DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Part 23

[Docket No. 26269; Notice No. 90-18]

RIN 2120-AD20

Small Airplane Airworthiness Review Program Notice No. 4

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Notice of Proposed Rulemaking (NPRM).

SUMMARY: This notice proposes changes to the airframe and flight airworthiness standards for normal, utility, acrobatic, and commuter category airplanes that are based on a number of recommendations discussed at the Small Airplane Airworthiness Review Conference held on October 22–26, 1984, in St. Louis, Missouri. These proposals arise from the recognition that updated safety standards will continue to provide an acceptable level of safety in the design requirements for small airplanes used in both private and commercial operations. The proposed changes, if adopted, would provide design requirements applicable to advancements in technology being incorporated in current designs and would reduce the regulatory burden in showing compliance with some requirements while maintaining an acceptable level of safety.

DATES: Comments must be received on or before October, 25, 1990.

ADDRESSES: Comments on this notice may be mailed in triplicate to: Federal Aviation Administration, Office of the Chief Counsel, Attn: Rules Docket (AGC–10), Docket No. 26269, 800 Independence Avenue, SW., Washington, DC 20591, or delivered in triplicate to: Room 915–G, 800 Independence Avenue, SW., Washington, DC 20591. Comments delivered must be marked Docket No. 26269. Comments may be inspected in Room 915–G between 8:30 a.m. and 5 p.m. on weekdays, except on Federal holidays.

In addition, the FAA is maintaining an information docket of comments in the Office of the Assistant Chief Counsel, ACE–7, Federal Aviation Administration, Central Region, 601 East 12th Street, Kansas City, Missouri 64106. Comments in the information docket may be inspected in the Office of the Assistant Chief Counsel weekdays, except Federal holidays, between the hours of 7:30 a.m. and 4 p.m.

FOR FURTHER INFORMATION CONTACT: Bobby Sexton, Standards Office (ACE–110), Small Airplane Directorate, Aircraft Certification Service, Central Region, Federal Aviation Administration, 601 East 12th Street, Kansas City, Missouri 64106; Telephone (816) 426–5688.

SUPPLEMENTARY INFORMATION:

Comments Invited

Interested persons are invited to participate in the making of each proposed rule by submitting such written data, views, or arguments as they may desire. Comments relating to the environmental, energy, or economic impact that might result from adopting the proposals in this notice are invited. Public comments are specifically solicited by this notice on the following subjects:

Proposal 2, § 23.3, Permit installation of turbojet engines on commuter category airplanes.

Proposal 7, § 23.65, Requirement for performance limitations based on weight, altitude and temperature.

Proposal 10, § 23.145, Control force limits for reduced pilot strength, and

Proposal 29, § 23.307, Material correction factors during structural tests.

Communications should identify the regulatory docket or notice number and be submitted in triplicate to the address specified above. All communications received on or before the closing date for comments specified above will be considered by the Administrator before taking further action on this rulemaking. Commenters wishing the FAA to acknowledge receipt of comments submitted in response to this notice must include a self-addressed, stamped postcard on which the following statement is made: "Comments to Docket No. 26269." The postcard will be date stamped and returned to the commenter. All comments received will be available, both before and after the closing date for comments, in the Rules Docket for examination by interested persons. A report summarizing each substantive public contact with FAA personnel concerned with this rulemaking will be filed in the docket.

Availability of NPRM

Any person may obtain a copy of this NPRM by submitting a request to the Federal Aviation Administration, Office of Public Affairs, Attn: Public Inquiry Center, (APA–200), 800 Independence Avenue, SW., Washington, DC 20591, or by calling (202) 267–3484. Communications must identify the notice number of this NPRM. Persons interested in being placed on the mailing list for future NPRMs should also request a copy of Advisory Circular No. 11–2A, Notice of Proposed Rulemaking Distribution System, which describes the application procedure.

Background

On January 31, 1983, the FAA announced the Small Airplane Airworthiness Review Program and invited all interested persons to submit proposals for changes to part 23 (48 FR 4290; Notice No. CE–83–1). The objective of the Review Program was to encourage public participation in improving and updating the airworthiness standards applicable to small airplanes.

On June 9, 1983, the FAA, in response to requests from interested persons, reopened the proposal period for submission of proposals. This action (48 FR 26623; Notice No. CE–83–1A) was based upon an FAA determination that it would be in the public interest to allow more time for the public and the aviation industry to submit their proposals.

By the close of the proposal period on May 3, 1984, the FAA had received approximately 560 proposals in response to Notice Nos. CE–83–1 and CE–83–1A. On July 25, 1984, the FAA issued Notice No. CE–84–1 (49 FR 30053) announcing the Availability of Agenda, Compilation of Proposals, and Announcement of the Small Airplane Airworthiness Review Program Conference to discuss the proposals. The conference was held on October 22–26, 1984, in St. Louis, Missouri. A copy of the transcript of all discussions held during the conference is filed in Docket No. 23494.

Notice No. 1 of the Small Airplane Airworthiness Review Program is directed toward improvement of crashworthiness and has resulted in issuance of amendment 23–36 to part 23 (53 FR 30802; August 15, 1987). Notices numbered 2 and 5 address issues of specific concern in past and current certification programs and Notice No. 3 addresses systems and powerplant issues.

A number of proposals were submitted to the conference that did not result in proposed changes to the rule. The FAA decision to take no further regulatory action on those proposals was based on information gained at the conference or during post-conference review. The regulatory sections are included below along with the explanation of why no action was taken to amend the rule.

No action is being taken to amend § 23.1 Applicability.

Explanation: Conference proposal 1 recommends elimination of reference to

the number of passengers and to the term "small" airplanes in paragraph (a) of § 23.1.

Conference discussion relative to this proposal was primarily centered around the level of safety that would result with adoption of this proposal. One commenter suggested that the FAA consider conference proposal 1 in combination with Notice of Proposed Rulemaking (NPRM) 83–17 (48 FR 52010; November 15, 1983) addressing commuter category, which was still pending at the time of the conference.

Subsequent to the conference, the FAA issued amendment 23–34 (52 FR 1806; January 15, 1987) to add the commuter category to part 23. As a part of that amendment, § 23.1 was changed to read substantially as proposed by conference proposal 1.

Reference: Conference proposal 1.

No action is being taken to amend § 23.3 Airplane categories.

Explanation: There are two conference proposals directed at § 23.3.

Conference proposal 2 recommends the changes to part 23 necessary to allow the certification of commuter category airplanes with turbojet propulsion systems. Currently, the commuter category applies only to propeller-driven multiengine airplanes and includes both piston-driven and turbine-driven propeller systems. Current part 23 precludes the use of turbojet propulsion systems on commuter category airplanes.

Conference proposal 2 was largely supported at the conference. One commenter noted that a change to allow turbojet propulsion systems was not intended to account for a growing sophistication, it simply is recognition that such a means of propulsion is available. Another commenter noted that terms like "power" and "thrust" are used throughout part 23. That commenter noted that during a recent recertification of a specific part 25 turbojet airplane to part 23 requirements, extensive rule changes were not required; therefore, the rule change as proposed by conference proposal 2 is reasonable.

In general, the FAA recognizes that there is a great interest in providing a viable regulation to allow the use of turbojet propulsion systems on commuter category airplanes. The FAA further recognizes that prior to promulgation of such a regulation, careful study and review is necessary by all concerned.

By this notice, the FAA solicits comments on the advisability of changing existing part 23 to allow the use of turbojet propulsion systems on commuter category airplanes. The FAA will accept preliminary comments on the advisability of such a change and declares its intent that any definitive proposals resulting from such comments will be included in future notices. The FAA further solicits comments relative to possible conflicts such a proposal would have on existing part 23 requirements. Specifically, the FAA is interested in identifying any existing requirements that would require revision to allow the use of turbojet propulsion systems on commuter category airplanes.

Conference proposal 3 recommends changes to part 23 to allow the approval of single-engine airplanes with maximum takeoff weights of up to 20,000 pounds. This proposal was included in the part 23 review as a result of a commitment made by the FAA in response to a petition for exemption from the current 12,500 pound limitation for single-engine airplanes. In that petition, a member of the public requested certification of a single-engine airplane, intended for cargo use only, which would have a maximum takeoff weight of 14,500 pounds.

One commenter noted that single-engine military aircraft having takeoff weights in excess of 12,500 pounds were common during World War II. That commenter stated that, in light of the reliability of new turbopropeller engines, a heavy single-engine airplane was a practical design. The position was further supported by two commenters who agreed that such a design was feasible.

Several commenters opposed the proposal. One commenter voiced concern not only for the safety of the passengers in the airplane, but for the potential damage to people and property on the ground resulting from a single engine failure and the subsequent forced landing. That commenter preferred that airplanes of the size proposed have at least two engines.

The FAA has concluded that certification of single-engine airplanes having maximum takeoff weights in excess of 12,500 pounds is not in the public interest notwithstanding the "cargo-only" utilization proposed. Further, the FAA has determined that the "stay-up" capability of twin-engine airplanes having takeoff weights above 12,500 pounds is necessary to protect both the United States flying public and persons and/or property on the ground.

Reference: Conference proposals 2 and 3.

No action is being taken to amend § 23.21 Proof of compliance.

Explanation: Conference proposal 4 recommends deleting the phrase "by calculations based on, and equal in accuracy to, the results of flight testing", which is currently contained in § 23.21(a). The proponent contended that such a requirement is capable of misinterpretation.

Further, conference proposal 4 recommends that the detail provisions concerning flight test tolerances, which are stated in § 23.21(b), should be omitted and would be more properly located in the Engineering Flight Test Guide for Small Airplanes, FAA Order 8110.7 (where they appear in Section 11).

Note: Subsequent to the conference, the FAA issued Advisory Circular (AC) 23–8, entitled "Flight Test Guide for Certification of Normal, Utility and Acrobatic Airplanes", and the FAA cancelled FAA Order 8110.7. This AC was later revised to include flight test requirements for commuter category airplanes. AC 23–8A, entitled "Flight Test Guide for Certification of part 23 Airplanes", provides guidance for flight test certification requirements for all categories of part 23 airplanes.

Since FAA Order 8110.7 was in effect at the time of the conference and was referenced throughout the conference, it continues to be referenced in this notice, when appropriate, instead of current Advisory Circular AC 23–8A.

In response to the proposal, one commenter opposed the change on the basis that it eliminates analytical procedures from the type certification process and would, therefore, require considerably more flight testing. That commenter stated that further flight testing would result in more expense and would probably have no effect on overall safety.

Another commenter concurred with the intent of the proposal (but possibly not the exact wording), even though it may require more flight testing and added expense.

The FAA has carefully reviewed the current requirements and the proposal, and has concluded that no change to the wording of the current requirements is necessary.

The FAA does not agree with deleting the flight test tolerances required in § 23.21(b). Paragraph (b) states maximum permissible tolerances by regulation, whereas stating these tolerances in an FAA Order alone would not be mandatory.

Reference: Conference proposal 4.

No action is being taken to amend § 23.29 Empty weight and corresponding center of gravity.

Explanation: Conference proposal 9 recommends the deletion of paragraph (b) of § 23.29, which states "The condition of the airplane at the time of determining empty weight must be one that is well defined and can be easily

repeated." The proponent contends that the requirement should be in part 21 and that the intent is covered under that portion of § 23.23 that addresses adverse conditions of loads and centers of gravity.

Two attendees opposed deletion of the requirement contending that the current requirement is a good and valid one. The FAA agrees that a simple and repeatable method for determining an empty weight is necessary to establish a minimum level of safety for type certification; therefore, no change is proposed.

Reference: Conference proposal 9.

No action being taken to amend § 23.49 Stalling speed.

Explanation: The FAA has reviewed the following proposals and the transcript from the conference and has concluded that no revision to the requirements of § 23.49 is warranted at this time.

Conference proposal 26 recommends a text that accomplishes substantially the same objectives as presently stated in § 23.49. It was the consensus at the conference, and the FAA agrees, that the requirements as currently stated are adequate.

Conference proposal 27 recommends a deletion of the 61-knot stall speed limitation for single-engine airplanes but recommends retention of the 61-knot stall speed limitation for those multiengine airplanes lacking the capability of complying with § 23.67 Climb: One engine inoperative. It was the consensus at the conference that the 61-knot stall speed limitation for single-engine airplanes should be retained in the interest of maintaining the current level of safety for these airplanes in the event of an engine failure.

Conference proposal 30 recommends deleting the requirements of § 23.49(b)(2) and proposes to require that all multiengine airplanes have a positive one-engine-inoperative climb capability as recommended in the proponents recommendation for § 23.67. It was the consensus at the conference, and the FAA agrees, that the 61-knot stall speed requirements, as presently stated, should remain unchanged.

Conference proposal 31 recommends a requirement to establish a maximum permitted value for the takeoff speed. It was the consensus at the conference that the proposal would be too limiting, and effectively combined operating rules and type certification requirements. Additionally, the proposal was not supported by conference attendees other than the proponent.

Reference: Conference proposals 26, 27, 30, and 31. Conference proposals 28 and 29 were deferred for discussion under the issues applicable to the "primary category" airplane currently under consideration by the FAA.

No action being taken to propose a new § 23.71 Glide: single-engine airplanes.

Explanation: Conference proposal 55 recommends issuance of a new § 23.71 to require that a glide ratio (the horizontal distance traveled in a glide per 1000 feet of altitude) be determined for all single-engine airplanes.

During discussion of conference proposal 55, several commenters supported the concept of a glide ratio and discussed the specific location in the AFM where such a ratio should be placed.

One commenter had no strong objection to requiring a glide ratio determination, but questioned if such a rule might be beyond the level of safety of part 23.

One commenter noted that such information has been provided on several airplanes without having a mandatory requirement to do so. Another commenter agreed that such information would be useful but should not be made mandatory.

Post conference review indicates that a requirement to add glide ratios does not add significantly to an increased level of safety and can provide the pilot with information that could be misleading in an emergency situation. Specifically, the altitude available to the pilot (the altimeter reading) is normally the altitude above measured sea level (MSL). The altitude needed to use a glide ratio with any certainty is the altitude above ground level (AGL). With few exceptions, the AGL is less than the MSL. The differences can vary significantly throughout the continental U.S.

The possibility of overestimating the glide distance, because the pilot chooses to use the altimeter reading (MSL) without correcting for ground elevation, is a strong consideration when proposing a change to part 23. Since, in the event of engine failure, there is little time for the pilot to refer to the AFM for glide ratio information, and since the pilot would need to correct for wind velocity, for aircraft configuration and for available altitude above the ground, the FAA has concluded that such a proposed rule change is not appropriate for part 23. However, the FAA does agree that the procedures, speeds, and configurations for glide following engine failure are necessary and proposes them in § 23.1585 of this notice.

Reference: Conference proposal 55.

No action is being taken to propose a new § 23.73 Landing speeds.

Explanation: Conference proposal 56 recommends establishment of landing approach speeds for both the all engines operating condition and the one-engine-inoperative condition. It was the consensus of the conference that the existing controllability testing for one-engine-inoperative conditions and § 23.1585 adequately address the concerns of this proposal.

Reference: Conference proposal 56.

No action is being taken to amend § 23.77 Balked landing.

Explanation: Conference proposal 62 recommends changing § 23.77(a) to convert the "angle of climb" listed as a slope to a "gradient of climb" listed as a percentage. No change in the related climb performance was proposed. Additionally, the proposal recommends eliminating the two-second flap retraction exception listed in § 23.77(a)(3). Finally, the proposal recommends limiting the balked-landing speed to the speed used to show compliance with § 23.75.

These changes were generally opposed at the conference. One commenter stated that there are still airplanes being built with manual retract systems where the two-second flap retraction exception is appropriate. Two commenters opposed restricting the balked-landing, go-around speed to the approach speed, contending instead that demonstrated safe transition between speeds is sufficient. The FAA has determined that § 23.77(a) is adequate for the concerns identified in the proposal.

Conference proposal 63 was withdrawn at the conference.

Reference: Conference proposals 62 and 63.

No action is being taken to amend § 23.151 Acrobatic maneuvers.

Explanation: Conference proposal 97 recommends establishment of specific requirements for acrobatic category airplanes and proposes material for inclusion as an appendix to part 23 that identifies those specific maneuvers necessary for acrobatic category certification.

The proposal was opposed at the conference on the basis that the current rule is sufficient and that the proposed appendix material, which was interpretative, should be inserted in a flight test handbook.

Post conference review indicates that the existing requirements have resulted in a level of safety envisaged for this type of airplane, and that a change, as proposed, is unjustified.

Reference: Conference proposal 97.

No action is being taken to amend § 23.173 Static longitudinal stability.

Explanation: Conference proposal 119 recommends demonstration of static longitudinal stability for all speeds from minimum speed up to V_D. Demonstration to V_D was opposed at the conference. Conference proposal 120 recommends adding clarification to state that the requirements must be met when stability augmentation systems are installed. It was the consensus at the conference that this addition is unnecessary since the airplane must comply with the requirements in the configuration presented by the applicant.

Reference: Conference proposals 119 and 120.

No action is being taken to amend § 23.335 Design airspeeds.

Explanation: Conference proposal 187 recommends revision of § 23.335(c) to increase the design load factor to account for possible overloads resulting from maximum airplane maneuvers at speeds greater than $V=V_S\sqrt{n}$ for cases where the applicant chooses a design maneuvering speed greater than $V_S\sqrt{n}$ as allowed by § 23.335(c). In support of conference proposal 187, the submitter states that the purpose of maneuvering speed (in addition to supplying a speed for design of control surfaces in accordance with §§ 23.423, 23.441 and 23.445) is to provide an operating speed where a pilot can be assured of not exceeding the design limits during maneuvers. If a design maneuvering speed in excess of $V_S\sqrt{n}$ is chosen (as currently allowed by § 23.335(c)), and if the airplane is operated at that speed during maneuver, the potential exists for a pilot to exceed the design limit load factor unless that load factor is increased accordingly.

Post conference review indicates that the design maneuvering speed criteria provided in § 23.335 is necessary and sufficient for control surface design. As such, design maneuvering speed selections greater than $V_S\sqrt{n}$ are appropriate, and requiring increases in load factor above those specified in § 23.337 are unjustified.

However, the FAA recognizes that maneuvering speed is also used by the pilot as that airspeed below which full control surface inputs can be accomplished without structural damage. Maneuvering speed may also be used as a gust penetration speed to minimize the possibility of airframe damage. If the airplane is maneuvered at its maximum weight at airspeeds less than $V_S\sqrt{n}$ the airplane will stall prior to exceeding the maximum design load factor. If the airplane is operated at speeds greater than $V_S\sqrt{n}$ in the same conditions, the maximum design load factor can be exceeded.

The FAA recognizes the dual meaning given maneuvering speed and agrees that the maneuvering speed used to design the control surfaces and the maneuvering speed used by the pilot have different purposes, yet §§ 23.335, 23.1507, and 23.1563 use the same term, "design maneuvering speed, V_A". The FAA proposes to leave § 23.335 unchanged but would establish an "operating maneuvering speed; V_O" in § 23.1507, and alter § 23.1563 to require an airspeed placard listing a maximum operating maneuvering speed, instead of the design maneuvering speed, V_A. Since the operating maneuvering speed (that speed where the C_{NA} max curve intersects the design load factor line) will reduce for weights less than maximum weight, the applicant may choose to placard operational maneuvering speeds for more weights than the maximum.

Reference: Conference proposal 187.

No action is being taken to amend § 23.337 Limit maneuvering load factors.

Explanation: Conference proposal 188 proposes to add an additional sentence to § 23.337(c) to state that control movement limitations would not normally be acceptable as sufficient justification for reducing the maneuvering load factor.

