required for landing.

(c) If a pressure refueling system is installed, it must have a means to—

(1) Prevent the escape of hazardous quantities of fuel;

(2) Automatically shut-off before exceeding the maximum fuel quantity of the airplane; and

(3) Provide an indication of a failure at the fueling station.

§ 23.935 Powerplant induction and exhaust systems.

The air induction system for each power unit and its accessories must—

(a) Supply the air required by that power unit and its accessories under expected operating conditions; and

(b) Provide a means to discharge potential harmful material.

§ 23.940 Powerplant ice protection.

(a) The airplane design must prevent foreseeable accumulation of ice or snow that adversely affects powerplant operation.

(b) The powerplant design must prevent any accumulation of ice or snow that adversely affects powerplant operation, in those icing conditions for which certification is requested.

§ 23.1000 Powerplant fire protection.

(a) A powerplant may only be installed in a designated fire zone.

(b) Each component, line, and fitting carrying flammable fluids, gases, or air subject to fire conditions must be fire resistant, except components storing concentrated flammable material must be fireproof or enclosed by a fireproof shield.

(c) The applicant must provide a means to shut off fuel or flammable material for each powerplant that must—

(1) Not restrict fuel to remaining units; and

(2) Prevent inadvertent operation.

(d) For levels 3 and 4 airplanes with a powerplant located outside the pilot's view that uses combustible fuel, the applicant must install a fire extinguishing system.

(e) For levels 3 and 4 airplanes, the applicant must install a fire detection system in each designated fire zone.

(f) Each fire detection system must provide a means to alert the flightcrew in the event of a detection of fire or failure of the system.

(g) There must be a means to check the fire detection system in flight.

Subpart F—Equipment

§ 23.1300 Airplane level systems requirements.

(a) The equipment and systems required for an airplane to operate safely in the kinds of operations for which certification is requested (Day VFR, Night VFR, IFR) must be designed and installed to—

(1) Meet the level of safety applicable to the certification and performance level of the airplane; and

(2) Perform their intended function throughout the operating and environmental limits specified by the applicant.

(b) Non-required airplane equipment and systems, considered separately and in relation to other systems, must be designed and installed so their operation or failure does not have an adverse effect on the airplane or its occupants.

§ 23.1305 Function and installation.

(a) Each item of installed equipment must—

(1) Perform its intended function;

(2) Be installed according to limitations specified for that equipment; and

(3) Be labeled, if applicable, as to its identification, function or operating limitations, or any combination of these factors.

(b) There must be a discernable means of providing system operating parameters required to operate the airplane, including warnings, cautions, and normal indications to the responsible crewmember.

(c) Information concerning an unsafe system operating condition must be provided in a timely manner to the crewmember responsible for taking corrective action. Presentation of this information must be clear enough to avoid likely crewmember errors.

§ 23.1310 Flight, navigation, and powerplant instruments.

(a) Installed systems must provide the flightcrew member who sets or monitors flight parameters for the flight, navigation, and powerplant the information necessary to do so during each phase of flight. This information must include—

(1) Parameters and trends, as needed for normal, abnormal, and emergency operation; and

(2) Limitations, unless the applicant shows each limitation will not be exceeded in all intended operations.

(b) Indication systems that integrate the display of flight or powerplant parameters to operate the airplane or are required by the operating rules of this chapter must—

(1) Not inhibit the primary display of flight or powerplant parameters needed by any flightcrew member in any normal mode of operation; and

(2) In combination with other systems, be designed and installed so information essential for continued safe flight and landing will be available to the flightcrew in a timely manner after any single failure or probable combination of failures.

§ 23.1315 Equipment, systems, and installations.

For any airplane system or equipment whose failure or abnormal operation has not been specifically addressed by another requirement in this part, the applicant must:

(a) Examine the design and installation of airplane systems and equipment, separately and in relation to other airplane systems and equipment to determine—

(1) If a failure would prevent continued safe flight and landing; and

(2) If any other failure would significantly reduce the capability of the airplane or the ability of the flightcrew to cope with adverse operating conditions.