The only comment received at the conference was in opposition to conference proposal 188. That commenter contended that the proposal simply defined one of several possible conditions of compliance, and suggested that advisory material would be more appropriate.

The FAA agrees that conference proposal 188 addresses only one of several possible conditions that might be used to show compliance with existing § 23.337(c). Conference proposal 188 does not prohibit the use of limitations of control movement as a method of compliance; it proposes that such a design would not normally be acceptable. The FAA finds that a rule similar to conference proposal 188 is unnecessary and that existing § 23.337(c) is sufficient.

Reference: Conference proposal 188.

No action is being taken to amend § 23.345 High lift devices.

Explanation: There are three conference proposals directed at § 23.345. Conference proposal 191 recommends increasing the design limit and ultimate load factors for wing flaps and their supporting structure to account for slipstream effects and to provide a minimum static and fatigue strength capability. Subsequent to the conference, the FAA issued amendment 23-38 (54 FR 39508), which amends § 23.572 to address fatigue requirements for those parts of the wing whose failure would be catastrophic. The FAA interprets such parts of the wing to include flaps and the effects of propeller slipstream impingement on those flaps. As such, no change to § 23.345 is recommended as a result of conference proposal 191.

Conference proposal 192 recommends adoption of new requirements applicable to the en route use of high lift devices. Conference discussion indicated that this proposal was primarily directed at the en route use of flaps. One commenter noted that requirements similar to those recommended in conference proposal 192 are mandated in existing § 23.373 applicable to speed control devices, such as spoilers and drag flaps. The FAA has determined that typical small airplanes utilize flaps in en route conditions as speed control devices and, as such, the FAA does not intend to propose similar requirements beyond existing § 23.373 for such designs. The FAA would expect to apply § 23.373 to such flap designs whether called high lift devices or speed control devices.

References: Conference proposals 191 and 192.

Conference proposal 190 was deferred for discussion under the issue applicable to the "primary category" airplane currently under consideration by the FAA.

No action is being taken to amend § 23.365 Pressurized cabin loads.

Explanation: Conference proposal 194 recommends revising § 23.365(a) to no longer require the 150 percent increase in the pressure load when it is combined with the ultimate maneuver load factor in order to comply with the combined loading test requirements for the cabin pressure vessel. Conference proposal 194 recommends no change from the current requirement to assure that the structure will withstand the limit loads resulting from zero up to the maximum relief valve setting but proposes to consider the same pressure loads as ultimate loads when combined with the ultimate flight load. This, in effect, eliminates the 1.5 safety factor for ultimate pressure load conditions.

In support of conference proposal 194, the submitter notes that § 23.841 requires two pressure relief valves in each pressure cabin and argues that pressure loads beyond the limit of the pressure relief valve were not probable. The submitters contend that loads beyond the pressure relief valve setting in combination with ultimate airloads were a result of more than the single failure criteria accepted for small airplanes and that simultaneous

application of two ultimate loads is unprecedented in part 23.

One commenter agreed in part with the proposal, stating that since the load in the pressure cabin is predictable, a reduction in the 150 percent safety factor might be justified. That commenter was opposed to total elimination of the 150 percent safety factor.

Another commenter objected to any reduction in the safety factor for ultimate loading below that already existing in part 23.

One commenter noted that conference proposal 194 was based on the pressure resulting from the maximum relief valve setting, which was usually higher than the operating pressure. That commenter felt that it was illogical to ask for 150 percent of that loading to be combined with the ultimate flight load since such a condition will never be achieved in real life.

Another commenter noted that, from a practical sense, the fatigue requirements generally design the cabin anyway. The proposed rule will not, in most cases, make any difference in design but will reduce the difficulty of testing to test to prove the design.

Another commenter pointed out that the limit cabin pressure without airloads is required to be 1.33 times the normal operating pressure. When increased to ultimate pressure using the 150 percent value, the fuselage pressure vessel must be designed for twice the maximum relief valve setting. This is true even with the two required pressure relief valves. That commenter noted that it was possible to obtain ultimate maneuver load on the airframe but contended that there was no practical way to get ultimate pressure in the pressure vessel. That commenter was unaware of any airplane that had the capability of pressurizing the pressure vessel to twice the relief valve setting. That commenter was of the opinion that conference proposal 194 had merit.

The FAA has reviewed conference proposal 194 and the philosophical intent of the 150 percent safety factor used for ultimate load testing. The FAA finds that the 150 percent increase must be applied to design service conditions to provide a factor of safety beyond the limit condition. The probability of whether or not the 150 percent load is operationally obtainable is not related to the intent of this safety factor. The design condition of full maneuver loads on a pressurized cabin constitutes the design service condition and, as such, the 150 percent safety factor is appropriate. Accordingly, no change is proposed to § 23.365(a).

Conference proposal 195 recommends revising § 23.365 (e) to (1) reword existing paragraph (e); (2) include consideration of cabin penetration due to the probability of engine disintegration, and (3) require consideration of the probability of detachment of parts of the airplane resulting in passenger injury during sudden decompression. This proposal parallels particular similar existing part 25 requirements.

Items (2) and (3) were strongly opposed by commenters at the conference primarily because of the small cabin volume of part 23 airplanes when compared to the volume of part 25 airplanes.

One commenter stated that decompression tests run on part 25 business jets (cabin volumes similar to part 23 airplanes) indicated very little movement of the anthropomorphic dummies or the cabin contents. That commenter stated that, in some cases, the sleeve on the anthropomorphic dummy was noted to move and, in one case, a piece of paper shifted aft a couple of inches.

Another commenter contended that there was no practical design that would prevent penetration of the cabin when a complete engine deterioration occurred.

Post conference review indicates that, in practical small airplane designs, the effects of cabin depressurization are sufficiently different from those of transport category airplanes to justify differences in the requirements. However, Report AM 67–14, entitled "An Evaluation of Potential Decompression Hazards in Small Pressurized Aircraft", published by the Federal Aviation Administration, Office of Aviation Medicine, June 1967, indicates that during sudden decompression, the volumes of even small pressurized aircraft are sufficient to cause passenger ejections from the aircraft, fatal injuries from head impact, concussion and unconsciousness, and, in some cases, even lung rupture. The report recommends considering double-pane windows and plug type exits on all pressurized airplanes. Specific requirements for windows in pressurized airplanes were added by amendment 23–7, effective 1969 and changes to door locking mechanisms have been adopted into part 23 by amendment No. 1 of the Small Airplane Airworthiness Program, (amendment 23–36, 53 FR 30802; August 15, 1988). Therefore, no change is proposed to existing § 23.365(e) and conference proposal 195 is withdrawn.

Reference: Conference proposals 194 and 195.

No action is being taken to amend § 23.373 Speed control devices.

Explanation: Conference proposal 198 proposes to revise § 23.373(a) for all small airplanes having gross weights in excess of 6,000 pounds to increase the deployment speed of speed control devices from the currently allowed placard speed chosen during certification to the design dive speed V_D.

In support of conference proposal 198, the submitter notes that designs have been previously approved that have placarded speeds no higher than V_C. The submitter doubts that anyone deliberately flies at V_D, but contends that existing requirements demand load investigations to V_D because high speed upsets do occur for whatever reason, and aircraft do exceed the maximum airspeed operating limits. The submitter argues that, in such cases, the pilot may use any speed control device available to avoid an excessive overspeed situation in spite of being above the maximum placarded speed. One commenter noted that the condition described by the submitter is not a normal incident and that existing safety factors allow some margin for error.

Conference discussion regarding the 6,000-pound weight demarcation indicated that such a weight limit was consistent with that of appendix A and particular performance requirements of part 23.

Post conference review does not indicate excessive service difficulties related to speed control devices on small airplanes. Recovery from the condition of overspeed described by the submitter, which includes delays in pilot action, are normal certification demonstrations of compliance to § 23.253, consistent with deployment speed limitations appropriate for the airplane design.

Reference: Conference proposal 198.

No action is being taken to amend § 23.399 Dual control system.

Explanation: Conference proposal 201 proposes to add a new paragraph to § 23.399 requiring that control systems design account for pilot forces applied together in the same direction. This proposal is substantially identical to existing transport category requirements on the same subject.

As justification, conference proposal 201 states that experience has shown that such a rule is necessary; but such a contention was unsupported at the conference. One commenter opposed the proposal because of the inadequate justification and pointed out that the examples cited during conference discussion on this proposal were related to malfunctions. That commenter stated

that the existing regulation contains sufficient safety factors to compensate for such malfunctions.

After further analysis, the FAA has determined that adequate requirements exist in current § 23.399.

Reference: Conference proposal 201.

No action is being taken to amend § 23.423 Maneuvering loads.

Explanation: There were three conference proposals directed toward § 23.423. Conference proposal 205 recommends changes to appendix B of part 23. Partially as a result of conference proposal 204, and by Notice No. 2 of the Small Airplane Airworthiness Review Program, the FAA has initiated rulemaking action to eliminate appendix B in its entirety from part 23 (54 FR 9276; March 6, 1989). The FAA does not intend to take further action on conference proposal 205.

Conference proposal 206 proposes limiting the use of the equations of § 23.423(b) to airplanes having design dive speeds, V_D, of less than 300 knots and recommended demonstration of check pitch maneuvers at V_D. This proposal was opposed at the conference.

Reference: Conference proposals 205 and 206.

No action is being taken to amend § 23.499 Supplementary conditions for nose wheels.

Explanation: Conference proposal 215 recommends new requirements for nose wheels on airplanes over 6,000 pounds maximum weight to provide loads for situations where significant steering effort is necessary, such as the effort needed to extract the nose gear from a rut. The proposal was opposed at the conference. One commenter stated that the loads seemed arbitrary and lacked service experience as justification.

Reference: Conference proposal 215.

No action is being taken to amend § 23.507, Jacking Loads, or § 23.509, Towing Loads.

Explanation: Conference proposals 216 and 217 recommend exempting these requirements from airplanes weighing less than 1,500 pounds. The FAA concludes that these proposals are more appropriate to "primary category" airplanes.

Reference: Conference proposals 216 and 217 were deferred for discussion under the issues applicable to the "primary category" airplane currently being considered by the FAA.

No action is being taken to amend § 23.571 Pressurized cabin.

Explanation: Conference proposal 224 recommends that for fatigue substantiation, certification by "analysis alone" on simple structure should be eliminated. Further, it proposes to adopt fail-safe criteria similar to part 25 criteria but with a larger increase in cabin differential pressure to align more closely with European philosophy.

Conference discussion indicated analytical approaches to fatigue substantiation had been conservative primarily because of the scatter factors required by the FAA. Further, several commenters noted that there had been no adverse service history on part 23 airplanes sufficient to justify the proposed changes.

Reference: Conference proposal 224.

No action is being taken to amend § 23.572 Flight structure.

Explanation: There are five conference proposals directed at § 23.572 and one that proposes a new § 23.573.

Conference proposals 226 and 229 recommended extending the existing fatigue requirements to the empennage by either including the term "empennage" in existing § 23.572 or by establishing a new section entitled "Empennage and associated structure". Conference proposal 225 recommends that § 23.572 apply to canard and tandem wing configurations as well as the main wing. Conference proposal 228 recommends excluding airplanes of less than 1500 pounds from the requirements of § 23.572. Conference proposals 227 and 515 recommend requiring fatigue strength or fail-safe substantiation for any part of the airplane primary structure whose failure would be catastrophic. Finally, conference proposal 227 also recommends that the loads resulting from propeller wake-induced vibrations be specifically addressed, and conference proposal 515 recommends requiring fail-safe criteria as the primary method of substantiation for airplanes above 6,000 pounds.

Subsequent to the conference, the FAA has initiated a separate rulemaking action proposing fatigue strength or fail-safe substantiation of the empennage for normal, utility and acrobatic airplanes. The FAA expects that compliance with this proposed rule will be based on spectra that includes propeller effects. The FAA has initiated Notice 2 of the Small Airplane Airworthiness Review Program (54 FR 9276; March 6, 1989), which addresses fatigue requirements for canards, tandem wings, and winglets as a proposed change to § 23.572. The FAA finds insufficient service history to support requiring fail-safe strength as the primary method of substantiation for airplanes over 6,000 pounds.

Reference: Conference proposals 225, 226, 227, 229 and 515. Conference proposal 228 was deferred for discussion under the issues applicable to the "primary category" airplane currently under consideration by the FAA.

No action is being taken to amend § 23.607 Self-locking nuts.

Explanation: Conference proposal 231 recommends changes to § 23.607 to address environmental conditions. The proposal was opposed at the conference and withdrawn by the proponent.

Reference: Conference proposal 231.

No action is being taken to amend § 23.611 Accessibility.

Explanation: Conference proposal 232 proposes to add a new paragraph to § 23.611 requiring a practical inspection means for airplanes of 6,000 pounds or more maximum weight and to permit the use of nondestructive inspection aids to inspect structural elements where it is impractical to provide means for direct visual inspection. The justification for the proposal was that the proposed inspection method and the inspection interval are sufficient to ensure the continued airworthiness of the airplane, particularly for fail-safe designs.

One commenter opposed the proposal contending that the current rule adequately addressed the subject. Conference discussion indicated that some commenters believed that § 23.611 was directed toward visual inspections while others stated that the access necessary would be determined by the inspection method chosen by the applicant.

After further analysis of the proposal, the ensuing conference discussion and the current rule, the FAA has determined that § 23.611 does not limit the inspection method to be used but requires that a means must be provided to allow inspection regardless of the inspection method chosen. The FAA has determined that § 23.611 is adequate for the concerns identified in the proposal.

Reference: Conference proposal 232.

No action is being taken to amend § 23.627 Fatigue strength.

Explanation: Conference proposal 243 recommends deletion of § 23.627 and recommends incorporation of its contents into §§ 23.571 and 23.572.

Post conference review indicates that incorporating the contents of § 23.627 into either §§ 23.571 or 23.572 would limit its use to the fatigue considerations listed for either the pressure cabin or the wing structure. Currently, § 23.627 applies to all airplane structure and is not limited to those structures where fatigue is specifically addressed. Additionally, § 23.627 relates to design details of the airplane (e.g., rounded corners, elimination of notches) intended to avoid stress concentrations.

Conference comments appropriately resulted in the addition of fatigue considerations into the proposed change to § 23.613. However, since § 23.613

relates to material strength properties and design values and does not address the design details addressed in § 23.627, the FAA finds that the retention of § 23.627 is appropriate.

Reference: Conference proposal 243.

No action is being taken to amend § 23.671 General.

Explanation: Conference proposal 248 was withdrawn by the proponent prior to discussion at the conference.

Reference: Conference proposal 248.

No action is being taken to amend § 23.689, Cable systems.

Explanation: Conference proposal 255 recommends altering the wording of existing § 23.689(a)(2) from "Each cable system must be designed so that there will be no hazardous change in cable tension throughout the range of travel under operating conditions and tamperature variations; and" to "Each cable system must be designed so that there will be no hazardous change in cable tension throughout the range of travel under operating conditions, within a specified temperature range, and".

In support of conference proposal 255, the submitter stated that cable systems, even when temperature compensated, can be temperature limited at both low and high extremes. The submitter recommends that the temperature limits be identified to ensure adequate function of the system at operational temperature extremes.

One commenter stated that the design temperature extremes should be listed in the Airplane Flight Manual (AFM) and that the airplane be limited by those temperature values. Another commenter strongly opposed conference proposal 255, arguing that the present rule is adequate.

The FAA agrees that existing § 23.689(a)(2) is adequate. By stating "under operating conditions and temperature variations," the rule includes all expected operating conditions and temperature variations expected in service. Reasonable administration of § 23.689(a)(2) precludes the need for the change proposed.

Reference: Conference proposal 255.

No action is being taken to amend § 23.723 Shock absorption tests.

Explanation: Conference proposal 258 recommends revising § 23.723 to allow certification of landing gear primarily by analysis and to require tests only as an option to analysis. Current § 23.723 requires testing to demonstrate the energy absorption capability of the landing gear and allows analysis for increases in weights on previously approved gear only when the energy absorption characteristics are shown to be identical.

Conference discussion concerning the need for energy absorption tests indicated that new certifications should require testing. One commenter stated that drop tests are needed for new designs but that extrapolation of older designs would be appropriate.

Another commenter pointed to discussions on this subject during the 1983 Airframe Policy Program Review conducted by the FAA. That commenter noted that the current rule allows increases in gross weight to be substantiated by analysis based on tests on landing gear with identical energy absorption characteristics; however, changes in energy absorption characteristics in conjunction with weight increases require further drop-test substantiation.

Current § 23.723 was first proposed in 1975 (40 FR 2480; June 10, 1975) as a result of an FAA airworthiness review program. Initially, § 23.723 was proposed substantially as it currently reads, except that the word "identical" was initially proposed as the word "similar." Based on public comment, that analysis must be based on landing gear tests conducted on a landing gear system with identical, not similar, energy absorption characteristics, the FAA agreed and published the current § 23.723.

References: Conference proposal 258.

No action is being taken to amend § 23.777 Cockpit controls, § 23.779 Motion and effect of cockpit controls, or § 23.781 Cockpit control knob shape.

Explanation: There were five proposals recommending changes to these sections. Subsequent to the conference, the FAA issued amendment 23–33, Standardization of Cockpit Controls for Small Airplanes (51 FR 26654; July 24, 1986).

Reference: Conference proposals 277, 278, 279, 280 and 516.

No action is being taken to amend § 23.853 Compartment interiors.

Explanation: Conference proposals 301 and 302 address issues relating to airplanes weighing less than 1500 pounds. The FAA concludes that these proposals are more appropriate to "primary category" airplanes.

Reference: Conference proposals 301 and 302 are deferred for discussion under the issues applicable to the "primary category" airplane currently under consideration by the FAA.

No action is being taken to amend § 23.867 Lightning protection of structure.

Explanation: Conference proposal 304 addresses issues relating to airplanes weighing less than 1500 pounds. The FAA concludes that this proposal is more appropriate to "primary category" airplanes.

Reference: Conference proposal 304 is deferred for discussion under the issues applicable to the "primary category" airplane currently being considered by the FAA.

No action is being taken to amend § 23.1523 Minimum flight crew.

Explanation: Conference proposal 478 recommends that specific pilot workload criteria be included in § 23.1523. Subsequent to the conference, the FAA issued amendment 23–34 (52 FR 1806; January 15, 1987), which includes the substance of that conference proposal.

Reference: Conference proposal 478.

No action is being taken to amend § 23.1529 Instructions for Continued Airworthiness.

Explanation: Conference proposal 480 addresses issues relating to airplanes weighing less than 1500 pounds. The FAA concludes that this proposal is more appropriate to "primary category" airplanes.

Reference: Conference proposal 480 is deferred for discussion under the issues applicable to the "primary category" airplane currently being considered by the FAA.

No action is being taken to amend § 23.1559 Operating limitations placard.

Explanation: Conference proposal 490 recommends deletion of paragraph (a)(1), stating that the operating limitations in the Airplane Flight Manual (AFM) are sufficient for airplanes certificated in one category only. While there was consensus at the conference that the requirement of paragraph (a)(1) should be deleted, post-conference review indicates that this placard continues to be necessary in each airplane to assure that the airplane is operated in accordance with the limitations in the AFM. No change is proposed accordingly.

Reference: Conference proposal 490.

No action is being taken to amend part 23 to add a new § 23.1586.

Explanation: Conference proposal 503 recommends establishing a new *§ 23.1586 Performance operating limitations* to include weight, airport elevation and ambient temperature (WAT) conditions as limitations on the airplane. Discussion relating to WAT performance is included in proposed § 23.65 (conference proposal 12) of this notice.

Reference: Conference proposal 503.

No action is being taken to amend appendix C of part 23.

Explanation: Conference proposal 512 recommended changing the angle of the main wheel component. After

conference discussion, the proposal was withdrawn by the proponent at the conference.

Reference: Conference proposal 512.

Regulatory Evaluation

Benefit-Cost Analysis

The regulatory evaluation prepared for this NPRM analyzes the costs and benefits to update airworthiness standards for part 23 airplanes. This NPRM is the fourth in a series of notices proposing to amend part 23 (Airworthiness Standards: Normal, Utility, Acrobatic, and Commuter Category Airplanes) of the Federal Aviation Regulations (FAR). This NPRM is based on a number of proposals submitted at the Small Airplane Airworthiness Review Conference held on October 22–26, 1984, in St. Louis, Missouri.

This regulatory action proposes 81 amendments to the current airworthiness standards for part 23 airplanes. The major objective of these proposals is to develop updated airworthiness standards for the design of aircraft, permit incorporation of advanced technology in aircraft design and reduce the regulatory burden in showing compliance with some requirements while maintaining an acceptable level of safety. Many of them are geared toward high performance aircraft.

Of the 81 proposals, 80 are expected to impose either zero or negligible costs on aircraft manufacturers. Such proposals would either clarify existing requirements or afford manufacturers the option to incorporate the newest technology in their future models should they choose to do so. The remaining proposal (§ 23.851) is expected to impose significant costs on manufacturers. It will be discussed and analyzed, in terms of costs and benefits, in the following subsection of this evaluation.

Analysis of Proposed § 23.851: Fire Extinguishers

a. Costs

Unit capital costs per certification were estimated at $17,600 for design, $675 for testing and $1,100 for certification. Production costs per airplane were estimated at $425, which includes the mounting bracket as well as the fire extinguisher itself.

The total incremental costs were estimated at $523,000 over the 10-year study period (1990–1999), which reduces to about $324,000 on a discounted basis, in 1988 dollars. (See detailed regulatory evaluation, which is contained in the docket, for additional information on means by which the cost estimate of $523,000 was derived.)

b. Benefits

It was not possible to quantify the benefits of this proposal because the simple availability of a fire extinguisher on an airplane would not necessarily prevent injuries resulting from burns. The availability of a fire extinguisher would not prevent burn injuries if the pilot and his passengers are unable to reach it because of injuries resulting solely from crash impacts. Therefore, one cannot assume that this proposal would prevent all injuries received from burns. In addition, it is difficult to determine if a fatality should be attributed to ground impact forces or ensuing fires in examining the accident record. In spite of these data problems, a cogent argument can be made that fire extinguishers would be cost-beneficial. Most fatalities resulting from small airplane crashes have been caused by burns rather than injuries received at the time of impact. Over the next 10 years (1990–1999), if this proposal prevented only three people from dying because of their inability to escape from a burning aircraft, the benefits would exceed the costs. In addition, the availability of fire extinguishers would be very useful in limiting the damage to aircraft resulting from on-the-ground fires either prior to takeoff or after a crash in which impact forces alone have not caused hull damage.

c. Conclusion

In view of the estimated cost of $324,000 (discounted) and the analysis, which indicates that the benefits of this proposal will exceed its costs if its adoption prevents as few as three people from dying because of their inability to escape from a burning aircraft, the FAA believes that proposed § 23.851 is cost-beneficial.

On balance, in addition to proposed § 23.851, the FAA firmly believes that all of the amendments contained in this notice are cost-beneficial.

The Regulatory Evaluation that has been placed in the docket contains additional information related to the costs and benefits that are expected to accrue from the implementation of this proposed rule.

International Trade Impact Assessment

The proposals in this notice would have little or no impact on trade for both U.S. firms doing business in foreign countries and foreign firms doing business in the U.S. In the U.S., foreign manufacturers would have to meet U.S. requirements, and thus they would gain no competitive advantage. In foreign countries, U.S. manufacturers would not be bound by part 23 requirements and could, therefore, implement the proposals under study solely on the basis of competitive considerations.

Initial Regulatory Flexibility Determination

The Regulatory Flexibility Act of 1980 (RFA) was enacted by Congress to ensure that small entities are not unnecessarily and disproportionately burdened by government regulations. The RFA requires agencies to review rules that may have "a significant economic impact on a substantial number of small entities".

The FAA's criteria for a small aircraft manufacturer is one employing fewer than 75 employees, a substantial number is a number that is not fewer than 11 and that is more than one-third of the small entities subject to the proposed rules, and a significant impact is one having an annual cost of more than $15,000 (in 1988 dollars) per manufacturer.

A review of domestic general aviation manufacturing companies indicates that only six companies meet the size threshold of 75 employees or fewer. The proposed amendments to 14 CFR part 23, therefore, would not have a significant economic impact on a substantial number of small entities.

Federalism Implications

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

Conclusion

For reasons discussed earlier in the preamble, the FAA has determined that this document (1) involves a proposed regulation that is not major under the provisions of Executive Order 12291, (2) is not significant under DOT Regulatory Policies and Procedures (44 FR 11034; February 26, 1979), and (3) in addition, I certify that under the criteria of the Regulatory Flexibility Act, this proposed rule, if promulgated, will not have a significant economic impact on a substantial number of small entities. In addition, this proposal, if adopted, would have little or no impact on trade opportunities for U.S. firms doing

business overseas or for foreign firms doing business in the United States.

List of Subjects in 14 CFR Part 23

Aircraft, Air transportation, Aviation safety, Safety, Tires.

Issued in Washington, DC, on June 15, 1990.

Daniel P. Salvano,

Acting Director of Airworthiness.

The Proposed Amendment

Accordingly, the Federal Aviation Administration proposes to amend part 23 of the Federal Aviation Regulations (14 CFR part 23), as follows:

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

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

Authority: 49 U.S.C. 1344, 1354(a), 1355, 1421, 1423, 1425, 1428, 1429, and 1430; 49 U.S.C. 106(g) (Revised, Pub. L. 97-449, January 12, 1983).

2. Section 23.23 is revised to read as follows:

§ 23.23 Load distribution limits.

(a) Ranges of weights and centers of gravity within which the airplane may be safely operated must be established. If a weight and center of gravity combination is allowable only within certain load distribution limits (such as spanwise) that could be inadvertently exceeded, these limits must be established for the corresponding weight and center of gravity combinations.

(b) The load distribution may not exceed:

(1) The selected limits;

(2) The limits at which the structure is proven; or

(3) The limits at which compliance with each applicable flight requirement of this subpart is shown.

Explanation: This proposal specifies the conditions necessary for limiting the load distribution for weight and balance considerations. The current rule does not comprehensively define the load distribution limits that must be considered; it only addresses the effect of low fuel. This proposal defines a comprehensive set of load distributions that include the effects of low fuel.

Existing § 23.25(a)(2) restricts the airplane maximum weight to a value not less than the weight of an airplane containing full oil, one-half hour of fuel, and having each seat occupied; or, to a value not less than the weight of an airplane containing minimum crew, and full fuel and oil to full tank capacity.

In the past, these restrictions have been interpreted as weight limitations only. The FAA is aware of airplanes that have been manufactured or modified with centers-of-gravity so far aft at the basic empty weight that the airplane cannot be loaded with each seat occupied, full oil and one-half hour of fuel on board without exceeding the aft center of gravity envelope.

The FAA does not expect each airplane to be capable of carrying full fuel and full passengers. The trade-off between the number of passengers and the amount of fuel on board is a long-standing, successful practice. This proposal does not preclude such practice. However, this proposal is intended to assure that when a member of the United states flying public considers a six-place airplane, that person can expect such an airplane to carry six occupants, along with at least thirty-minutes of fuel and full oil. In order to do so, the airplane must not only be within weight limits, but also within c.g. limits. By stating § 23.23(b)(3) as "each applicable flight requirement of this subpart," this proposal requires the maximum weight limitations to be within the weight *and* balance envelope.

An additional submittal to the conference suggested interpretative material for airplanes of 3,000 pounds or less. The suggestion stated that for these smaller airplanes the lateral distribution limits could be shown by flight test, since the amount of fuel would be relatively small when using the one gallon per twelve horsepower criteria of the present rule. The FAA considers that the requirement as proposed eliminates the need for the suggested interpretative material.

It was the consensus at the conference that the proposal more clearly state the purpose of the requirement for load distribution limits, and the FAA agrees. Therefore, the FAA is proposing a change substantially as submitted and discussed at the conference relative to load distribution limits, that is similar to requirements applicable to transport category airplanes.

Reference: Conference proposals 5 and 6.

§ 23.25 [Amended]

3. Section 23.25(a)(2) is amended by inserting a comma after the words "category airplanes" and before the words "and 190 pounds", and by replacing the parenthetical phrase "(unless otherwise placarded)" with the parenthetical phrase "(unless otherwise placarded, except that pilot seats must assume an occupant of 190 pounds)."

Explanation: This proposal clarifies the criteria used for assuming occupant weights in normal, commuter, utility and acrobatic category airplanes.

The addition of the comma, as proposed, separates the criteria for the occupant weight used in normal and commuter category airplanes from the criteria for the occupant weight used in utility and acrobatic category airplanes. The intent of this proposal is to assure that each seat in a normal or commuter category airplane is designed for an occupant weighing at least 170 pounds, and that placarding the seat to any lesser value is not acceptable for these categories.

Placarding seats for an occupant weight of less than 190 pounds (for other than crew seats) is appropriate for airplanes having dual category certification. For example, for an airplane certificated in both the normal and utility category, compliance would be shown assuming 170 pound occupants in each seat for normal category; and for utility category, compliance would be shown assuming 190 pound occupants in the pilot seats and lesser weights in other occupant seats if necessary. Any seat restricted to a lesser weight must be placarded. The placard could reduce the occupant weight in that seat, or prohibit occupancy of the seat altogether in the utility category, but would require certification for a 170 pound occupant in the normal category.

The FAA recognizes that, lacking clear guidance, past certifications have not followed this practice. Airplanes have been certificated with "child seats" that are placarded for specific weights less than 170 pounds. Part 23 does not provide criteria for child seats, and such certifications would be prohibited by this proposal.

This proposal is based on post conference review of § 23.25. There is no comparable conference proposal.

There were two conference proposals directed at § 23.25.

The proponent of conference proposal 7 contends that paragraph (b)(3)(ii) is imprecise as written since it does not adequately define the engine fuel use. Additionally, on turbopropeller-powered airplanes the proponent contends that demonstration of operation at maximum continuous power may well be impossible without exceeding V_{MO}.

One commenter opposed the change contending the rule is satisfactory as written. That commenter noted that the proponent's justification for the proposal speaks to "operation at maximum continuous power may well be impossible without exceeding V_{MO}." The commenter contended that this had nothing to do with the requirement and that if an applicant, or whoever is running the test, decided not to exceed V_{MO}, then a climb could be initiated rather than maintaining level flight. It was the consensus of attendees that conference proposal 7 should be withdrawn. The FAA agrees that the subject paragraph should not be changed as proposed.

Reference: Conference proposal 7. Conference proposal 8 was deferred for discussion under the issues applicable to the "primary category" airplane currently under consideration by the FAA. See explanation of conference proposal 5.

4. Section 23.33 is amended by revising paragraphs (b)(1), (b)(2) and (d)(2) to read as follows:

§ 23.33 Propeller speed and pitch limits.

* * * * *

(b) * * *

(1) During takeoff and initial climb at V_Y, the propeller must limit the engine r.p.m. to a speed not greater than the maximum allowable takeoff r.p.m. as follows:

(i) For reciprocating-engine-powered airplanes, at full throttle or at maximum allowable takeoff manifold pressure.

(ii) For turbopropeller-powered airplanes, at maximum allowable takeoff power.

(2) During a closed throttle glide (or closed power lever, as applicable) the propeller may not cause an engine speed above 110 percent of maximum continuous speed at the following speeds:

(i) For reciprocating-engine-powered airplanes, at the placarded never-exceed speed, V_{NE}.

(ii) For turbopropeller-powered airplanes, at the placarded maximum operating speed, V_{MO}.

* * * * *

(d) * * *

(2) With the governor inoperative, the propeller blades at the lowest possible pitch, with takeoff power, the airplane stationary, and no wind, compliance must be shown with either—

(i) A means to limit the maximum engine speed to 103 percent of the maximum allowable takeoff r.p.m.; or

(ii) For an engine with an approved overspeed, a means to limit the maximum engine and propeller speed to not more than 99 percent of the maximum approved overspeed.

Explanation: The current requirements are stated in a manner that does not consider the turbine engine/propeller combination nor other requirements applicable to turbopropeller-powered airplanes. Usually, there are two governors in the engine/propeller system of turbopropeller-powered airplanes; one controlling the propeller rotational speed and, in many installations, a second one controlling any overspeed of the turbine engine. If the propeller governor is made inoperative, then the limit is established by the turbine engine overspeed governor on the order of 106 to 108 percent. Therefore, for turbine engines, the 103 percent requirement of existing paragraph (d)(2) is not appropriate since it is defined at a condition of takeoff manifold pressure. Manifold pressure is a term that can only be applied to reciprocating engines and is inappropriate for turbine engines.

Existing paragraph (b)(1) also states a condition that does not fully recognize the difference between reciprocating-engine-powered and turbopropeller-powered airplanes. The term "at full throttle" and, particularly, "at maximum allowable takeoff manifold pressure" imply conditions for reciprocating engines that are not terms normally associated with turbopropeller engines.

Existing paragraph (b)(2) states a condition also specifically applicable to reciprocating-engine-powered airplanes; that is, a closed throttle glide at the placarded "never-exceed speed". Turbine powered airplanes have no requirement to establish a "never-exceed speed" but are required by § 23.1505(c) to establish a maximum operating limit speed. Conference proposal 10 stated V_{MO} only, and eliminated consideration of reciprocating-engine-powered airplanes from paragraph (b)(2) of that section.

Section 23.33(b) applies to propellers not controllable in flight. A turbopropeller-powered airplane with a fixed pitch propeller system is not a foreseeable or likely combination; however, in the interest of clarity, the FAA proposes a change to paragraph (b)(2) stating conditions specifically applicable to reciprocating and turbopropeller-powered airplanes.

There are two proposals addressing the lack of appropriate requirements applicable to turbopropeller-powered airplanes and a third proposal addressing engine/propeller combinations when Supplemental Type Certificate applications are being evaluated.

The FAA has carefully considered conference proposals 10, 11, and 12 submitted to the conference recommending changes to § 23.33, the discussions recorded in the conference transcript, and the current requirements. The FAA concludes that conference proposals 10 and 11 have merit but does not agree with the exact wording of either. Therefore, the FAA is proposing to amend paragraphs (b)(1), (b)(2), and (d)(2) to set forth the requirements applicable to turbopropeller-powered airplanes recognizing their unique characteristics when compared to reciprocating-engine-powered airplanes.

Conference proposal 12 recommends a new subparagraph (c) to require a functional flight test to assure governor/propeller adequacy. This proposal was opposed at the conference. One commenter contended that subparagraphs a and b adequately cover this issue and that conference proposal 12 identifies compliance procedures. Two other commenters stated that the contents of conference proposal 12 would be more appropriate as guidance material. The FAA agrees and has included similar material in Advisory Circular AC 23-8A, entitled "Flight Test Guide for Certification of Part 23 Airplanes", issued February 9, 1989.

Reference: Conference proposals 10, 11, and 12.

5. Section 23.45 is amended by removing paragraph (e), by redesignating paragraph (f) as paragraph (e), by amending the cross reference in newly redesignated paragraph (e)(2) from (f)(3) to (e)(3), by amending the cross references in newly redesignated paragraph (e)(5) introductory text from (f)(3) and (f)(4) to (e)(3) and (e)(4), respectively, and by revising paragraphs (b) and (d) to read as follows:

§ 23.45 General.

* * * * *

(b) The performance data must correspond to the propulsive power or thrust available under the particular ambient atmospheric conditions, the particular flight condition, and the relative humidity specified in paragraph (d) of this section.

* * * * *

(d) The performance, as affected by engine power or thrust, must be based on a relative humidity of—

(1) 80 percent, at and below standard temperature; and

(2) 34 percent, at and above standard temperature plus 50 °F.

(3) Between the two temperatures listed in paragraphs (d)(1) and (d)(2) of this section, the relative humidity must vary linearly.

* * * * *

Explanation: This proposal makes clarifying changes to the existing requirements and combines the requirements currently applied in type certification programs for reciprocating-engine airplanes with those for turbine-engine-powered airplanes. The current requirement in paragraph (d) states for reciprocating-engine-powered airplanes, the performance, as affected by engine power, must be based on a relative humidity of 80 percent in a standard atmosphere. In practice, equivalent level of safety determinations have been made with the relative humidity at 80 percent but with the temperature below standard, because it is an unwarranted burden to obtain the precise condition of exactly 80 percent in a standard atmosphere. It was the consensus at the conference, and the FAA agrees, that this change is necessary to clarify the purpose of the requirement.

There are two nearly identical conference proposals to clarify the phrase "approved power or thrust" used in paragraph c. One recommends replacement by the phrase "approved minimum power or thrust," the other recommends the phrase "nominal power or thrust." The proponents defined "approved minimum power or thrust" as the lowest value of the variation of the maximum power on new production engines and "nominal power or thrust" as the lowest value of maximum power expected on an in service engine over the service life of that engine. It was the consensus at the conference that confusion exists relative to the interpretation of this phrase; but no agreement was reached relative to specific wording.

Subsequent to the conference, the FAA issued AC 23-8A, dated February 9, 1989. Post conference review indicates that sufficient guidance exists in that AC to resolve the confusion relative to this phrase in § 23.45(c) and accordingly no change is proposed.

Conference proposals 13 and 14 recommends changes addressing the lightweight, small airplane. It was concluded by the FAA that the proposals were more appropriate to the "Primary Airplane" petition for rulemaking submitted by the Aircraft Owners and Pilots Association (AOPA) and the Experimental Aircraft Association (EAA) (49 FR 39336; October 5, 1984). The FAA determined that no fruitful discussion of these proposals could be obtained during the conference in light of that petition.

Two proposals submitted to the conference were withdrawn by the proponent following discussions at the conference. The first

proposal dealt with performance requirements being met at ambient atmospheric conditions instead of standard conditions; and the second dealt with engine power based on specific humidity; that is, pounds of water to pounds of air.

Another proposal recommends demonstration that the airplane performance procedures can be executed consistently, in service, by pilots of average skill. After much discussion at the conference, it was the consensus, and the FAA agrees, that the words addressing the skill level of pilots to perform various performance requirements remain as Presently worded in the applicable sections of part 23.

The last conference proposal addressing changes to § 23.45 deals with the effect of dry and wet grass on the takeoff and landing distances determined in complying with other requirements. Currently part 23 does not specify the type of surface used in determining takeoff or landing distances. However, § 23.1587(a)(6) requires that the type of surface used in determining these distances be stated in the Airplane Flight Manual. The FAA recognizes that most testing for determining takeoff and landing distances is from a smooth, dry, hard surfaced runway and recognizes the adverse effects from other types of surfaces. The use of smooth, dry, hard surfaced runways results in test data that is repeatable. Some of the questions raised at the conference concerning just grass runways alone were: How wet is wet grass, type of grass, grass blade length, standing water depth in the grass if wet, etc. Other questions concerning types of runways dealt with gravel sizes and snow depths. It was stated that such a list could be nearly endless. The FAA has concluded that the requirement in § 23.1587(a)(6) provides an appropriate minimum standard for type certification of part 23 airplanes. Therefore, no proposal is being made to address this issue.