(b) Design and install each system and equipment, examined separately and in relation to other airplane systems and equipment, such that—

(1) Each catastrophic failure condition is extremely improbable;

(2) Each hazardous failure condition is extremely remote; and

(3) Each major failure condition is remote.

§ 23.1320 Electrical and electronic system lightning protection.

For an airplane approved for IFR operations:

(a) Each electrical or electronic system that performs a function, the failure of which would prevent the continued safe flight and landing of the airplane, must be designed and installed such that—

(1) The airplane system level function continues to perform during and after the time the airplane is exposed to lightning; and

(2) The system automatically recovers normal operation of that function in a timely manner after the airplane is exposed to lightning unless the system's recovery conflicts with other operational or functional requirements of the system.

(b) Each electrical and electronic system that performs a function, the failure of which would reduce the capability of the airplane or the ability of the flightcrew to respond to an adverse operating condition, must be designed and installed such that the function recovers normal operation in a timely manner after the airplane is exposed to lightning.

§ 23.1325 High-intensity Radiated Fields (HIRF) protection.

(a) Electrical and electronic systems that perform a function, the failure of which would prevent the continued safe flight and landing of the airplane, must be designed and installed such that—

(1) The airplane system level function is not adversely affected during and after the time the airplane is exposed to the HIRF environment; and

(2) The system automatically recovers normal operation of that function in a timely manner after the airplane is exposed to the HIRF environment, unless the system's recovery conflicts with other operational or functional requirements of the system.

(b) For airplanes approved for IFR operations, the applicant must design and install each electrical and electronic system that performs a function, the failure of which would reduce the capability of the airplane or the ability of the flightcrew to respond to an adverse operating condition, so the function recovers normal operation in a timely manner after the airplane is exposed to the HIRF environment.

§ 23.1330 System power generation, storage, and distribution.

The power generation, storage, and distribution for any system must be designed and installed to—

(a) Supply the power required for operation of connected loads during all likely operating conditions;

(b) Ensure no single failure or malfunction will prevent the system from supplying the essential loads required for continued safe flight and landing; and

(c) Have enough capacity, if the primary source fails, to supply essential loads, including non-continuous essential loads for the time needed to complete the function, for—

(1) At least 30 minutes for airplanes certificated with a maximum altitude of 25,000 feet (7,620 meters) or less; and

(2) At least 60 minutes for airplanes certificated with a maximum altitude over 25,000 feet (7,620 meters).

§ 23.1335 External and cockpit lighting.

(a) The applicant must design and install all lights to prevent adverse effects on the performance of flightcrew duties.

(b) Any position and anti-collision lights, if required by part 91 of this chapter, must have the intensities, flash rate, colors, fields of coverage, and other characteristics to provide sufficient time for another aircraft to avoid a collision.

(c) Any position lights, if required by part 91 of this chapter, must include a red light on the left side of the airplane, a green light on the right side of the airplane, spaced laterally as far apart as space allows, and a white light facing aft, located on an aft portion of the airplane or on the wing tips.

(d) The applicant must design and install taxi and landing lights so they provide sufficient light for night operations.

(e) For seaplanes or amphibian airplanes, riding lights must provide a white light visible in clear atmospheric conditions.

§ 23.1400 Safety equipment.

Safety and survival equipment, required by the operating rules of this chapter, must be reliable, readily accessible, easily identifiable, and clearly marked to identify its method of operation.

§ 23.1405 Flight in icing conditions.

(a) If an applicant requests certification for flight in icing conditions, the applicant must demonstrate that—

(1) The ice protection system provides for safe operation; and

(2) The airplane is protected from stalling when the autopilot is operating in a vertical mode.

(b) The demonstration specified in paragraph (a) of this section, must be conducted in atmospheric icing conditions specified in part 1 of appendix C to part 25 of this chapter, and any additional icing conditions for which certification is requested.

§ 23.1410 Pressurized systems elements.

(a) The minimum burst pressure of hydraulic systems must be at least 2.5 times the design operating pressure. The proof pressure must be at least 1.5 times the maximum operating pressure.

(b) On multiengine airplanes, engine driven accessories essential to safe operation must be distributed among multiple engines.

(c) The minimum burst pressure of cabin pressurization system elements must be at least 2.0 times, and proof pressure must be at least 1.5 times, the maximum normal operating pressure.