Reference: Conference proposals 15 through 25. Conference proposals 13 and 14 were deferred for discussion under the issues applicable to the "primary category" airplane currently under consideration by the FAA.

6. Section 23.53 is amended by revising paragraphs (a), (b)(1)(ii) and (b)(2)(ii) to read as follows:

§ 23.53 Takeoff speeds.

(a) For multiengine airplanes, the rotation speed, V_R, may not be less than V_{MC} determined in accordance with § 23.149.

(b) * * *

(1) * * *

(ii) 1.3 V_{SI}, or any lesser speed, not less than 1.2 V_{SI} that is shown to be safe for continued flight (or land-back, if applicable) under all conditions, including turbulence and complete failure of the critical engine.

(2) * * *

(ii) Any lesser speed, not less than 1.2 V_{SI}, that is shown to be safe under all conditions, including turbulence and complete engine failure.

* * * * *

Explanation: This proposal introduces a rotation speed, V_R, for multiengine airplanes and eliminates reference to V_x for airspeeds at 50 feet. The discussions at the conference were prior to the adoption of § 23.53 Takeoff speeds, by amendment 23-34. The discussions centered on takeoff speeds and proposed revisions to the requirements stated in the then current § 23.51 Takeoff. Since the FAA is not proposing changes to existing § 23.51, and since those items previously included in § 23.51 are now in § 23.53, conference comments relative to the previous § 23.51 are included in the discussion of current § 23.53.

Conference proposal 32 recommends a factoring of the takeoff distance. It was the consensus at the conference that the recommendation was more appropriate to operating rules and was opposed. Conference proposal 38, recommends moving the requirements of paragraph (e) of § 23.51 to § 23.45.

The consensus at the conference was that the requirement remain as stated and in the then current § 23.51. The FAA agrees with the consensus expressed.

The FAA is proposing to revise paragraph (a) by changing the current requirement that the lift-off speed, "V_{LOF}, not be less than V_{MC}", to a proposed requirement that the rotation speed, "V_R, not be less than V_{MC}". The lift-off speed, V_{LOF}, is undefined in terms of pilot action and, unlike the speed at which the pilot rotates for takeoff while on the ground, may result in a critical condition in case of an engine failure at V_{LOF} equal to V_{MC}. It was the consensus at the conference that this change enhances the level of safety and is a necessary change to the applicable requirements for normal, utility, and acrobatic category multiengine airplanes and is consistent with industry practice.

The FAA is proposing changes to paragraph (b) to eliminate reference to V_X plus four knots since it was the consensus at the conference, and the FAA agrees, that the constraints of 1.1 V_{MC} and 1.2 V_{SI} are more appropriate as minimum requirements at the 50 foot obstacle height.

The FAA is proposing a clarifying change to § 23.53(b)(1)(ii). The current requirement reads, in pertinent part, " * * * complete engine failure." For multiengine airplanes, the requirement is intended to mean a complete failure of the critical engine and the requirement has been applied in that manner. The intent of § 23.53(b)(1)(ii) is to assure that the chosen takeoff speeds result in multiengine airplanes that are capable of safe continued flight (or safe land-back, if appropriate) after single-engine failure under reasonable variations in ambient conditions. It was the consensus at the conference that the requirement should be revised to clarify the intent.

Conference proposal 33 was withdrawn by the proponent prior to being discussed at the conference.

Reference: Conference proposals 32, 33, 34, 35, 36, 37, and 38.

7. Section 23.65 is amended by revising paragraph (a) to read as follows:

§ 23.65 Climb: All engines operating.

(a) Each airplane must have a steady angle of climb at sea level of at least 1:12 for landplanes or 1:15 for seaplanes and amphibians with—

(1) A speed not less than 1.2 V_{SI};

(2) Not more than maximum continuous power on each engine;

(3) The landing gear retracted;

(4) The wing flaps in the takeoff position; and

(5) The cowl flaps or other means for controlling the engine cooling air supply in the position used in the cooling tests required by §§ 23.1041 through 23.1047.

* * * * *

Explanation: This proposal deletes the current rate-of-climb requirements and specifies a minimum speed at which the angle-of-climb criteria must be met. There were five proposals submitted to the conference relating to revisions to this section. One proposal recommends introducing operational requirements into § 23.65, which was opposed at the conference on the basis that mixing operation requirements and airworthiness standards within part 23 is inappropriate. Two proposals deal with moving the requirements for balked landing performance from § 23.77 to § 23.65, plus one of these proposals recommends introducing operational requirements into the airworthiness standards. Opposition was voiced to both of these proposals. First, it was not considered appropriate to mix operational requirements with the airworthiness standards, and, secondly, no useful purpose was identified to move balked landing requirements from § 23.77.

The FAA is proposing to delete the rate-of-climb requirement presently stated in paragraph (a) and state the minimum speed at which the angle of climb must be met. It was the consensus at the conference that this proposal would be an improvement in the minimum performance standard for the type certification of small airplanes. One commenter opposed requiring a minimum speed at which the angle of climb must be met; however, the FAA considers deletion of the current climb requirement contingent on this speed constraint.

Conference proposal 42 was withdrawn by the proponent prior to any discussion by the conference attendees.

There were three proposals relative to airplane performance intended to account for the aircraft weight, the operational altitude, and the ambient temperature (WAT). Since these proposals relate to takeoff and climb, they are discussed here.

Conference proposal 39 would establish a new section to (1) require climb performance based on WAT limitations, (2) set limitations on maximum takeoff speeds, and (3) establish operational cloud base and visibility limits.

Conference proposal 40 would establish a new section to require consideration of WAT in compliance with §§ 23.65 and 23.67.

Conference proposals 53 and 54 would establish a new section to define the en route climb conditions, including WAT, the

airplane configuration, and the airspeeds to be used for compliance with those conditions.

Conference discussion on these proposals was mixed relative to requiring WAT charts on all airplanes. One commenter who opposed these proposals contended that such rules would essentially eliminate the certification of an entire class of airplanes, i.e., the light twins. Another commenter agreed that most light twin airplanes could not maintain positive climb in the configurations proposed. A third commenter contended that there was no justification available to indicate that current performance levels for twin-engine airplanes are unsatisfactory. One commenter agreed with the proponent of these proposals and stated that transport category climb performance criteria should be applied to small airplanes.

Subsequent to the conference and these discussions, part 23 has been amended to add the commuter category. In that amendment, WAT criteria was added to apply to commuter category airplanes for takeoff, climb and landing conditions. Part 23 currently includes WAT criteria for turbine-powered multiengine airplanes in the specific phase of *Climb: one engine inoperative.*

Post conference review indicates that the application of WAT criteria to the performance of all part 23 airplanes, including single-engine airplanes, is not appropriate. Turbine-powered twin-engine airplanes and commuter category airplanes apply WAT criteria in varying degrees. By this notice, the FAA solicits public comment on the need for WAT criteria as information or as a limitation on piston-powered twin-engine part 23 airplanes; and as a separate issue, whether WAT criteria is necessary on turbine-powered twin-engine part 23 airplanes, specifically during the takeoff and landing phase. Comment should address any data relative to the need to change the existing criteria.

Reference: Conference proposals 39, 40, 41, 42, 43, 44, 45, 53 and 54.

8. Section 23.141 is revised to read as follows:

§ 23.141 General.

The airplane must meet the requirements of §§ 23.143 through 23.253 at all practical operating altitudes, not exceeding the maximum operating altitude established under § 23.1527, without exceptional piloting skill, alertness, or strength.

Explanation: The FAA is proposing a clarification to the general requirements for flight characteristics. The proposal is substituting the words "at all practical operating altitudes, not exceeding the maximum operating altitude established under § 23.1527" for the words "at the normally expected operating altitudes". It was the consensus at the conference that the proposal clarifies the objective requirement of the section. One recommendation made at the conference was to make the requirement applicable up to the maximum operating altitude. However, this recommendation was rejected because some of the requirements cannot be demonstrated due to airplane performance limitations. Therefore, good cause exists to retain the wording "practical operating altitudes."

Reference: Conference proposal 64.

9. Section 23.143 is amended by removing the word "Dive" in paragraph (a)(4) and inserting the word "Descent" in its place.

Explanation: The FAA is proposing this change because the word "descent" more accurately reflects the total phase of flight and is considered preferable to the word "dive" in the current requirement. The proposal submitted to the conference also included an appendix. It was the consensus that the material in the proposed appendix would be more appropriate in the Flight Test Guide for small airplanes or an advisory circular. The FAA agrees with this consensus and has included appropriate portions in AC 23-8A, "Flight Test Guide for Certification of part 23 Airplanes", issued February 9, 1989.

A second proposal submitted to the conference recommends reducing the maximum permissible forces in the table of paragraph (c). There was objection expressed to this recommendation because the proposed forces were unacceptably low and could possibly require powered control systems for many general aviation airplanes. The FAA has concluded that this issue needs further study before making a proposal to reduce the currently specified forces.

Reference: Conference proposals 65 and 66.

10. Section 23.145 is revised to read as follows:

§ 23.145 Longitudinal control.

(a) It must be possible, at speeds below the trim speed, to pitch the nose downward so that the rate of increase in airspeed allows prompt acceleration to the trim speed with—

(1) Maximum continuous power on each engine and the airplane as nearly as possible in trim at 1.3 V_{S1};

(2) Power off and the airplane as nearly as possible in trim at 1.3 V_{S1}; and

(3) Wing flaps and landing gear—

(i) retracted; and

(ii) extended.

(b) With the landing gear extended, no change in trim or exertion of more than 50 pounds control force with one hand for a short period of time may be required for the following maneuvers:

(1) With flaps retracted, and the airplane as nearly as possible in trim at 1.4 V_{S1}, extend the flaps as rapidly as possible and allow the airspeed to transition from 1.4 V_{S1} to 1.4 V_{SO}—

(i) With power off; and

(ii) With the power necessary to maintain level flight.

(2) With flaps extended and the airplane as nearly as possible in trim at 1.2 V_{SO}:

(i) With power off, quickly apply takeoff power or thrust and retract flaps as rapidly as possible to the recommended go-around setting while attaining and maintaining the speed used to show compliance with § 23.77. Retract the gear when positive rate of climb is established.

(ii) With power for and in level flight at 1.1 V_{SO}, it must be possible to maintain approximately level flight while retracting the flaps as rapidly as possible with simultaneous application of not more than maximum continuous power.

(iii) In paragraphs (b)(2)(i) and (b)(2)(ii) of this section, if gated flap positions are provided, the airplane may be retrimmed between each stage of retraction.

(3) With maximum takeoff power, landing gear retracted, flaps in the takeoff position and the airplane as nearly as possible in trim at V_{FE} appropriate to the takeoff flap position, retract the flaps as rapidly as possible while maintaining speed constant.

(4) With power off, flaps and landing gear retracted, and the airplane as nearly as possible in trim at 1.4 V_S, apply takeoff power rapidly while maintaining the same airspeed.

(5) With power off, landing gear and flaps extended, and the airplane as nearly as possible in trim at 1.4 V_{SO}, obtain and maintain airspeeds between 1.1 V_{SO} and either 1.7 V_{SO} or V_{FE}, whichever is lower.

(c) At speeds above V_{MO}/M_{MO} and up to V_D/M_D, a maneuvering capability of 1.5 g must be demonstrated to provide a margin to recover from upset or inadvertent speed increase.

(d) It must be possible, with a pilot control force of not more than 10 pounds, to maintain a speed of not more than 1.3 V_{SO} during a power-off glide with landing gear and wing flaps extended, and with—

(1) The most forward center of gravity approved for the maximum weight; and

(2) The most forward center of gravity approved for any weight.

(e) By using normal flight and power controls, except as otherwise noted in paragraphs (e)(1) and (e)(2) of this section, it must be possible to establish a zero rate of descent at an attitude suitable for a controlled landing without exceeding the operational and structural limitations of the airplane, as follows:

(1) For single-engine and multiengine airplanes, without the use of the primary longitudinal control system.

(2) For multiengine airplanes—

(i) Without the use of the primary directional control; and

(ii) If a single failure of any one connecting or transmitting link would affect both the longitudinal and directional primary control system,

without the primary longitudinal and directional control system.

Explanation: This proposal corrects the trim reference to §§ 23.161(c) (3) and (4), which were eliminated in amendment 23-21 and redesignates trim speeds and procedures. Conference proposal 69 recommends that the trim speed be changed to 1.3 V_{S1} and that this be incorporated in the proposed rule § 23.145(a).

Several conference proposals suggest relief for certain particular configurations that could not meet the proposed trim speeds. Therefore, all trims are worded "as nearly as possible in trim at". There was a conference agreement that all of the tests should be conducted at the proposed speeds regardless of the trim capabilities of the particular aircraft, which makes the rule much simpler and straightforward.

Conference proposal 75 suggests a force of 50 pounds be substituted for "no more than can be readily applied with one hand for a short period". As a result of issues raised during the discussion of conference proposal 66 relative to the strengths of female pilots, the FAA considered values less than 50 pounds.

FAA report number FAA-AM-73-23, dated December 1973, entitled "Study of Control Force Limits for Female Pilots," page 14, indicates that those pilots tested could pull an elevator control with 50 pounds of force for between 30 and 40 seconds, or 35 pounds for between 75 and 100 seconds. Since § 23.145(b) addresses temporary control force input prior to retrim, the FAA considers a 50 pound input appropriate.

Any additional information that addresses control force input relative to reduced pilot strength will be included as comments to this proposal.

One proposal suggests demonstrations to closely represent actual operational circumstances. The FAA agrees and has carried the proposal one step further and proposes a complete balked landing demonstration as § 23.145(b)(2)(i). As suggested in the proposal, the demonstration is started at 1.2 V_{SO}, to allow for the possibility of a pilot inadvertently flying at somewhat less than the normal approach speed of 1.3 V_{SO}. Present § 23.145(c) is included in the same section due to its similarity to the balked landing phase of flight. Gated flap positions are addressed in proposed § 23.145(b)(2)(iii).

Proposed § 23.145(b) is intended to include all significant tests or demonstrations appropriate to longitudinal control at low speeds. However, there were no proposals or discussions that consider longitudinal control at speeds up to V_D/M_D. With some of the new certification projects having M_D up to .77 and maximum altitudes above 40,000, a requirement to demonstrate the ability to pull at least 1.5 g up to V_D/M_D has been proposed as § 23.145(c).

Reference: Conference proposals 67 through 80 and 514.

11. Section 23.147 is revised to read as follows:

§ 23.147 Directional and lateral control.

For each multiengine airplane, it must be possible, while holding the wings level within 5 degrees, to make sudden changes in heading safely in both directions. This must be shown at 1.4 V_{S1} with heading changes up to 15 degrees (except that the heading change at which the rudder force corresponds to the limits specified in § 23.143 need not be exceeded), with the—

(a) Critical engine inoperative and its propeller in the minimum drag position;

(b) Remaining engines at maximum continuous power;

(c) Landing gear—

(i) retracted; and

(ii) extended; and

(d) Flaps in the most favorable climb position.

Explanation: This proposal deletes existing paragraph (a) in its entirety, renumbers the remaining requirements and deletes reference to center of gravity. There was general agreement at the review to delete § 23.147(a) because any airplane that complies with the rate of roll requirements of § 23.157 would also comply with § 23.147(a), thereby making it redundant. There was also general agreement that one speed (either 1.4 V_{S1} or V_Y) would adequately demonstrate compliance with § 23.147(b) since they are practically the same speed. It was decided to use 1.4 V_{S1} since it is generally the easiest to determine. It was also decided to delete § 23.147(b)(5), center of gravity at the rearmost position, because § 23.21 already requires compliance with each requirement of subpart B throughout the range of loading conditions.

A proposal was made to prohibit excessive control forces to maintain straight flight with a sudden reduction of power after accelerating from climb speed to V_{MO} or V_{NO}, and from V_{MO} or V_{NO} to V_D. There was general opposition to this proposal and it is not included.

A proposal was made to require sudden engine failure in the takeoff configuration at the all engine initial climb speed and recovery after a two-second delay. There were comments that two seconds was too long. It was concluded that since the V_{MC} demonstration of § 23.149 is a more severe test of engine failure at a much more critical speed, this proposal was not included.

It was proposed to make the power requirement for § 23.147 (a and b), "Remaining engine at maximum continuous power, or for turbine engines, the maximum power selected by the applicant as an operating limitation for use during climb." For this flight condition, it was decided to retain, "maximum continuous power."

Reference: Conference proposals 81 through 85.

12. Section 23.149 is amended by replacing the word "recovery" in paragraph (d) with the words "the maneuver" and by revising paragraphs (a), (b), and (c) to read as follows:

§ 23.149 Minimum control speed.

(a) V_{MC} is the calibrated airspeed at which, when the critical engine is suddenly made inoperative, it is possible to maintain a straight flight with a yaw of not more than 20 degrees with that engine still inoperative, and maintain straight flight with an angle of bank of not more than 5 degrees. The ability to maintain straight flight at V_{MC} in a static condition with a bank of not more than 5 degrees must also be demonstrated. The method used to simulate critical engine failure must represent the most critical mode of powerplant failure with respect to controllability expected in service.

(b) V_{MC} may not exceed 1.2 V_{S1}, where V_{S1} is determined at the maximum takeoff weight, with—

(1) Maximum available takeoff power or thrust on the engines;

(2) The most unfavorable center of gravity;

(3) The airplane trimmed for takeoff;

(4) The maximum sea level takeoff weight, or any lesser weight necessary to show V_{MC};

(5) The airplane in the most critical takeoff configuration, except with the landing gear retracted; and

(6) The airplane airborne and the ground effect negligible.

(c) A minimum speed to intentionally render the critical engine inoperative must be established and stated as an operating limitation in § 23.1583 and designated as the safe, intentional, one-engine-inoperative speed, V_{SSE}. V_{SSE} shall not be less than V_{S1} at maximum takeoff weight, nor greater than the higher of 1.05 V_{MC}, or V_{MC} determined at zero bank angle.

* * * * *

Explanation: This proposal defines standards for determining the minimum control speed and rewords particular portions of § 23.149 for clarity. The FAA is proposing a revision to paragraph (a) to eliminate any implication of loss of control and to establish a standard for heading change of not more than 20 degrees. It was the conference consensus that this would be an improvement over the current requirement. Conference proposals 86 and 87 were withdrawn at the conference in favor or conference proposal 88, which is substantially the proposed change for paragraph (a).

The FAA is proposing to combine the requirements of current paragraph (b) applicable to reciprocating-engine-powered airplanes and those of current paragraph (c) applicable to turbine-engine-powered airplanes into one paragraph designated as paragraph (b). The current requirements are substantially the same for both types of airplanes, except current paragraph (b) is somewhat more detailed with respect to flap position, propeller position, and cowl flap

position; whereas the most critical takeoff configuration specified in current paragraph (c) is considered more encompassing and objectively stated in determining the critical condition for V_{MC} for airplanes type certificated in accordance with the airworthiness standards of part 23.

V_{MC}, as determined in § 23.149, applies to the minimum flight speed at which the airplane is directionally and laterally controllable when the critical engine is suddenly made inoperative. The FAA is proposing the establishment and determination of an intentional one-engine-inoperative speed for the purpose of inflight pilot training. V_{SSE} must be determined considering the maintenance of a conservative controllability margin with respect to V_{MC} when the critical engine is suddenly and intentionally rendered inoperative. The establishment and determination of a V_{SSE} is an important and necessary safety requirement for pilot training in multiengine airplanes and needs to be established during the type certification program. It was the consensus of the conference attendees that the FAA should propose a requirement that applicants establish a safe and conservative minimum speed for multiengine airplanes when the critical engine is intentionally rendered inoperative for training purposes.