(d) The minimum burst pressure of pneumatic system elements must be at least 3.0 times, and proof pressure must be at least 1.5 times, the maximum normal operating pressure.

(e) Other pressurized system elements must have pressure margins that take into account system design and operating conditions.

§ 23.1457 Cockpit voice recorders.

(a) Each cockpit voice recorder required by the operating rules of this chapter must be approved and must be installed so that it will record the following:

(1) Voice communications transmitted from or received in the airplane by radio.

(2) Voice communications of flightcrew members on the flight deck.

(3) Voice communications of flightcrew members on the flight deck, using the airplane's interphone system.

(4) Voice or audio signals identifying navigation or approach aids introduced into a headset or speaker.

(5) Voice communications of flightcrew members using the passenger loudspeaker system, if there is such a system and if the fourth channel is available in accordance with the requirements of paragraph (c)(4)(ii) of this section.

(6) If datalink communication equipment is installed, all datalink communications, using an approved data message set. Datalink messages must be recorded as the output signal from the communications unit that translates the signal into usable data.

(b) The recording requirements of paragraph (a)(2) of this section must be met by installing a cockpit-mounted area microphone, located in the best position for recording voice communications originating at the first and second pilot stations and voice communications of other crewmembers on the flight deck when directed to those stations. The microphone must be so located and, if necessary, the preamplifiers and filters of the recorder must be so adjusted or supplemented, so that the intelligibility of the recorded communications is as high as practicable when recorded under flight cockpit noise conditions and played back. Repeated aural or visual playback of the record may be used in evaluating intelligibility.

(c) Each cockpit voice recorder must be installed so that the part of the communication or audio signals specified in paragraph (a) of this section obtained from each of the following sources is recorded on a separate channel:

(1) For the first channel, from each boom, mask, or handheld microphone, headset, or speaker used at the first pilot station.

(2) For the second channel from each boom, mask, or handheld microphone, headset, or speaker used at the second pilot station.

(3) For the third channel—from the cockpit-mounted area microphone.

(4) For the fourth channel from:

(i) Each boom, mask, or handheld microphone, headset, or speaker used at the station for the third and fourth crewmembers.

(ii) If the stations specified in paragraph (c)(4)(i) of this section are not required or if the signal at such a station is picked up by another channel, each microphone on the flight deck that is used with the passenger loudspeaker system, if its signals are not picked up by another channel.

(5) And that as far as is practicable all sounds received by the microphone listed in paragraphs (c)(1), (2), and (4) of this section must be recorded without interruption irrespective of the position of the interphone-transmitter key switch. The design shall ensure that sidetone for the flightcrew is produced only when the interphone, public address system, or radio transmitters are in use.

(d) Each cockpit voice recorder must be installed so that:

(1) (i) It receives its electrical power from the bus that provides the maximum reliability for operation of the cockpit voice recorder without jeopardizing service to essential or emergency loads.

(ii) It remains powered for as long as possible without jeopardizing emergency operation of the airplane.

(2) There is an automatic means to simultaneously stop the recorder and prevent each erasure feature from functioning, within 10 minutes after crash impact.

(3) There is an aural or visual means for preflight checking of the recorder for proper operation.

(4) Any single electrical failure external to the recorder does not disable both the cockpit voice recorder and the flight data recorder.

(5) It has an independent power source—

(i) That provides 10±1 minutes of electrical power to operate both the cockpit voice recorder and cockpit-mounted area microphone;

(ii) That is located as close as practicable to the cockpit voice recorder; and

(iii) To which the cockpit voice recorder and cockpit-mounted area microphone are switched automatically in the event that all other power to the cockpit voice recorder is interrupted either by normal shutdown or by any other loss of power to the electrical power bus.

(6) It is in a separate container from the flight data recorder when both are required. If used to comply with only the cockpit voice recorder requirements, a combination unit may be installed.

(e) The recorder container must be located and mounted to minimize the probability of rupture of the container as a result of crash impact and consequent heat damage to the recorder from fire.

(1) Except as provided in paragraph (e)(2) of this section, the recorder container must be located as far aft as practicable, but need not be outside of the pressurized compartment, and may not be located where aft-mounted engines may crush the container during impact.

(2) If two separate combination digital flight data recorder and cockpit voice recorder units are installed instead of one cockpit voice recorder and one digital flight data recorder, the combination unit that is installed to comply with the cockpit voice recorder requirements may be located near the cockpit.

(f) If the cockpit voice recorder has a bulk erasure device, the installation must be designed to minimize the probability of inadvertent operation and actuation of the device during crash impact.

(g) Each recorder container must—

(1) Be either bright orange or bright yellow;

(2) Have reflective tape affixed to its external surface to facilitate its location under water; and

(3) Have an underwater locating device, when required by the operating rules of this chapter, on or adjacent to the container, which is secured in such manner that they are not likely to be separated during crash impact.

§ 23.1459 Flight data recorders.

(a) Each flight recorder required by the operating rules of this chapter must be installed so that—

(1) It is supplied with airspeed, altitude, and directional data obtained from sources that meet the aircraft level system requirements of § 23.1300 and the functionality specified in § 23.1305;

(2) The vertical acceleration sensor is rigidly attached, and located longitudinally either within the approved center of gravity limits of the airplane, or at a distance forward or aft of these limits that does not exceed 25 percent of the airplane's mean aerodynamic chord;

(3)(i) It receives its electrical power from the bus that provides the maximum reliability for operation of the flight data recorder without jeopardizing service to essential or emergency loads;

(ii) It remains powered for as long as possible without jeopardizing emergency operation of the airplane;

(4) There is an aural or visual means for preflight checking of the recorder for proper recording of data in the storage medium;

(5) Except for recorders powered solely by the engine-driven electrical generator system, there is an automatic means to simultaneously stop a recorder that has a data erasure feature and prevent each erasure feature from functioning, within 10 minutes after crash impact;

(6) Any single electrical failure external to the recorder does not disable both the cockpit voice recorder and the flight data recorder; and

(7) It is in a separate container from the cockpit voice recorder when both are required. If used to comply with only the flight data recorder requirements, a combination unit may be installed. If a combination unit is installed as a cockpit voice recorder to comply with § 23.1457(e)(2), a combination unit must be used to comply with this flight data recorder requirement.

(b) Each non-ejectable record container must be located and mounted so as to minimize the probability of container rupture resulting from crash impact and subsequent damage to the record from fire. In meeting this requirement, the record container must be located as far aft as practicable, but need not be aft of the pressurized compartment, and may not be where aft-mounted engines may crush the container upon impact.

(c) A correlation must be established between the flight recorder readings of airspeed, altitude, and heading and the corresponding readings (taking into account correction factors) of the first pilot's instruments. The correlation must cover the airspeed range over which the airplane is to be operated, the range of altitude to which the airplane is limited, and 360 degrees of heading. Correlation may be established on the ground as appropriate.

(d) Each recorder container must—

(1) Be either bright orange or bright yellow;

(2) Have reflective tape affixed to its external surface to facilitate its location under water; and

(3) Have an underwater locating device, when required by the operating rules of this chapter, on or adjacent to the container, which is secured in such a manner that they are not likely to be separated during crash impact.

(e) Any novel or unique design or operational characteristics of the aircraft shall be evaluated to determine if any dedicated parameters must be recorded on flight recorders in addition to or in place of existing requirements.

Subpart G—Flightcrew Interface and Other Information

§ 23.1500 Flightcrew interface.

(a) The pilot compartment and its equipment must allow each pilot to perform his or her duties, including taxi, takeoff, climb, cruise, descent, approach, landing, and perform any maneuvers within the operating envelope of the airplane, without excessive concentration, skill, alertness, or fatigue.

(b) The applicant must install flight, navigation, surveillance, and powerplant controls and displays so qualified flightcrew can monitor and perform all tasks associated with the intended functions of systems and equipment. The system and equipment design must make the possibility that a flightcrew error could result in a catastrophic event highly unlikely.

§ 23.1505 Instrument markings, control markings, and placards.

(a) Each airplane must display in a conspicuous manner any placard and instrument marking necessary for operation.