The FAA recognizes that when V_{MC} is established on airplanes equipped with autofeather, and if autofeather is used when establishing V_{MC}, V_{SSE} demonstrations must be limited to conditions where autofeather is armed and operative.

The FAA is proposing to remove the word "recovery" in paragraph (d) and insert the words "the maneuver" in its place. This change is necessary because the word "recovery" implies a loss of control of the airplane. Such a loss is not in keeping with the public interest to maintain a minimum level of safety for multiengine airplanes. It is also consistent with the proposed change to paragraph (a) to limit a change in heading to 20 degrees.

Conference proposals 94, 95, and 96 address the issues of establishing the minimum control speed with one-engine-inoperative with the airplane in the approach and landing configurations. The FAA has concluded that by requiring the procedures for safe one-engine-inoperative approaches and landings, it is unnecessary to establish another V_{MC} for these conditions. The consensus at the conference was that this is a reasonable method in addressing these issues.

Reference: Conference proposals 86 through 96.

13. Section 23.153 is revised to read as follows:

§ 23.153 Control during landings.

It must be possible, while in the landing configuration, to safely complete a landing without encountering forces in excess of those prescribed in § 23.143(c) following an approach to land—

(a) At a speed 5 knots less than the speeds used in complying with the requirements of § 23.75 and with the airplane in trim, or as nearly as possible in trim, and without the trimming control being moved throughout the maneuver;

(b) At an approach gradient equal to the steepest recommended for operational use; and

(c) With only those power or thrust changes that would be made when landing normally from an approach at 1.3 V_{S1}.

Explanation: This proposal requires that all airplanes, regardless of weight, be safely controllable during landings. Conference proposal 98 recommended adding a requirement "to overcome any excessive sink rate". The FAA has concluded that a meaningful definition of the word "excessive" would be necessary to the requirement as proposed and that other requirements preclude excessive sink rates such as the landing gear requirements of §§ 23.723 and 23.725.

The proposal requires that control during landings be shown at the steepest gradients recommended for operational use and that the changes in power or thrust be those made when landings are normally performed from an approach at 1.3 V_{S1}.

Reference: Conference proposals 98 and 99.

14. Section 23.155 is amended by revising paragraph (b) to read as follows:

§ 23.155 Elevator control forces in maneuvers.

* * * * *

(b) The requirement of paragraph (a) of this section must be met at 75 percent of maximum continuous power for reciprocating engines, or the maximum power or thrust selected by the applicant as an operating limitation for use during cruise for reciprocating or turbine engines, and with the wing flaps and landing gear retracted—

(1) In a turn, with the trim setting used for level flight at V_A; and

(2) In a turn with the trim setting used for the maximum level flight speed, except that the speed may not exceed V_{NE} or V_{MO}/M_{MO}, whichever is appropriate.

* * * * *

Explanation: This proposal clarifies the conditions used to demonstrate elevator control force. During discussion at the conference, it became clear that some confusion existed with regard to the current requirements. This proposal identifies the two speed conditions for meeting the requirements of paragraph (a). Conference proposals 102 and 103 addressed this clarification.

Conference proposal 100 recommends deleting the requirements of the entire section because the objectives of the requirements are closely related to those of §§ 23.173 and 23.175 concerning static longitudinal stability. As further support for the deletion, the proponent noted that part 25 does not have a similar requirement. Another commenter stated that the probable reason for this was because part 25 airplanes do not perform acrobatic maneuvers and because the requirements for static longitudinal stability deal with force gradients rather than the force values of § 23.155. In addition, it was stated by one attendee that static stability and maneuvering stability are two different issues and the FAA agrees.

Conference proposal 101 recommends that the tests specified should include speeds up to V_D instead of extrapolating to the appropriate limit. The FAA does not agree because the risk of flight testing increases without an improvement in the increased level of safety at this high speed.

Reference: Conference proposals 100, 101, 102 and 103. Conference proposal 104 was deferred for discussion under the issues applicable to the "primary category" airplane.

15. Section 23.157 is amended by adding the phrase "but not more than 10 seconds," after the word "seconds," and before the word "where," in paragraph (a)(2); by adding the phrase "but not more than 7 seconds" after the word "seconds" and before the word "where" in paragraph (c)(2); and by revising paragraph (b) to read as follows:

§ 23.157 Rate of roll.

* * * * *

(b) The requirement of paragraph (a) of this section must be met when rolling the airplane in each direction with—

(1) Flaps in the takeoff position;

(2) Landing gear retracted;

(3) For a single engine airplane, at maximum takeoff power; and for a multiengine airplane with the critical engine inoperative and the propeller in the minimum drag position, and the other engines at maximum takeoff power; and

(4) The airplane trimmed at a speed equal to the greater of 1.2 V_{S1} and 1.1 V_{MC}, or as nearly as possible in trim for straight flight.

* * * * *

Explanation: The FAA is introducing a 10-second limit to the time calculated by the equation in § 23.157(a)(2) and a 7-second limit to the time calculated by the equation in § 23.157(c)(2). The limit restricts all airplanes above 12,500 pounds to a maximum rate of roll, thereby correcting an inadvertent oversight introduced when the commuter category was added by amendment 23-34.

Additionally, the FAA proposes to change the engine power condition in paragraph (b)(3) for multiengine airplanes from maximum continuous power to maximum takeoff power on the operative engines in order to more realistically evaluate the rate of roll capability when the critical engine is inoperative and the propeller of the inoperative engine is in the minimum drag position during the takeoff condition. In addition, it is proposed that the speed for multiengine airplanes be not less than 1.1 V_{MC}. This will clarify that this speed is related to the takeoff safety speed

immediately after a takeoff associated with an engine failure where obstacle clearance may be a problem and reasonable rates of roll are necessary.

References: Conference proposals 107 through 112. Conference proposals 105 and 106 were deferred for discussion under the issues applicable to the "primary category" airplane currently being considered by the FAA. Conference proposals 109 and 111 were withdrawn prior to any substantive conference discussions.

16. Section 23.175 is amended by revising paragraphs (a)(3) to read as follows:

§ 23.175 Demonstration of static longitudinal stability.

* * * * *

(a) * * *

(3) All reciprocating engines operating at maximum continuous power, or turbine engines operating at the maximum power selected by the applicant as an operating limitation for use during climb; and

* * * * *

Explanation: The FAA is proposing to revise the engine power requirements for the climb condition. Conference proposal 121 recommends revision of subparagraph 23.175(a)(4) to include a trim speed as high as the speed used to show compliance with the engine cooling requirements of § 23.1041. Conference discussion indicated that the engine cooling requirements were already in §§ 23.1045 and 23.1047, and that clarification was needed prior to further action. Conference proposal 122 recommends that the engine power be the maximum continuous power or the maximum power selected by the applicant as an operating limitation for use during a climb. It was the conference consensus that this revision to § 23.175(a)(3) should be made and the FAA agrees. Conference proposal 122 also recommends that the flaps be in the retracted position. The FAA does not agree with this recommendation because the climb flap position may be other than the retracted position and the present wording of the current requirement encompasses all positions used for climb.

Conference proposal 123 proposes to revise the required cruise conditions by eliminating reference to high speed and low speed cruise conditions, and to eliminate the gear down condition. The only commenter doubted that sufficient justification existed to change the current rule as proposed. Subsequent to the conference, the FAA issued amendment 23–34 (52 FR 1806; January 15, 1987) revising § 23.175. No additional revision is proposed.

Conference proposal 124 recommended adding a requirement to evaluate an airplane for static longitudinal stability in the takeoff configuration. The FAA is not aware of any in service problems relating to the lack of a specific requirement for such an evaluation. Accordingly, no requirement is proposed.

Reference: Conference proposals 121, 122, 123, and 124.

17. Section 23.177 is amended by revising paragraphs (a)(1), (a)(2) and (a)(3) to read as follows:

§ 23.177 Static directional and lateral stability.

(a) * * *

(1) The static directional stability, as shown by the tendency to recover from a skid with the rudder free, must be positive for any landing gear and flap position appropriate to the takeoff, climb, cruise, approach and landing configurations. This must be shown with symmetrical power up to maximum continuous power, and at speeds from 1.2 V_{SI} in the takeoff configuration and 1.3 V_{SI} in other configurations, up to the maximum allowable speed for the condition being investigated in the takeoff, climb, cruise and approach configurations. For the landing configuration, the power must be up to that necessary to maintain a 3 degree angle of descent in coordinated flight. The angle of sideslip for these tests must be appropriate to the type of airplane. At larger angles of sideslip, up to that at which full rudder is used or a control force limit in § 23.143 is reached, whichever occurs first, and at speeds from 1.2 V_{SI} to V_A, the rudder pedal force must not reverse.

(2) The static lateral stability, as shown by the tendency to raise the low wing in a sideslip, must be positive for any landing gear and flap position. This must be shown with symmetrical power, up to 75 percent of maximum continuous power, at speeds above 1.2 V_{SI} in the takeoff configuration and 1.3 V_{SI} in other configurations, up to the maximum allowable speed for the configuration being investigated in the takeoff, climb, approach and cruise configurations. For the landing configuration, the power must be up to that necessary to maintain a 3 degree angle of descent in coordinated flight. The angle of bank for these tests must be appropriate to the type of airplane and the rudder force must not exceed 150 pounds. The static lateral stability must not be negative at 1.2 V_{SI}.

(3) In straight, steady slips at 1.2 V_{SI} for any landing gear and flap positions, and for any symmetrical power conditions up to 50 percent of maximum continuous power, the aileron and rudder control movements and forces must increase steadily, but not necessarily in constant proportion, as the angle of slip is increased up to the maximum appropriate to the type of airplane. At larger slip angles up to the angle at which full rudder and aileron control is used or a control force limit contained in § 23.143 is obtained, the aileron and rudder control movements and forces must not reverse as the angle of sideslip is increased. Enough bank must accompany the sideslip to hold a constant heading. Rapid entry into, and recovery from, a maximum sideslip considered appropriate for the airplane must not result in uncontrollable flight characteristics.

* * * * *

Explanation: The FAA is proposing to revise paragraph (a) to require that static directional and lateral stability be shown under more realistic operating conditions expected in service. Paragraph (a)(1) would be revised to evaluate the static directional stability in the approach configuration at the engine power necessary to maintain a 3 degree angle of descent in symmetrical coordinated flight instead of the maximum continuous power condition currently required.

A revision to paragraph (a)(2) is proposed that would require static lateral stability in the landing configuration at the engine power necessary to maintain a 3 degree angle of descent in symmetrical coordinated flight instead of the 75 percent maximum continuous power condition currently required. In addition, it is proposed to delete the current requirement, which states that the bank angle may not be less than 10 degrees. Many airplanes are being required to demonstrate compliance within a condition that results in an unsteady sideslip and necessitates the presence of interconnect springs or other types of interconnections. The issue is related to crosswind landing control. The incorporation of spring interconnects for small or zero sideslip may lead to hazardous crosswind landings when small or zero sideslip should not be hazardous. Conference proposal 126 recommends permitting an unstable rate of roll not to exceed 1 degree per second. It was the consensus at the conference that the measurement of 1 degree per second in flight could result in an unrealistic or unrepetitive evaluation of the static lateral stability of the airplane because of shifts within the fuel tank. The FAA agrees, and therefore, the 1 degree per second instability is not being proposed.

Conference proposal 127 was generally agreed upon as encompassing the necessary improvements to the current rule. That proposal specifies angles of bank for the tests. Specified angles of bank were rejected by the attendees because of agreement to remove the mandatory bank angle in the current requirement of paragraph (a)(2), since most airplanes are demonstrating compliance in what amounts to an unsteady sideslip maneuver. In addition, the conference proposal recommends relaxation of the requirements proposed for landplanes when modified by the addition of floats to convert the landplane to a seaplane. The recommendation applicable to seaplanes with floats is based upon the well recognized and very specialized constraints applicable to floatplane operations. Conventional floats are, by their design, destabilizing when added to an airplane. If the basic airplane is then modified to regain the stability levels of

the landplane, controllability of the floatplane while on the water is almost always severely limited. The proponent of this recommendation contends that by limiting the application of the recommendation to the addition of floats on previously certificated landplanes, an initial baseline stability level is assured. The installation of floats will cause an incremental reduction in the baseline stability levels that the proponent considered acceptable, subject to the constraints as set forth in the recommendation when the basic stability requirements are the same as those required of landplanes. The FAA recognizes that the installation of floats on a landplane will present a problem to stability but is of the opinion that an airplane, whether a landplane or a seaplane so converted by the addition of floats, must comply with the static directional and lateral stability requirements.

Conference proposal 129 recommends a relaxation of the static lateral stability requirement similar to that permitted by the military in requirements set forth in Military Standard MIL-F-8785B. The FAA does not agree with this relaxation because the handling qualities requirements for the military emphasize maneuverability at the expense of stability in their airplanes and the objectives of the requirements are not the same.

Conference proposal 130 recommends relaxing the speed requirement to 1.3 V_{SI} in configurations other than the takeoff configuration. It was the conference consensus that this relaxation would more realistically set forth a minimum requirement, since rarely are airplanes operated below 1.3 V_{SI}. The FAA agrees with the recommended revision.

Conference proposal 131 recommends deleting the requirements currently set forth in paragraph (b) of § 23.177 because two-control airplanes have not been designed for a number of years and any future designs could be addressed by the issuance of special conditions. It was the consensus that because paragraph (b) states the requirements for two-control airplanes, the processing of special conditions could be time-consuming. Therefore, the FAA does not propose any action to remove the requirements for two-control airplanes, since the requirements should be available to any applicant desiring to design a two-control airplane in the future.

Reference: Conference proposals 125, 126, 127, 129, 130, and 131. Conference proposal 128 was deferred for discussion under the issues applicable to the "primary category" airplane currently under consideration by the FAA.

§ 23.179 [Removed]

18. Section 23.179 is removed.

Explanation: The current requirements of § 23.179 Instrumented stick force measurements, are statements of how the requirements may be met rather than actual requirements. It was the consensus at the conference, and the FAA agrees, that the material should be in an Advisory Circular since the material is considered guidance for type certification programs.

Reference: Conference proposals 132, 133, and 134.

19. Section 23.181 is amended by revising paragraphs (a)(2) and (b)(2), and by adding a new paragraph (c) to read as follows:

§ 23.181 Dynamic stability.

(a) * * *

(2) In a fixed position except when compliance with § 23.672 is shown.

(b) * * *

(2) In a fixed position except when compliance with § 23.672 is shown.

(c) During the conditions as specified in § 23.175, when the longitudinal control force required to maintain speeds differing from the trim speed by at least plus and minus 15 percent is suddenly released, the response of the airplane must not exhibit any dangerous characteristics nor be excessive in relation to the magnitude of the control force released. Any long-period oscillation of flight path (phugoid oscillation) that results must not be so unstable as to increase the pilot's workload or otherwise endanger the airplane.

Explanation: The FAA is revising the requirement to account for required stability augmentation systems and is proposing a requirement to evaluate the airplane for phugoid-type oscillations. Flight test experience has shown that devices employed in the longitudinal stability of an airplane can introduce unacceptable dynamic characteristics as a result of violent phugoid-type oscillations when small out-of-trim control forces are released. The additional requirement is proposed to assure that an evaluation is made for such characteristics.

The FAA received six recommendations to revise § 23.181. Conference proposal 135 recommends specific numbers to define when short period oscillations are heavily damped. It was the consensus at the conference, and the FAA agrees, that short period behavior is obvious and that the guidance material contained in the then current FAA Order 8110.7, Engineering Flight Test Guide for Small Airplanes, is satisfactory without requiring force measurements in every case. (Note: FAA Order 8110.7 has been canceled and replaced by Advisory Circular AC 23-8A, "Flight Test Guide for Certification of Part 23 Airplanes", dated February 9, 1989.) Conference proposal 136 addresses the requirements of § 23.181 when a yaw damper is installed. The FAA has determined that the proposed change to § 23.181 is unnecessary because the airplane must comply with the requirements whether or not a yaw damper is installed to meet the requirements. Conference proposal 137 recommends evaluation of short period oscillations to the V_D speed. The FAA has concluded that such evaluations are currently required by §§ 23.251 and 23.253. Therefore, a revision to § 23.181 to address this issue is unnecessary. Conference proposal 138 recommends removal of the specific requirements of damping in § 23.181(b) and recommends that the airplane must be positively damped with the controls free. It was the consensus that the current requirements are appropriate, but that if removed from the section, the numbers should be stated in the Engineering Flight Test Guide for Small Airplanes. The FAA concluded that the current requirements are adequate and should not be revised.

Conference proposal 139 recommends a new requirement concerning the dynamic stability of an airplane conducted under the conditions in which the longitudinal static stability is assessed under § 23.175. It was the consensus at the conference that the airplane should be evaluated as stated in the proposal for a new paragraph (c) to § 23.181 and the FAA agrees. The opinion was also expressed that the requirements should be more precise, however, no specific recommendations were received. Conference proposal 140 recommends substantially the same requirement as conference proposal 139, but the consensus at the conference was that the recommendation of conference proposal 140 was not clear and that guidance material of the Engineering Flight Test Guide for Small Airplanes would be appropriate for applying the proposed rule of paragraph (c) to § 23.181.

Reference: Conference proposals 135 through 140.

20. Section 23.201 is amended by revising paragraphs (c), (f)(4), and (f)(5) to read as follows:

§ 23.201 Wings level stall.

* * * * *

(c) The wings level stall characteristics must be demonstrated in flight as follows: Starting from a speed above the stall warning speed, the elevator control must be pulled back so that the rate of speed reduction will not exceed one knot per second until a stall is produced, as shown by an uncontrollable downward pitching motion of the airplane, until the control reaches the stop, or until the activation of an artificial stall barrier; e.g., stick pusher. Normal use of the elevator control for recovery is allowed after the pitching motion has unmistakably developed, or after the control has been held against the stop for not less than two seconds. In addition, engine power may not be increased for recovery until the speed has increased to approximately 1.2 V_{S1}.

* * * * *

(f) * * *

(4) *Power:*

(i) Power off; and

(ii) For airplanes of 6,000 pounds or less maximum weight, 75 percent of maximum continuous power; or

(iii) For airplanes of more than 6,000 pounds maximum weight, the power required for level flight in the landing configuration at maximum landing weight and a speed of 1.4 V_{S0}, except that the power may not be less than 50 percent of maximum continuous power

and need not exceed 75 percent maximum continuous power.

(5) *Trim:* The airplane trimmed at a speed as near 1.5 V_{S1} as practicable.

* * * * *

Explanation: The FAA is proposing to clarify the requirements of paragraph (c) by stating the length of time that the elevator control must be against the stop to consider that the airplane is in a stall condition. In addition, the FAA recognizes the use of artificial stall barrier systems such as a stick pusher, as an acceptable means of defining stall when the artificial stall barrier system activates. It was the consensus of the attendees at the conference that this clarification is needed in the airworthiness standards.

The FAA is proposing to revise paragraph (f) to differentiate between airplanes of 6,000 pounds or less and those of more than 6,000 pounds with respect to the power to be used in power-on stalls. Heavier airplanes with high power-to-weight ratios attain extremely high nose attitudes at 75 percent maximum continuous power. The FAA does not consider the tests demonstrating stall characteristics from these extremely nose high attitudes as an enhancement to safety. Accordingly, the FAA is proposing to lower the power by proposing that a power be used of not less than 50 percent maximum continuous power or the power necessary to maintain level flight in the landing configuration and a speed of 1.4 V_{S0}. It was the consensus that these revisions would enhance the level of safety during wings level stall tests and not lower than the level of safety intended by the airworthiness standards.