(b) The applicant must clearly mark each cockpit control, other than primary flight controls, as to its function and method of operation.

(c) The applicant must include instrument marking and placard information in the Airplane Flight Manual.

§ 23.1510 Airplane flight manual.

The applicant must provide an Airplane Flight Manual that must be delivered with each airplane that contains the following information—

(a) Operating limitations and procedures;

(b) Performance information;

(c) Loading information; and

(d) Any other information necessary for the operation of the airplane.

§ 23.1515 Instructions for continued airworthiness.

The applicant must prepare Instructions for Continued Airworthiness, in accordance with appendix A of this part, that are acceptable to the Administrator prior to the delivery of the first airplane or issuance of a standard certification of airworthiness, whichever occurs later.

Appendix A to Part 23—Instructions for Continued Airworthiness

A23.1 *General*

(a) This appendix specifies requirements for the preparation of Instructions for Continued Airworthiness as required by this part.

(b) The Instructions for Continued Airworthiness for each airplane must include the Instructions for Continued Airworthiness for each engine and propeller (hereinafter designated ''products''), for each appliance required by this chapter, and any required information relating to the interface of those appliances and products with the airplane. If Instructions for Continued Airworthiness are not supplied by the manufacturer of an appliance or product installed in the airplane, the Instructions for Continued Airworthiness for the airplane must include the information essential to the continued airworthiness of the airplane.

(c) The applicant must submit to the FAA a program to show how changes to the Instructions for Continued Airworthiness made by the applicant or by the manufacturers of products and appliances installed in the airplane will be distributed.

A23.2 Format

(a) The Instructions for Continued Airworthiness must be in the form of a manual or manuals as appropriate for the quantity of data to be provided.

(b) The format of the manual or manuals must provide for a practical arrangement.

A23.3 Content

The contents of the manual or manuals must be prepared in the English language. The Instructions for Continued Airworthiness must contain the following manuals or sections and information:

(a) Airplane maintenance manual or section.

(1) Introduction information that includes an explanation of the airplane's features and data to the extent necessary for maintenance or preventive maintenance.

(2) A description of the airplane and its systems and installations including its engines, propellers, and appliances.

(3) Basic control and operation information describing how the airplane components and systems are controlled and how they operate, including any special procedures and limitations that apply.

(4) Servicing information that covers details regarding servicing points, capacities of tanks, reservoirs, types of fluids to be used, pressures applicable

to the various systems, location of access panels for inspection and servicing, locations of lubrication points, lubricants to be used, equipment required for servicing, tow instructions and limitations, mooring, jacking, and leveling information.

(b) Maintenance Instructions

(1) Scheduling information for each part of the airplane and its engines, auxiliary power units, propellers, accessories, instruments, and equipment that provides the recommended periods at which they should be cleaned, inspected, adjusted, tested, and lubricated, and the degree of inspection, the applicable wear tolerances, and work recommended at these periods. However, the applicant may refer to an accessory, instrument, or equipment manufacturer as the source of this information if the applicant shows that the item has an exceptionally high degree of complexity requiring specialized maintenance techniques, test equipment, or expertise. The recommended overhaul periods and necessary cross reference to the Airworthiness Limitations section of the manual must also be included. In addition, the applicant must include an inspection program that includes the frequency and extent of the inspections necessary to provide for the continued airworthiness of the airplane.

(2) Troubleshooting information describing probable malfunctions, how to recognize those malfunctions, and the remedial action for those malfunctions.

(3) Information describing the order and method of removing and replacing products and parts with any necessary precautions to be taken.

(4) Other general procedural instructions including procedures for system testing during ground running, symmetry checks, weighing and determining the center of gravity, lifting and shoring, and storage limitations.

(c) Diagrams of structural access plates and information needed to gain access for inspections when access plates are not provided.

(d) Details for the application of special inspection techniques including radiographic and ultrasonic testing where such processes are specified by the applicant.

(e) Information needed to apply protective treatments to the structure after inspection.

(f) All data relative to structural fasteners such as identification, discard recommendations, and torque values.

(g) A list of special tools needed.

(h) In addition, for level 4 airplanes, the following information must be furnished—

(1) Electrical loads applicable to the various systems;

(2) Methods of balancing control surfaces;

(3) Identification of primary and secondary structures; and

(4) Special repair methods applicable to the airplane.