In addition, the FAA is proposing a revision to the trim speed used during the tests. The current requirement states that the airplane must be trimmed at 1.5 V_{S1} or at the minimum trim speed, whichever is higher. It is being proposed that the trim speed be as near 1.5 V_{S1} as practicable. It was the consensus that the current requirement should be revised to be more general than currently stated. However, one proposal to relax the trim requirement to values of 1.3 V_{S1} to 1.5 V_{S1} was not generally supported and the FAA concurs with the nonsupport of this proposal.

References: Conference proposals 141 through 147.

21. Section 23.203 is amended by revising paragraphs (b) introductory text, (b)(4), (b)(5), (c)(1), (c)(4), and (c)(5) to read as follows:

§ 23.203 Turning flight and accelerated stalls.

* * * * *

(b) When the stall has fully developed or the elevator has reached its stop, it must be possible to regain level flight by normal use of the flight controls but without increasing power, and without—

* * * * *

(4) Exceeding a bank angle of 60 degrees in the original direction of the turn or 30 degrees in the opposite direction in the case of turning flight stalls, and without exceeding a bank angle of 90 degrees in the original direction of the turn or 60 degrees in the opposite direction in the case of accelerated stalls; and

(5) Exceeding the maximum permissible speed or allowable limit load factor.

(c) * * *

(1) *Wing Flaps:* Retracted, fully extended, and in each intermediate position, as appropriate.

* * * * *

(4) *Power:*

(i) Power off; and

(ii) For airplanes of 6,000 pounds or less maximum weight, 75 percent of maximum continuous power; or

(iii) For airplanes of more than 6,000 pounds maximum weight, the power required for level flight in the landing configuration at maximum landing weight and a speed of 1.4 V_{SO}, except that the power may not be less than 50 percent maximum continuous power and need not exceed 75 percent maximum continuous power.

(5) *Trim:* The airplane trimmed at a speed as near 1.5 V_{S1} as practicable.

Explanation: The FAA is proposing changes to the roll excursion requirements in paragraph (b) to clarify the permissible limits for both turning stalls and accelerated stalls. The current requirement for not more than 60 degrees of roll is considered to be insufficiently severe in the case of turning flight stalls because it would permit a roll into the turn to go to 90 degrees of bank. In addition, the current requirement is considered overly stringent in the case of a roll out of the turn in an accelerated stall since the bank angle is limited to 30 degrees. It is proposed to permit a bank angle of up to 60 degrees. It was the consensus at the conference that the proposal should be set forth in a notice of proposed rulemaking.

As in § 23.201(f), the FAA is proposing to revise paragraph (c) to differentiate between airplanes of 6,000 pounds or less and those of more than 6,000 pounds with respect to the power to be used in power-on stalls for the same reasons provided in the explanation of the proposed change to § 23.201(f) (Proposal 20 of this notice). It was the consensus that these revisions would enhance the level of safety during turning flight and accelerated stall tests.

In addition, the FAA is proposing a revision to the trim speed to be used during the tests. It is being proposed that the trim speed be as near 1.5 V_{S1} as practicable. It was the consensus at the conference that the current requirement should be revised to be more general than currently stated. However, one proposal to change the trim requirements to values of 1.3 V_{S1} to 1.5 V_{S1} was not generally supported by the attendees nor by the FAA.

Conference proposal 155 recommends additional stall requirements for aerobatic and utility category airplanes. It was the consensus that the current requirements adequately address these issues and the FAA agrees. Therefore, the FAA is taking no action on this recommendation.

References: Conference proposals 148, 149, 150, and 155.

22. Section 23.205 is amended by revising paragraphs (b)(1) and (b)(6) to read as follows:

§ 23.205 Critical engine inoperative stalls.

* * * * *

(b) * * *

(1) *Wing flaps:* Retracted and set to the position used to show compliance with § 23.67.

* * * * *

(6) *Trim:* Level flight, critical engine inoperative, except that for an airplane of 6,000 pounds or less maximum weight that has a stalling speed of 61 knots or less and cannot maintain level flight with the critical engine inoperative, the airplane must be trimmed for straight flight, critical engine inoperative, at a speed as near 1.5 V_{S1} as practicable.

Explanation: The FAA is proposing that critical engine inoperative stalls be evaluated with the wing flaps in the climb position. The flap position to show compliance with the requirements for climb with the critical engine inoperative may not necessarily be the retracted position as currently required. This additional configuration is likely to occur subsequent to an engine failure and the FAA is of the opinion that the stall evaluation requirements should include this configuration if different from the retracted position. There were no objections voiced at the conference to this proposal.

The FAA is proposing to require that the airplane be trimmed at a speed as near 1.5 V_{S1} as practicable in place of the current requirement, which states "at a speed not greater than 1.5 V_{S1}". It was the consensus that this change to the airworthiness standards should be proposed.

One submittal to the conference does not recommend any specific changes to this section, but rather advanced a concept of adequate requirements for minimum control speeds with the critical engine inoperative, V_{MC}, stall characteristics with the critical engine inoperative, and pilot training. The FAA concurs with the concepts submitted.

References: Conference proposals 151, 153, and 154. Conference proposal 152 was a continuation of conference proposal 151 and not a separate proposal submittal.

23. Section 23.207 is amended by revising paragraph (c) and by adding a new paragraph (d) to read as follows:

§ 23.207 Stall warning.

* * * * *

(c) For the stall tests required by § 23.201(c), the stall warning must begin at a speed exceeding the stalling speed by a margin of not less than 5 knots, but not more than the greater of 10 knots or

15 percent of the stalling speed, and must continue until the stall occurs.

(d) For all other stall tests, the stall warning must begin at not less than 5 knots above the stall speed and be sufficiently in advance of the stall for the stall to be averted by action after the stall warning first occurs. In addition, the stall warning must not operate during a normal takeoff, a takeoff continued with one engine inoperative or approach to landing.

Explanation: The FAA is proposing a revision to paragraph (c) to require the current stall warning margins to be applicable to straight stalls as set forth in § 23.201(c) and to state requirements for turning flight and accelerated stalls in a new paragraph (d). The proposal is to assure that an adequate margin above the stalling speed exists in the two stall condition requirements; i.e., §§ 23.201 and 23.203.

Service experience has shown that the current requirements are appropriate for slow, wings level stalls but when the stall warning margin requirements are applied to turning flight and accelerated stalls that the time differences between the stall warning and stall is often so small that the pilot has insufficient time to prevent the stall. This has been found to be particularly true during accelerated stalls with the upper limit at 10 knots above the stall.

It was the conference consensus that the previously discussed changes to the stall warning requirements should be proposed by the FAA in a notice of proposed rulemaking. One issue discussed regarding operation of the stall warning was in conference proposal 159, which stated, in part, the stall warning shall not operate during normal takeoff or landing. While it was agreed that the stall warning should not activate during normal takeoffs, some normal landings may result in activation of the stall warning. Therefore, it was suggested that the word "approach" be used in place of landing. The FAA agrees.

Conference proposal 156 recommends that the pilot be provided with a visual display that indicates that the airplane's stall margin is the relationship between the airplane's lift coefficient and the maximum lift coefficient possible for the airplane's configuration. There was no expression of disagreement with the objectives of this proposal, but it was considered to be beyond the scope of the requirements of part 23. The proposal seems to state design criteria for the system instead of stating the objectives necessary to regulate a stall warning.

Conference proposal 158 recommends adding a sentence to the current requirements that under all conditions of power, flap and entry rate, objectionable warnings must be minimized. The FAA agrees with this objective, but is of the opinion that the proposed revisions of paragraph (c) and the new paragraph (d) meet this objective.

Conference proposal 160 recommends adding a requirement that the stall warning be audible to the pilot when wearing approved headphones. There were extensive comments relative to the audibility of warnings, including stall warnings, when the pilot chooses to use a headset specifically designed to reduce apparent noise level. Several commenters identified other required audible warning systems. Since reasonable design would introduce the stall warning into the speaker system and, subsequently, into the headset, the commenters discussed whether these systems could or should also be introduced into the speaker system so that they could be fed into the earphones of acoustical attenuating headsets.

Section 23.207 requires that "the stall warning must give clearly distinguishable indications under expected conditions of flight." The FAA recognizes that there might be airplanes that, because of the noisy environment or other reasons such as to reduce pilot workload, would require acoustical attenuating headsets as a mandatory part of the basic certification. If these exist, compliance with § 23.207 would demand that audible enunciations be fed through the headset. The FAA does not propose to impose such requirements on airplanes when the pilot chooses to voluntarily use such a headset. Additionally, there are part 23 airplanes with stall warning systems that are driven aerodynamically and are completely independent of any electrical system. The FAA does not propose to prohibit such designs by demanding that these stall warnings be somehow introduced into the speaker system. Accordingly, no change is proposed.

Reference: Conference proposals 156, 157, 158, 159, and 160.

24. Section 23.233 is amended by revising paragraphs (a) and (b), and by adding a new paragraph (d) to read as follows:

§ 23.233 Directional stability and control.

(a) It must be demonstrated that there is no uncontrollable ground or water looping tendency in 90° crosswinds, up to a wind velocity of 0.2 V_{so}, at any speed at which the airplane may be expected to be operated on the ground or water.

(b) The airplane must be satisfactorily controllable in power-off landings at normal landing speed, without using brakes or engine power to maintain a straight path until the speed has decreased to at least 50 percent of the speed at touchdown.

* * * * *

(d) Seaplanes must demonstrate satisfactory directional stability and control for water operations up to the maximum wind velocity specified in paragraph (a) of this section.

Explanation: The FAA is proposing to clarify paragraph (a) by specifying that it must be *demonstrated* that the current requirements are met. The recommendation was made on the basis that "demonstrated crosswind velocity" must be shown and § 23.233 was not clear that controllability in a crosswind had to be demonstrated.

The FAA is proposing to revise paragraph (b) by requiring that the airplane be satisfactorily controllable by the aerodynamic forces of the rudder until the airspeed has reduced to at least half of the touchdown speed. It was the conference consensus that this requirement would assure adequate directional stability and control.

The FAA is proposing directional stability and control requirements for seaplanes to assure reasonable control of the airplane during water operations up to the maximum wind velocity of 0.2 V_{so}. There was a question raised at the conference as to whether the recommendation was necessary. The FAA has determined that the proposal should be stated for seaplanes based upon the problems encountered where "step taxiing" and turns on the step have created hazardous conditions in strong crosswinds.

Reference: Conference proposals 168 and 169.

25. Section 23.235 is revised to read as follows:

§ 23.235 Taxiing condition.

(a) The shock-absorbing mechanism must not damage the structure of the airplane when the airplane is taxied on the roughest ground that may be reasonably expected in normal operation, including takeoffs and landings.

(b) The applicant must provide water handling information and allowable sea conditions for seaplanes and amphibians in the Airplane Flight Manual in accordance with § 23.1581(a)(2).

Explanation: The current requirement for taxiing conditions only refers to one aspect of operation on rough surfaces. The FAA is proposing to require an evaluation of the operation of the airplane on the roughest surface that may be reasonably expected in service during taxiing, takeoffs, and landings. This proposal reflects the operational experience of some small airplanes.

The FAA is proposing to require water handling information and information on allowable sea conditions for small airplanes that may be operated from water.

It was the consensus at the conference that the existing requirements be expanded to include the evaluation of rough surface takeoffs and landings. Also, it was agreed that the water handling characteristics be included in the Airplane Flight Manual in accordance with § 23.1581(a)(2), where other information is required that is necessary for safe operation because of design, operating, or handling characteristics for seaplanes and amphibian airplanes.

Reference: Conference proposals 170 and 171.

26. Section 23.251 is revised to read as follows:

§ 23.251 Vibration and buffeting.

There must be no vibration or buffeting severe enough to result in structural damage, and each part of the airplane must be free from excessive vibration, under any appropriate speed

and power conditions up to V_D/M_D. In addition, there must be no buffeting in any normal flight condition severe enough to interfere with the satisfactory control of the airplane or cause excessive fatigue to the flight crew. Stall warning buffeting within these limits is allowable.

Explanation: The FAA is proposing a change to the current requirement to clarify that buffeting must not cause structural damage in any envelope condition and to specify a single value of V_D/M_D rather than the minimum value of V_D permitted in the structural requirements. The V_D/M_D value is consistent with other handling qualities assessed and is compatible with the structural requirements. There was consensus at the conference that the current requirement should be revised to address these changes.

Reference: Conference proposal 172.

27. Section 23.253 is amended by revising paragraphs (a) and (b) introductory text to read as follows:

§ 23.253 High speed characteristics.

* * * * *

(a) Operating conditions and characteristics likely to cause inadvertent speed increases (including upsets in pitch and roll) must be simulated with the airplane trimmed at any likely speed up to V_{MO}/M_{MO}. These conditions and characteristics include gust upsets, inadvertent control movements, low stick force gradients in relation to control friction, passenger movement, leveling off from climb, and descent from Mach to airspeed limit altitude.

(b) Allowing for pilot reaction time after occurrence of the effective inherent or artificial speed warning specified in § 23.1303, it must be shown that the airplane can be recovered to a normal attitude and its speed reduced to V_{MO}/M_{MO}, without—

* * * * *

Explanation: The FAA is proposing to expand the trim condition specified in paragraph (a) from "any likely cruise speed" to "any likely speed". This encompasses the descent trim condition. It was the conference consensus that this change should be made.

The proposal to revise paragraph (b) would specify that the speed warning is that stated in § 23.1303. It was the conference consensus that this proposal was needed for clarity.

Reference: Conference proposals 173 and 174.

28. Section 23.305 is amended by revising paragraph (b) to read as follows:

§ 23.305 Strength and deformation.

* * * * *

(b) The structure must be able to support ultimate loads without failure for at least three seconds, except local failures or structural instabilities between limit and ultimate load are acceptable only if the structure can sustain the required ultimate load for at least three seconds. However, when proof of strength is shown by dynamic tests simulating actual load conditions, the three second limit does not apply.

Explanation: This proposal clarifies the FAA's interpretation of failure during static ultimate load test. Using existing § 23.305, the test is a failure if a part or component fails (e.g., a rivet) beyond limit load but below ultimate load during a static ultimate load test. Using a more liberal interpretation, a failure or structural instability between limit and ultimate load is acceptable as long as the entire structure demonstrates the capability to carry ultimate load for three seconds. This proposal clarifies this disparity but is not intended to relieve the requirement for deflection shown in § 23.301(c) or § 23.305(a). The intent of this proposal was unopposed at the conference.

Reference: Conference proposal 178.

29. Section 23.307 is amended by redesignating existing paragraph (b) as paragraph (c); and by adding a new paragraph (b) to read as follows:

§ 23.307 Proof of structure.

* * * * *

(b) In order to minimize the possibility of any structure being under strength, the results obtained from required substantiating load tests conducted instead of analysis, or at load levels not substantiated by analysis, must be corrected using material correction factors to account for—

(1) Differences between the mechanical properties of the test article and the guaranteed minimum design mechnical properties defined in § 23.615; and

(2) Dimensional variations of the test article from the minimum construction dimensions listed in the type design.

* * * * *

Explanation: This proposal recommends a new requirement to correct structural test results for material correction factors. There were four conference proposals directed toward § 23.307. This proposal was developed from conference proposal 179.

Conference proposal 179 recommends that the results of strength tests be corrected to account for departures from the mechanical properties and dimensions assumed in the design calculations. In support of conference proposal 179, the submitter contends that variations in mechanical properties are accounted for during structural analysis by careful selection of design values to assure that the probability of structure being under strength because of material variations is sufficiently remote, as required by existing § 23.613(b). The submitter states that when the manufacturer elects to demonstrate compliance with the strength requirements of part 23 by testing, it becomes equally necessary to account for material variations. The submitter contends that correction of test results is necessary to ensure a correct interpretation of that test. The submitter states that similar requirements exist in part 25.

Several commenters disagreed with the proposal. One commenter pointed out that existing part 25 excludes redundant-type structure. The commenter noted that, from a practical sense, in redundant-type structural testing, it would be difficult to identify the failure sequence and then apply the proper correction factors, especially in light of the different modes of failure. That commenter also noted that corrections for dynamic tests would be difficult.

Another commenter also contended that part 25 excludes redundant-type structure. The commenter stated that it would be difficult to decide what correction factor to apply because such factors would be different for each member of the structure. Also, the correction factor would be different for each failure mode; e.g., tensile, shear, or buckling. The commenter asserted that the problem is compounded when trying to determine what failure occurs first in order to determine what correction factor to apply.

Another commenter referred to a letter sent by that commenter to the FAA in response to solicitation for comments on a proposed advisory circular on the subject of material correction factors. Although the letter was not read into the record at the conference, pertinent portions of that letter are presented here. In that letter, the commenter contended that no predictable procedure exists to apply load correction ratios and that such a proposal indicates FAA's belief that mill tolerance standards for contemporary aircraft are inadequate. In the letter, the commenter stated that such a position is unfounded based on long experience of previously tested airplanes. The commenter further pointed out that CAR 3.174 was not changed when it was recodified into § 23.307 and contended that policy material related to CAR 3.174 is still pertinent to § 23.307. The commenter argued that the FAA should reissue the policy related to CAR 3.174.

Note: For clarification to the reader, the referenced policy material (CAM 3.174–1(b)) is provided as part of the analysis section below.

Another commenter contended that there are very rigid procedures for quality control and that adoption of conference proposal 179 would be, in effect, showing a lack of confidence in assuming that the item does, in fact, conform to the drawings.

Two other commenters agreed that there is no rational way to correct for material variability and that dimensional variability was part of the quality control system.

Two commenters supported the proposal and voiced support for the draft advisory circular titled "Material Correction Factors Notice of Availability, published in the **Federal Register** (49 FR 4299; February 3, 1984). That draft AC has been withdrawn by the FAA, as published in the **Federal Register** (51 FR 468; January 6, 1986), in part, because of lack of a regulatory basis.

FAA Analysis—A review of the regulatory history relating to material correction factors follows.

CAR 04.3021 stated, in pertinent part, that when a unit other than the specific one tested is incorporated in the airplane presented for certification, the results of strength tests shall be reduced to correspond to the minimum guaranteed mechanical properties of material specified in the drawings, unless the loads are carried at least 15 percent beyond the required values.

CAR 3 did not contain the above requirement, but CAM 3 did contain the following policy:

"CAM 3.174–1(b) In cases of static or dynamic tests of structural components, no material correction factor is required. The manufacturer, however, should use care to see that the strength of the component tested conservatively represents the strength of subsequent similar components to be used on aircraft to be presented for certification. The manufacturer should, in addition, include in his report of tests of major structural components, a statement substantially as follows:

"The strength properties of materials and dimensions of parts used in the structural component(s) tested are such that subsequent components of these types used in aircraft presented for certification will have strengths substantially equal to or exceeding the strengths of the components tested."

Part 23 does not contain a specific requirement for material correction factors. However, the following requirement is contained in current § 23.615 Design properties:

§ 23.615(c) Material correction factors for structural items such as sheets, sheet-stringer combinations, and riveted joints, may be omitted if sufficient test data is obtained to allow a probability analysis showing that 90 percent or more of the elements will equal or exceed allowable design values.

The current related transport airplane requirement is included herein for comparison.

§ 25.307(d) When static or dynamic tests are used to show compliance with the requirements of § 25.305(b) for flight structures, appropriate material correction factors must be applied to the test results, unless the structure, or part thereof, being tested has features such that a number of elements contribute to the total strength of the structure and the failure of one element results in the redistribution of the load through alternate load paths.

Post conference analysis indicates that the FAA has approved various testing techniques for showing compliance with the requirements of existing § 23.307 or its predecessors. One technique involves incrementally increasing and releasing the load while monitoring deflection to determine when permanent deformation occurs, then increasing the load incrementally, holding each increment for three seconds, until failure occurs. Such a technique is used to define the values of limit load; i.e., the highest load carried before the structure suffers permanent deformation, and ultimate load; i.e., the highest load held by the structure for three seconds prior to failure.

Such testing techniques, without material correction factors to account for variations in material strength and dimensional variations, take advantage of the variation in material properties inherent in the material itself and can result in tested strengths higher than those expected on production articles. For single load path structures where the design "A" values of MIL–HDBK–5 are appropriate, there is a 95 percent confidence level that 99 percent of the articles will fail at a load higher than the design value. The chance of a component failing during testing below the design value is roughly one out of one hundred. As incremental increases in load are applied to the structure, the probability of failure increases, but the design "A" value is compromised. The incremental increases in load tend to test the probability of the material strength values, not the structure. For redundant structure, the 95 percent confidence level for a material being below the design "B" value is 90 percent. In multi-load path (redundant) structure, the chance of success is 90 out of 100 for each component. If the structure consists of 100 articles, the argument can be made that 10 may be under strength.

Historically, aluminum structure has met close dimensional mill tolerances and has had material properties test results provided to the airframe manufacturer by the metal manufacturer. The current use of advanced composite materials places the airframe manufacturer in the posture of manufacturing the material as well as fabricating the part. Variations in both the dimensions and the material properties for these articles tend to be greater than those of metal structures. These variations can become critical during substantiation testing.

The FAA recognizes that past structural testing practices have produced structures demonstrating a sound safety record. In addition, the agency has never set tolerance limits on the dimensions used in the type design. However, it is the FAA's position that some accounting for material variability is appropriate. The FAA offers the proposed rule to solicit public comment to better determine the need for, and the definition of, a requirement to account for the variability of dimensions and material properties for mill fabricated metals and airframe manufacturer fabricated composite materials.

Reference: Conference proposals 179, 180, 181, and 182.

30. Section 23.321 is amended by revising paragraph (b) introductory text to read as follows:

§ 23.321 General.

* * * * *

(b) Considering compressibility effects at each speed, compliance with the flight load requirements of this subpart must be shown—

* * * * *

Explanation: This proposal recommends that the effects of compressibility on flight loads be considered at each speed within the envelope. There were three conference proposals directed toward § 23.321. This proposal is developed from nearly identical conference proposals 183 and 185.

Currently, part 23 does not specifically require consideration of the effects of compressibility on airplane flight loads, even though several small airplanes have configurations and flight envelopes where compressibility effects are significant. This proposal requires that the effects of compressibility be considered throughout the flight envelope.

Two commenters objected to conference proposal 183 because it did not specifically define a minimum speed below which compressibility effects did not need to be considered. Both commenters noted that during the FAA sponsored Airframe Policy and Program Review (October 28, 1983), the FAA intended to initiate a study to define such a speed value.

Another commenter did not object to revising § 23.321 to consider compressibility, but that commenter did disagree with the statement in conference proposal 183 requiring consideration at every speed within the envelope, even down to slow speeds.

It was the conference consensus that compressibility should be considered when significant; however, most commenters contended that the FAA should promulgate a minimum airspeed below which the effects of compressibility could be disregarded.

One commenter argued that the FAA had set a precedent relative to a minimum airspeed for consideration of compressibility in the existing flutter requirements of § 23.629(d)(1) by limiting the simplified flutter criteria to below Mach .6 above 14,000 feet. (See proposed change to 23.629.)

One commenter differentiated between the free-stream Mach number of the airplane and the Mach number of the airflow over certain local areas on the airfoil. That commenter noted that a definite minimum Mach number would be convenient, but not necessarily accurate for all conditions or for all airplanes.

Another commenter noted that the compressibility effect at 60 knots could obviously be considered insignificant; therefore, that commenter argued that in such a case compressibility had been considered and compliance with the proposed rule could be shown without extensive analysis.

Post conference review indicates that consideration of compressibility will vary with the particular airfoil and wing chosen, the airplane configuration, and the operational envelope of the airplane. The FAA does not agree that the airspeed value in § 23.629, which limits the use of simplified flutter criteria, is pertinent to this issue.

Conference consensus was that significant effects of compressibility must be accounted for. The FAA does not agree that a firm number should be placed in the regulations to define when compressibility becomes significant since compressibility effects become significant based on the nature of aerodynamics.

The FAA recognizes that most small airplanes will not require significant adjustments of flight loads due to compressibility effects. When data shows that compressibility effects are insignificant and, if the certification authority agrees, then the effects of compressibility will have been

considered and the intent of this proposed rule change is met.

Conference proposal 184 recommends that § 23.321 include provisions for a structural reserve fuel condition yielding inertia relief based on wing fuel quantities chosen by the manufacturer and approved by the certificating authority. Conference proposal 184 is directed at airplanes having maximum takeoff weights above 6,000 lbs. and proposes reductions in design load factors used for the structural reserve fuel condition from 100 percent to 90 percent of the maneuvering load factor and to 85 percent of the gust load factor.

In support of conference proposal 184, the submitter contends that the structural reserve fuel condition is missing from part 23, and conference proposal 184 is submitted to provide information to manufacturers wishing to adopt such a condition. The submitter offers no reason as to why conference proposal 184 is restricted to weights over 6,000 lbs. and explains that the new loads criteria is provided as a backstop to limit the inertia relief the applicant could gain by adopting a structural reserve condition. Without those limits, the submitter contends that the inertia relief would be fairly unlimited. The submitter confirms that, regardless of the reserve fuel relief, the basic structure must carry .9 times a positive maneuvering load factor and .85 gust velocity without consideration of fuel and assuming that the airplane is at the maximum weight.

One commenter stated that conference proposal 184 was not needed. That commenter contended that the general paragraph under loads (§ 23.301(b)) already requires load distribution to conservatively approximate or closely represent actual conditions and that if the design resulted in a limitation on the airplane due to a zero fuel condition, part 23 addresses that condition.

It was also noted at the conference that conference proposal 184 is similar to part 25. One commenter suggested adoption of the relevant section of part 25, while another commenter opposed the inclusion of part 25 on this subject.

Post conference review indicates that § 23.25 defines a minimum weight as not more than the sum of the empty weight, the minimum crew and a minimum amount of fuel specified therein. This minimum weight is the lowest weight at which compliance with each applicable requirement of part 23 is shown. Sections 23.301 and 23.625 discuss loads "distributed to conservatively approximate or closely represent actual conditions" or "any condition of operation in the V–n envelope" respectively.

The intent of part 23 is to assure safe design under all possible loading conditions within the design envelope. If a critical fuel loading condition can exist during normal operation, it should be accounted for in the design. Part 25 defines minimum weight differently and allows for fuel management limitations.

Reference: Conference proposals 183, 184, and 185.

31. Section 23.361 is amended by revising paragraphs (a) introductory text, (a)(2), and (c) introductory text to read as follows:

§ 23.361 Engine torque.

(a) Each engine mount and its supporting structure must be designed for the effects of—

* * * * *

(2) A limit engine torque corresponding to maximum continuous power and propeller speed acting simultaneously with the limit loads from flight condition A of § 23.333(d); and

* * * * *

(c) The limit engine torque to be considered under paragraph (a) of this section must be obtained by multiplying the mean torque by a factor of—

* * * * *

Explanation: This proposal revises § 23.361 to correct an unintended change introduced to part 23 at amendment 23–26, which significantly reduced the structural design torque levels necessary to be considered in conjunction with flight conditions at takeoff power. The intent is that the torque factors of paragraph (c) apply to all of paragraph (a).

This proposal is based on conference proposal 193 and was accepted without objection at the conference.

Reference: Conference proposal 193.

32. Section 23.369 is amended by revising the heading to read as follows:

§ 23.369 Rear lift truss.

* * * * *

Explanation: This proposal changes the title of § 23.369 by eliminating the phrase "Special conditions for" at the beginning of the title block. The content of § 23.369 remains unchanged.

Conference proposal 196 proposes to delete § 23.369 in its entirety because the submitter contended that there has been little interest in externally braced wings with a rear lift truss for the past 30 years. One commenter agreed.

The FAA has determined that the requirements of § 23.369 are valid and continue to be appropriate for part 23. However, the FAA has concluded that the term "special condition" should be limited to those design features set forth in § 21.16 and should not be used to describe requirements for existing designs.

Reference: Conference proposal 196.

33. Section 23.371 is amended by revising the heading and the introductory text of this section to read as follows:

§ 23.371 Gyroscopic and aerodynamic loads.

For turbine-powered airplanes, each engine mount and its supporting structure must be designed for the gyroscopic and aerodynamic loads that result, with the engines at maximum continuous r.p.m., under either of the following conditions:

* * * * *

Explanation: This proposal includes the aerodynamic loads in the design of the engine mount in addition to the gyroscopic loads currently required by § 23.371.

Conference proposal 197 recommends that a specific requirement be added to part 23 to account for N_p propeller loads when designing the engine mount and its supporting structure. Conference proposal 197 specifically excludes propellers having diameters of nine feet or less and recommends accounting for the component of the propeller lift vector, on large diameter propellers, that is perpendicular to the propeller rotation axis that develops during large pitch or yaw angles.

Discussion at the conference centered around the specific wording of the proposal, the definition of "large" angles of pitch and yaw, and whether the FAA should establish a specific propeller size (like a diameter of nine feet) to define when such aerodynamic loads become critical.

Post conference review indicates that Advisory Circular AC 20–66 entitled *Vibration Evaluation of Aircraft Propellers* makes subjective statements on propeller vibration for propellers whose diameter is above or below 13 feet. British Civil Airworthiness Requirements (BCAR) Chapter K3–4 addresses asymmetric flow through the propeller disc and states that such effects are relatively small and may be discounted on propellers having diamaters of nine feet or less.

The aerodynamic loads specified in this proposal include asymmetric flow through the propeller disc as well as other aerodynamically induced loads needed to design the engine mount and supporting structure. The FAA does not intend to establish a specific propeller diameter boundary below which such effects can be ignored.

Reference: Conference proposal 197.

34. Section 23.397(b) is amended by removing the words "130 pounds" in the last line of the table and inserting the words "150 pounds" in its place.

Explanation: This proposal increases the minimum rudder force shown in the last line of the table of § 23.397(b) from 130 pounds to 150 pounds to make it compatible with the "strength of pilots" limits shown in § 23.143.

There are two conference proposals directed at § 23.397. This proposal was developed from conference proposal 200. Conference proposal 199 was withdrawn at the conference. Conference proposal 200 was accepted at the conference without comment or opposition.

Reference: Conference proposal 200. Conference proposal 199 was withdrawn at the conference.

35. Section 23.415 is amended by adding a new paragraph (c) to read as follows:

§ 23.415 Ground gust conditions.

* * * * *

(c) The tie-down attachment fittings and the surrounding structure must be designed for limit load conditions resulting from wind speeds up to 65

knots horizontally from any direction for the weight determined to be critical for tie-down.

Explanation: This proposal revises § 23.415 to add requirements defining airplane tie-down loads, includes design criteria for attachment fittings and surrounding structure and is based on conference proposal 202.

In support of conference proposal 202, the submitter notes that inadvertent damage to primary structure could result if unapproved methods of tie-down were used. The submitter notes that such damage might result in in-flight failures because of undetected damage occurring on the ground and that such tie-down requirements are not currently included in part 23.

Conference proposal 202 recommends that these requirements apply only to airplanes weighing 6,000 lbs. and above. As a result of conference discussion, the proposal was revised to include all small airplanes.

Reference: Conference proposal 202.

36. Section 23.473 is amended by revising paragraph (f) to read as follows:

§ 23.473 Ground load conditions and assumptions.

* * * * *

(f) Energy absorption tests (to determine the limit load factor corresponding to the required limit descent velocities) must be made under § 23.723(a) unless specifically exempted by that section.

* * * * *

Explanation: This proposal revises § 23.473(f) to clarify when an energy absorption test is required. Section 23.723(a) exempts the need for an energy absorption test under certain circumstances and allows for compliance by analysis. Currently, § 23.473(f) states that tests must be made under § 23.723(a).

This proposal is based on comments received from conference proposal 212. At least one commenter stated that there were circumstances when testing was not required even though not specifically defined in § 23.473. The FAA has determined that the proposed change will clarify the intent of § 23.473.

Reference: Conference proposal 212.

37. Section 23.479 is amended by revising paragraphs (b) and (c) to read as follows:

§ 23.479 Level landing conditions.

* * * * *

(b) When investigating landing conditions, the drag components simulating the forces required to accelerate the tires and wheels up to the landing speed (spin-up) must be properly combined with the corresponding instantaneous vertical ground reactions, and the forward-acting horizontal loads resulting from rapid reduction of the spin-up drag loads (spring-back) must be combined with vertical ground reactions at the instant of the peak forward load, assuming wing lift and a tire-sliding coefficient of friction of 0.8. However, the drag loads may not be less than 25 percent of the maximum vertical ground reactions (neglecting wing lift).

(c) In the absence of specific tests or a more rational analysis for determining the wheel spin-up and spring-back loads for landing conditions, the method set forth in appendix D must be used. If appendix D is used, the drag components used for design must not be less than those given by appendix C.

* * * * *

Explanation: This proposal revises § 23.479(c) to add a new requirement to address spring-back loads during the development of ground loads. Additionally, this proposal allows for loads development based on testing or based on a rational analysis other than that referenced in appendix D. This proposal also restricts the minimum values of the drag component if the method referenced in appendix D is used.

Current § 23.479 allows the use of appendix C drag loads even when calculations using the more rational method of appendix D results in higher drag loads. According to the submitter, conference proposal 213 was intended to require the use of the more rational appendix D loads when those loads were higher than those of appendix C.

One commenter opposed conference proposal 213 in favor of conference proposal 513. That commenter, who also was the submitter of conference proposal 513, contended that conference proposal 513 is more appropriate and more clarifying because it addresses spring-back loads. That commenter contended that spring-back loads were addressed in CAR 3 but were omitted during part 23 recodification. That commenter correctly pointed out that current § 23.479 addresses only spin-up loads and does not address the springback condition.

FAA analysis of this proposal indicates that during normal landings, the landing gear develops aft loads caused by the acceleration of the wheel and tire from some initial rotational velocity in flight (usually zero) to the rotational velocity of the rolling tire, on the ground, at landing speed. During initial impact, energy is stored as deflection in the structure of the landing gear and also as kinetic energy of the wheel and tire. The resulting aft load is usually referred to as the spin-up load.

Spring-back is the forward acting load occurring the instant after the wheel and tire come up to speed and is the combination of loads created by the inertia of the wheel and tire and the loads caused by the elastic forward rebound of the landing gear structure. These spring-back loads are more likely to become critical on airplanes having large diameter wheels (high angular inertias) or high landing speeds.

The FAA has, and continues to accept, testing methods where the drag loads related to the spin-up condition were simulated by dropping a landing gear having a stationary (zero angular velocity) wheel and tire onto an inclined plane. This test method does not accurately predict the spring-back loads because it constrains the forward motion of the gear. Further, it does not fully account for the spring-back condition although some forward load develops due to elastic forward rebound of the landing gear structure. This test method would no longer be accepted if the proposed amendment is adopted.

Another accepted testing method consists of pre-rotating the tire in the reverse direction prior to dropping the gear on a flat surface. This method does not constrain the forward motion of the landing gear and more closely simulates the dynamics of the landing condition. Loads measured on, and analysis based on, such tests provide more rational approaches to loads development. This test method would continue to be accepted if the proposed amendment is adopted.

Reference: Conference proposals 213 and 513.

38. Section 23.485 is amended by adding a new paragraph (d) to read as follows:

§ 23.485 Side load conditions.

* * * * *

(d) The side loads prescribed in paragraph (c) of this section are assumed to be applied at the ground contact point and the drag loads may be assumed to be zero.

Explanation: This proposal clarifies the location and combination of loads. The proposal was unopposed at the conference.

Reference: Conference proposal 214.

39. Section 23.521 is amended by revising paragraphs (b) and (c) to read as follows:

§ 23.521 Water load conditions.

* * * * *

(b) Unless the applicant makes a rational analysis of the water loads, §§ 23.523 through 23.537 apply.

(c) Floats previously approved by the FAA may be installed on airplanes that are certificated under this part, provided that the floats meet the criteria of paragraph (a) of this section.

Explanation: This proposal and those proposing new §§ 23.523, 23.525, 23.527, 23.529, 23.531, 23.533, 23.535, 23.537 and a new appendix H are intended to incorporate a complete set of requirements for water loads into part 23. Currently, part 23 refers to requirements listed in ANC-3 and incorporates by reference many sections of part 25. ANC-3 is no longer in print and the FAA proposes that part 23 be a stand-alone regulation relative to seaplane or amphibian certification. These proposed changes are developed from conference proposal 519 and were accepted with only editorial comments from the conference attendees.

Reference: Conference proposal 519.

40. A new § 23.523 is added under the heading "Water Loads" to read as follows:

§ 23.523 Design weights and center of gravity positions.

(a) *Design weights.* The water load requirements must be met at each operating weight up to the design landing weight except that, for the takeoff condition prescribed in § 23.531, the design water takeoff weight (the maximum weight for water taxi and takeoff run) must be used.

(b) *Center of gravity positions.* The critical centers of gravity within the limits for which certification is requested must be considered to reach maximum design loads for each part of the seaplane structure.

Explanation: See proposal for § 23.521.

Reference: See proposal for § 23.521.

41. A new § 23.525 is added under the heading "Water Loads" to read as follows:

§ 23.525 Application of loads.

(a) Unless otherwise prescribed, the seaplane as a whole is assumed to be subjected to the loads corresponding to the load factors specified in § 23.527.

(b) In applying the loads resulting from the load factors prescribed in § 23.527, the loads may be distributed over the hull or main float bottom (in order to avoid excessive local shear loads and bending moments at the location of water load application) using pressures not less than those prescribed in § 23.533(b).

(c) For twin float seaplanes, each float must be treated as an equivalent hull on a fictitious seaplane with a weight equal to one-half the weight of the twin float seaplane.

(d) Except in the takeoff condition of § 23.531, the aerodynamic lift on the seaplane during the impact is assumed to be ⅔ of the weight of the seaplane.

Explanation: See proposal for § 23.521.

Reference: See proposal for § 23.521.

42. A new § 23.527 is added under the heading "Water Loads" to read as follows:

§ 23.527 Hull and main float load factors.

(a) Water reaction load factors n_w must be computed in the following manner:

(1) For the step landing case

$$n_w = \frac{C_1 V_{SO}^2}{(\text{Tan}^{2/3}\beta)\, W^{1/3}}$$

(2) For the bow and stern landing cases

$$n_w = \frac{C_1 V_{SO}^2}{(\text{Tan}^{2/3}\beta)\, W^{1/3}} \times \frac{K_1}{(1+r_x^2)^{2/3}}$$

(b) The following values are used:

(1) n_w = water reaction load factor (that is, the water reaction divided by seaplane weight).

(2) C_1 = empirical seaplane operations factor equal to 0.012 (except that this factor may not be less than that necessary to obtain the minimum value of step load factor of 2.33).

(3) V_{SO} = seaplane stalling speed in knots with flaps extended in the appropriate landing position and with no slipstream effect.

(4) β = Angle of dead rise at the longitudinal station at which the load factor is being determined in accordance with figure 1 of appendix H of this part.

(5) W = seaplane design landing weight in pounds.

(6) K_1 = empirical hull station weighing factor, in accordance with figure 2 of appendix H of this part.