A23.4 Airworthiness limitations section

The Instructions for Continued Airworthiness must contain a section titled Airworthiness Limitations that is segregated and clearly distinguishable from the rest of the document. This section must set forth each mandatory replacement time, structural inspection interval, and related structural inspection procedure required for type certification. If the Instructions for Continued Airworthiness consist of multiple documents, the section required by this paragraph must be included in the principal manual. This section must contain a legible statement in a prominent location that reads ‘‘The Airworthiness Limitations section is FAA approved and specifies maintenance required under §§ 43.16 and 91.403 of Title 14 of the Code of Federal Regulations unless an alternative program has been FAA approved.’’

PART 35—AIRWORTHINESS STANDARDS: PROPELLERS

■ 9. The authority citation for part 35 is revised to read as follows:

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

■ 10. In § 35.1, revise paragraph (c) to read as follows:

§ 35.1 Applicability.

* * * * *

(c) An applicant is eligible for a propeller type certificate and changes to those certificates after demonstrating compliance with subparts A, B, and C of this part. However, the propeller may not be installed on an airplane unless the applicant has shown compliance with either § 23.905(c) or § 25.907 of this chapter, as applicable, or compliance is not required for installation on that airplane.

* * * * *

■ 11. In § 35.37, revise paragraph (c)(1) to read as follows:

§ 35.37 Fatigue limits and evaluation.

* * * * *

(c) * * *

(1) The intended airplane by complying with § 23.905(c) or § 25.907 of this chapter, as applicable; or

* * * * *

PART 43—MAINTENANCE, PREVENTIVE MAINTENANCE, REBUILDING, AND ALTERATION

■ 12. The authority citation for part 43 is revised to read as follows:

Authority: 42 U.S.C. 7572; 49 U.S.C. 106(f), 106(g), 40105, 40113, 44701–44702, 44704, 44707, 44709, 44711, 44713, 44715, 45303.

■ 13. In part 43, appendix E, revise the introductory text and paragraph (a)(2) to read as follows:

Appendix E to Part 43—Altimeter System Test and Inspection

Each person performing the altimeter system tests and inspections required by § 91.411 must comply with the following:

(a) * * *

(2) Perform a proof test to demonstrate the integrity of the static pressure system in a manner acceptable to the Administrator. For airplanes certificated under part 25 of this chapter, determine that leakage is within the tolerances established by § 25.1325.

* * * * *

PART 91—GENERAL OPERATING AND FLIGHT RULES

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

Authority: 49 U.S.C. 106(f), 106(g), 1155, 40101, 40103, 40105, 40113, 40120, 44101, 44111, 44701, 44704, 44709, 44711, 44712, 44715, 44716, 44717, 44722, 46306, 46315, 46316, 46504, 46506–46507, 47122, 47508, 47528–47531, 47534, articles 12 and 29 of the Convention on International Civil Aviation (61 Stat. 1180), (126 Stat. 11).

■ 15. In § 91.205, revise paragraphs (b)(13) and (b)(14), and remove paragraph (b)(16) to read as follows:

§ 91.205 Powered civil aircraft with standard category U.S. airworthiness certificates: Instrument and equipment requirements.

* * * * *

(b) * * *

(13) An approved safety belt with an approved metal-to-metal latching device, or other approved restraint system for each occupant 2 years of age or older.

(14) For small civil airplanes manufactured after July 18, 1978, an approved shoulder harness or restraint system for each front seat. For small civil airplanes manufactured after December 12, 1986, an approved shoulder harness or restraint system for all seats. Shoulder harnesses installed at flightcrew stations must permit the flightcrew member, when seated and with the safety belt and shoulder harness fastened, to perform all

functions necessary for flight operations. For purposes of this paragraph—

(i) The date of manufacture of an airplane is the date the inspection acceptance records reflect that the airplane is complete and meets the FAA-approved type design data; and

(ii) A front seat is a seat located at a flightcrew member station or any seat located alongside such a seat.

* * * * *

■ 16. In § 91.313, revise paragraph (g) introductory text to read as follows:

§ 91.313 Restricted category civil aircraft: Operating limitations.

* * * * *

(g) No person may operate a small restricted-category civil airplane manufactured after July 18, 1978, unless an approved shoulder harness or restraint system is installed for each front seat. The shoulder harness or restraint system installation at each flightcrew station must permit the flightcrew member, when seated and with the safety belt and shoulder harness fastened or the restraint system engaged, to perform all functions necessary for flight operation. For purposes of this paragraph—

* * * * *

■ 17. In § 91.323, revise paragraph (b)(3) to read as follows:

§ 91.323 Increased maximum certificated weights for certain airplanes operated in Alaska.

* * * * *

(b) * * *

(3) The weight at which the airplane meets the positive maneuvering load factor *n, where* $n = 2.1 + (24{,}000/(W + 10{,}000))$ and W = design maximum takeoff weight, except that *n* need not be more than 3.8; or

* * * * *

■ 18. In § 91.531, revise paragraphs (a)(1) and (a)(3) to read as follows:

§ 91.531 Second in command requirements.

(a) * * *

(1) A large airplane or normal category level 4 airplane, except that a person may operate an airplane certificated under SFAR 41 without a pilot who is designated as second in command if that airplane is certificated for operation with one pilot.

* * *

(3) A commuter category airplane or normal category level 3 airplane, except that a person may operate those airplanes notwithstanding paragraph (a)(1) of this section, that have a passenger seating configuration, excluding pilot seats, of nine or less without a pilot who is designated as second in command if that airplane is type certificated for operations with one pilot.

* * * * *

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

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

Authority: 49 U.S.C. 106(f), 106(g), 40103, 40113, 40119, 41706, 42301 preceding note added by Pub. L. 112–95, Sec. 412, 126 Stat. 89, 44101, 44701–44702, 44705, 44709–44711, 44713, 44716–44717, 44722, 44729, 44732; 46105; Pub. L. 111–216, 124 Stat. 2348 (49 U.S.C. 44701 note); Pub. L. 112–95, 126 Stat. 62 (49 U.S.C. 44732 note).

■ 20. In § 121.310, revise paragraph (b)(2)(iii) to read as follows:

§ 121.310 Additional emergency equipment.

* * * * *

(b) * * *

(2) * * *

(iii) For a nontransport category turbopropeller powered airplane type certificated after December 31, 1964, each passenger emergency exit marking and each locating sign must be manufactured to meet the requirements of § 23.811(b) of this chapter in effect on June 16, 1994. On these airplanes, no sign may continue to be used if its luminescence (brightness) decreases to below 100 microlamberts.

* * * * *

PART 135—OPERATING REQUIREMENTS: COMMUTER AND ON DEMAND OPERATIONS AND RULES GOVERNING PERSONS ON BOARD SUCH AIRCRAFT

■ 21. The authority citation for part 135 continues to read as follows:

Authority: 49 U.S.C. 106(f), 106(g), 41706, 40113, 44701–44702, 44705, 44709, 44711–44713, 44715–44717, 44722, 44730, 45101–45105; Pub. L. 112–95, 126 Stat. 58 (49 U.S.C. 44730).

■ 22. In § 135.169, revise paragraphs (b) introductory text, (b)(6), and (b)(7), and add paragraph (b)(8) to read as follows:

§ 135.169 Additional airworthiness requirements.

* * * * *

(b) No person may operate a small airplane that has a passenger seating configuration, excluding pilot seats, of 10 seats or more unless it is type certificated—

* * * * *

(6) In the normal category and complies with section 1.(b) of Special Federal Aviation Regulation No. 41;

(7) In the commuter category; or

(8) In the normal category, using a means of compliance accepted by the Administrator equivalent to the airworthiness standards applicable to the certification of airplanes in the commuter category found in part 23 of this chapter through amendment 23–62, effective January 31, 2012.

* * * * *

Issued under authority provided by 49 U.S.C. 106(f), 44701(a), 44703 and Pub. L. 113–53 (127 Stat. 584; 49 U.S.C. 44704 note) in Washington, DC, on March 7, 2016.

Dorenda D. Baker,

Director, Aircraft Certification Service.

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