(7) r_x = ratio of distance, measured parallel to hull reference axis, from the center of gravity of the seaplane to the hull longitudinal station at which the load factor is being computed to the radius of gyration in pitch of the seaplane, the hull reference axis being a straight line, in the plane of symmetry, tangential to the keel at the main step.

(c) For a twin float seaplane, because of the effect of flexibility of the attachment of the floats to the seaplane, the factor K_1 may be reduced at the bow and stern to 0.8 of the value shown in figure 2 of appendix H of this part. This reduction applies only to the design of the carrythrough and seaplane structure.

Explanation: See proposal for § 23.521.

Reference: See proposal for § 23.521.

43. A new § 23.529 is added under the heading "Water Loads" to read as follows:

§ 23.529 Hull and main float landing conditions.

(a) *Symmetrical step, bow, and stern landing.* For symmetrical step, bow, and stern landings, the limit water reaction load factors are those computed under § 23.527. In addition—

(1) For symmetrical step landings, the resultant water load must be applied at the keel, through the center of gravity, and must be directed perpendicularly to the keel line;

(2) For symmetrical bow landings, the resultant water load must be applied at the keel, one-fifth of the longitudinal distance from the bow to the step, and must be directed perpendicularly to the keel line; and

(3) For symmetrical stern landings the resultant water load must be applied at the keel, at a point 85 percent of the longitudinal distance from the step to the stern post, and must be directed perpendicularly to the keel line.

(b) *Unsymmetrical landing for hull and single float seaplanes.* Unsymmetrical step, bow, and stern landing conditions must be investigated. In addition—

(1) The loading for each condition consists of an upward component and a side component equal, respectively, to 0.75 and 0.25 tan β times the resultant load in the corresponding symmetrical landing condition; and

(2) The point of application and direction of the upward component of the load is the same as that in the symmetrical condition, and the point of application of the side component is at the same longitudinal station as the upward component but is directed inward perpendicularly to the plane of symmetry at a point midway between the keel and chine lines.

(c) *Unsymmetrical landing; twin float seaplanes.* The unsymmetrical loading consists of an upward load at the step of each float of 0.75 and a side load of 0.25 tan β at one float times the step landing load reached under § 23.527. The side load is directed inboard, perpendicularly to the plane of symmetry midway between the keel and chine lines of the float, at the same longitudinal station as the upward load.

Explanation: See proposal for § 23.521.

Reference: See proposal for § 23.521.

44. A new § 23.531 is added under heading "Water Loads" to read as follows:

§ 23.531 Hull and main float takeoff condition.

For the wing and its attachment to the hull or main float—

(a) The aerodynamic wing lift is assumed to be zero; and

(b) A downward inertia load, corresponding to a load factor computed from the following formula, must be applied:

$$n = \frac{C_{TO}\, V_{S1}^2}{(\text{Tan}^{2/3}\beta)\, W^{1/3}}$$

where—

n = inertia load factor;

C_{TO} = empirical seaplane operations factor equal to 0.004;

V_{S1} = seaplane stalling speed (knots) at the design takeoff weight with the flaps extended in the appropriate takeoff position;

β = angle of dead rise at the main step (degrees); and
W = design water takeoff weight in pounds.

Explanation: See proposal for § 23.521.

Reference: See proposal for § 23.521.

45. A new § 23.533 is added under the heading "Water Loads" to read as follows:

§ 23.533 Hull and main float bottom pressures.

(a) *General.* The hull and main float structure, including frames and bulkheads, stringers, and bottom plating, must be designed under this section.

(b) *Local pressures.* For the design of the bottom plating and stringers and their attachments to the supporting structure, the following pressure distributions must be applied:

(1) For an unflared bottom, the pressure at the chine is 0.75 times the pressure at the keel, and the pressures between the keel and chine vary linearly, in accordance with figure 3 of appendix H of this part. The pressure at the keel (p.s.i.) is computed as follows:

$$P_k = C_2 \times \frac{K_2 V_{s1}^2}{Tan\ \beta_k}$$

where—

P_k = pressure (p.s.i.) at the keel;
C_2 = 0.00213;
K_2 = hull station weighing factor, in accordance with figure 2 of Appendix H of this part;
V_{s1} = seaplane stalling speed (knots) at the design water takeoff weight with flaps extended in the appropriate takeoff position; and
β_k = angle of dead rise at keel, in accordance with figure 1 of Appendix H of this part.

(2) For a flared bottom, the pressure at the beginning of the flare is the same as that for an unflared bottom, and the pressure between the chine and the beginning of the flare varies linearly, in accordance with figure 3 of appendix H of this part. The pressure distribution is the same as that prescribed in paragraph (b)(1) of this section for an unflared bottom except that the pressure at the chine is computed as follows:

$$P_{ch} = C_3 \times \frac{K_2 V_{s1}^2}{Tan\ \beta}$$

where—

P_{ch} = pressure (p.s.i.) at the chine;
C_3 = 0.0016;
K_2 = hull station weighing factor, in accordance with figure 2 of Appendix H of this part;
V_{s1} = seaplane stalling speed (knots) at the design water takeoff weight with flaps extended in the appropriate takeoff position; and
β = angle of dead rise at appropriate station.

The area over which these pressures are applied must simulate pressures occurring during high localized impacts on the hull or float, but need not extend over an area that would induce critical stresses in the frames or in the overall structure.

(c) *Distributed pressures.* For the design of the frames, keel, and chine structure, the following pressure distributions apply:

(1) Symmetrical pressures are computed as follows:

$$P = C_4 \times \frac{K_2 V_{s0}^2}{Tan\ \beta}$$

where—

P = pressure (p.s.i.);
C_4 = 0.078 C_1 (with C_1 computed under § 23.527);
K_2 = hull station weighing factor, determined in accordance with figure 2 of Appendix H of this part;
V_{s0} = seaplane stalling speed (knots) with landing flaps extended in the appropriate position and with no slipstream effect; and
β = angle of dead rise at appropriate station.

(2) The unsymmetrical pressure distribution consists of the pressures prescribed in paragraph (c)(1) of this section on one side of the hull or main float centerline and one-half of that pressure on the other side of the hull or main float centerline, in accordance with figure 3 of appendix H of this part.

These pressures are uniform and must be applied simultaneously over the entire hull or main float bottom. The loads obtained must be carried into the sidewall structure of the hull proper, but need not be transmitted in a fore and aft direction as shear and bending loads.

Explanation: See proposal for § 23.521.

Reference: See proposal for § 23.521.

46. A new § 23.535 is added under the heading "Water Loads" to read as follows:

§ 23.535 Auxiliary float loads.

(a) *General.* Auxiliary floats and their attachments and supporting structures must be designed for the conditions prescribed in this section. In the cases specified in paragraphs (b) through (e) of this section, the prescribed water loads may be distributed over the float bottom to avoid excessive local loads, using bottom pressures not less than those prescribed in paragraph (g) of this section.

(b) *Step loading.* The resultant water load must be applied in the plane of symmetry of the float at a point three-fourths of the distance from the bow to the step and must be perpendicular to the keel. The resultant limit load is computed as follows, except that the value of L need not exceed three times the weight of the displaced water when the float is completely submerged:

$$L = \frac{C_5 V_{s0}^2 W^{2/3}}{Tan^{2/3}\beta_s (1+r_y^2)^{2/3}}$$

where—

L = limit load (lbs.);
C_5 = 0.0053;
V_{s0} = seaplane stalling speed (knots) with landing flaps extended in the appropriate position and with no slipstream effect;
W = seaplane design landing weight in pounds;
β_s = angle of dead rise at a station ¾ of the distance from the bow to the step, but need not be less than 15 degrees; and
r_y = ratio of the lateral distance between the center of gravity and the plane of symmetry of the float to the radius of gyration in roll.

(c) *Bow loading.* The resultant limit load must be applied in the plane of symmetry of the float at a point one-fourth of the distance from the bow to the step and must be perpendicular to the tangent to the keel line at that point. The magnitude of the resultant load is that specified in paragraph (b) of this section.

(d) *Unsymmetrical step loading.* The resultant water load consists of a component equal to 0.75 times the load specified in paragraph (a) of this section and a side component equal to 3.25 tanβ times the load specified in paragraph (b) of this section. The side load must be applied perpendicularly to the plane of symmetry of the float at a point midway between the keel and the chine.

(e) *Unsymmetrical bow loading.* The resultant water load consists of a component equal to 0.75 times the load specified in paragraph (b) of this section and a side component equal to 0.25 tanβ times the load specified in paragraph (c) of this section. The side load must be applied perpendicularly to the plane of symmetry at a point midway between the keel and the chine.

(f) *Immersed float condition.* The resultant load must be applied at the centroid of the cross section of the float at a point one-third of the distance from the bow to the step. The limit load components are as follows:

vertical = $\rho g V$
aft = $C_x \rho_2 V^{2/3} (KV_{s0})^2$
side = $C_y \rho_2 V^{2/3} (KV_{s0})^2$

where—

ρ = mass density of water (slugs/ft.^{3})
V = volume of float (ft.^{3});
C_x = coefficient of drag force, equal to 0.133;

C_v = coefficient of side force, equal to 0.106;
K = 0.6, except that lower values may be used if it is shown that the floats are incapable of submerging at a speed of 0.8 V_{so} in normal operations;
V_{so} = seaplane stalling speed (knots) with landing flaps extended in the appropriate position and with no slipstream effect; and
g = acceleration due to gravity (ft/sec²).

(g) *Float bottom pressures.* The float bottom pressures must be established under § 23.533, except that the value of K_2 in the formulae may be taken as 1.0. The angle of dead rise to be used in determining the float bottom pressures is set forth in paragraph (b) of this section.

Explanation: See proposal for § 23.521.

Reference: See proposal for § 23.521.

47. A new § 23.537 is added under the heading "Water Loads" to read as follows:

§ 23.537 Seawing loads.

Seawing design loads must be based on applicable test data.

Explanation: See proposal for § 23.521.

Reference: See proposal for § 23.521.

48. A new § 23.573 is added under the heading "Water Loads" to read as follows:

§ 23.573 Damage tolerance and fatigue evaluation of structure.

Instead of complying with §§ 23.571 and 23.572 of this part, the applicant must evaluate composite airframe structure, the failure of which would result in catastrophic loss of the airplane in each wing (including canards, tandem wings, and winglets), empennage, their carrythrough and attaching wing structure, and/or pressure cabin, using the damage-tolerance criteria prescribed in paragraphs (b) through (j) of this section unless shown to be impractical. If the applicant establishes that damage-tolerance criteria is impractical for a particular structure, the aforementioned structure must be evaluated in accordance with the criteria of paragraphs (b) and (k) of this section. Where bonded joints are used, the structure must also be evaluated in accordance with paragraph (i) of this section.

(a) Metallic structure must be approved by using either the fail-safe/fatigue strength evaluations of § 23.571 and § 23.572 or by using the damage tolerant criteria of this section.

(b) It must be demonstrated by tests, or by analysis supported by tests, that the structure is capable of carrying ultimate load with impact damage. The level of impact damage considered need not be more than the established threshold of detectability considering the inspection procedures employed.

(c) The growth rate of damage that may occur from fatigue, corrosion, intrinsic defects, manufacturing defects or damage from discrete sources under repeated loads expected in service; i.e., between the time the damage becomes initially detectable and the time at which the extent of damage reaches the value selected by the applicant for residual strength demonstration, must be established by tests or analysis supported by tests.

(d) The damage growth, between initial detectability and the value selected for residual strength demonstrations, factored to obtain inspection intervals, must permit development of an inspection program suitable for application by operation and maintenance personnel.

(e) Instructions for continued airworthiness for the airframe must be established consistent with the results of the damage tolerance evaluations. Inspection intervals must be set so that after the damage initially becomes detectable by the inspection method specified, the damage will be detected before it exceeds the extent of damage for which residual strength is demonstrated.

(f) Loads spectra, load truncation, and the locations and types of damage considered in the damage tolerance evaluations must be documented in test proposals.

(g) The structure of the pressurized cabin must be shown by residual strength tests, or by analysis supported by tests, to be able to withstand the loads listed in subparagraphs (g)(1) and (g)(2) of this section, considered as ultimate loads, with damage consistent with the results of the damage tolerance evaluations.

(1) Critical limit flight loads with the combined effects of normal operating pressures and expected external aerodynamic pressures.

(2) The expected external aerodynamic pressures in 1 g flight combined with a cabin differential pressure without consideration of any other load.

(h) The structure in each wing (including canards, tandem wings, and winglets), empennage, their carrythrough, and attaching structure, including movable control surfaces, whose failure would be catastrophic, must be shown by residual strength tests, or analysis supported by residual strength tests, to be able to withstand critical limit flight loads, considered as ultimate loads, with the extent of damage consistent with the results of the damage tolerance evaluations.

(i) The limit load capacity of each bonded joint critical to safe flight must be substantiated by either of the following methods used singly or in combination:

(1) The maximum disbonds of each bonded joint consistent with the capability to withstand the loads in paragraphs (g) and (h) of this section must be determined by analysis, tests, or both. Disbonds of each bonded joint greater than this must be prevented by design features.

(2) Proof testing must be conducted on each production article that will apply the critical limit design load to each critical bonded joint.

(j) The effects of material variability and environmental conditions; e.g., exposure to temperature, humidity, erosion, ultraviolet radiation, and/or chemicals, on the strength and durability properties of the composite materials, must be accounted for in the damage tolerance evaluations and in the residual strength tests.

(k) For those structures where the damage tolerance method is shown to be impractical, the strength of such structures must be demonstrated by tests, or analysis supported by tests, to be able to withstand the repeated loads of variable magnitude expected in service. Impact damage in composite material components that may occur must be considered in the demonstration. The impact damage level considered must be consistent with detectability by the inspection procedures employed.

(l) Based on evaluations required by this section, inspections or other procedures must be established as necessary to prevent catastrophic failure, and must be included in the Airworthiness Limitations section of the Instructions for Continued Airworthiness required by § 23.1529.

Explanation: This proposal recommends amending part 23 to add a new § 23.573, applicable to composite structure and to provide the applicant the opportunity to use damage-tolerant design as an alternative to the safe-life/fail-safe design philosophies required by §§ 23.571 and 23.572 for metallic structure. This new section proposes a mandatory requirement for composite materials and offers an optional design philosophy for metallic structure.

The initial conference proposal on this subject was essentially a recodification of the pertinent parts of § 25.571 and was predominantly opposed at the conference on the basis that (1) it was an arbitrary insertion of part 25 requirements into part 23; (2) if chosen by the applicant, more stringent part 25 requirements could be used in the

certification basis of a small airplane; and (3) even as an option, the damage-tolerant criteria might later result in a change in part 23 design philosophy.

As a result of conference comments, the proposal was rewritten to remove many of the discrete source damage requirements, the uncontained high energy rotating machinery failure criteria, sonic fatigue requirements, and other criteria not already included in §§ 23.571 and 23.572. The proposal continues to be an option for metallic structure and was rewritten to more closely align with damage-tolerance special conditions applicable to composite structure recently published by the FAA.

In regard to the comment relating to the applicants ability to elect part 25 requirements instead of part 23 requirements, the FAA has further considered this proposal. The FAA recognizes that although adding part 25 requirements to the certification basis of a part 23 airplane may reduce use of the special condition process, this practice is essentially rulemaking without going through the process described in part 11, General Rulemaking Procedures. When there is a need or desire to make such a change in tbe applicable airworthiness requirements, it must be done by using the special condition or exemption procedures of part 11.

Reference: Conference proposal 229.

49. Section 23.613 is amended by revising paragraphs (b) and (c) and by adding paragraphs (d) and (e) to read as follows:

§ 23.613 Material strength properties and design values.

* * * * *

(b) Design values must be chosen to minimize the probability of structural failure due to material variability. Except as provided in paragraph (e) of this section, compliance with this paragraph must be shown by selecting design values that assure material strength with the following probability:

(1) Where applied loads are eventually distributed through a single member within an assembly, the failure of which would result in loss of structural integrity of the component; 99 percent probability with 95 percent confidence.

(2) For redundant structure, in which the failure of individual elements would result in applied loads being safely distributed to other load carrying members; 90 percent probability with 95 percent confidence.

(c) The effects of temperature on allowable stresses used for design in an essential component or structure must be considered where thermal effects are significant under normal operating conditions.

(d) The strength of the structure must minimize the probability of catastrophic fatigue failure, particularly at points of stress concentration.

(e) Design values greater than the guaranteed minimums required by this section may be used where only guaranteed minimum values are normally allowed if a "premium selection" of the material is made in which 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 design.

Explanation: This proposal revises § 23.613 to incorporate into part 23 the probability basis used for establishing material allowables. The probability basis is currently contained in MIL–HDBK–5 and incorporated by reference in §§ 23.613 and 23.615. There are four conference proposals directed at § 23.613. As a result of comments from the participants at the conference, conference proposals 233 through 239, concerning both §§ 23.613 and 23.615, were discussed concurrently. This proposal was developed primarily from conference proposal 233 and would change § 23.613 to state that basis directly, thereby eliminating the need to reference specific publications in the regulations.

A new paragraph (c) is proposed to address the effects of temperature on the strength properties of the materials and a new paragraph (d) similar to existing § 23.627 is proposed to address fatigue strength.

This proposal would make existing § 23.615 redundant, except for the requirements of § 23.615(b), which are being transferred to § 23.613(e) for clarity and for § 23.615(c), the intent of which is contained in the proposed change to § 23.307 included herein. These proposed changes more closely align part 23 with the comparable section proposed as a change to part 25 (Notice 84–21, 49 FR 47358, December 3, 1984).

Conference proposal 234 recommends elimination of paragraph (b) of current § 23.613. As justification, the submitter contends that the requirement of § 23.613(b) duplicates the intent of existing § 23.613 (a) and (c). The term "extremely remote" as used in paragraph 23.613(b) is not statistically defined in FAA terminology.

Conference proposal 235 recommends that paragraph (c) of existing § 23.613 be replaced to eliminate reference to specific design information sources like MIL–HDBK–5 and to add requirements that account for manufacturing practices and processes. The submitter withdrew conference proposal 235 in favor of conference proposal 233.

Conference proposal 236 recommends that paragraph (c) of existing § 23.613 be deleted and that the specific sources of design information listed therein be published as an advisory circular.

Conference proposal 237 recommends that existing § 23.615 be deleted in its entirety to be consistent with conference proposal 233.

Conference proposal 238 recommends including the definitions of "A" and "B" probability values in § 23.615 along with the addition of Joint Airworthiness Requirements (JAR) terminology.

Conference proposal 239 also recommends defining the "A" and "B" probability values in § 23.615, as did conference proposal 238. Conference proposal 239 was withdrawn at the conference in favor of conference proposal 233.

One commenter supported conference proposal 233 based on including conference proposal 234 and the substitution of the wording of existing § 23.627 instead of paragraph (d) of conference proposal 233. **Note:** Conference proposal 243 relates to fatigue requirements and recommended the deletion of existing § 23.627 in its entirety. This commenter proposed to retain the wording of existing § 23.627 instead of the wording recommended in paragraph (d) of conference proposal 233. This position was supported by one other commenter.

Another commenter contended that adoption of conference proposal 233 might be confusing because of the probability and confidence interval requirements. That commenter, as well as several others, suggested that changes made relative to material strength properties and design values should be consistent between parts 23, 25, 27 and 29.

Another commenter supported conference proposal 233 and withdrew conference proposals 235 and 239 in favor of conference proposal 233.

As a result of comments made by the committee chairman, discussion on the meaning of "minimize the probability" (relative to the first sentence in paragraph (b) of conference proposal 233) resulted in the conclusion that the action of selecting design values that assure material strength properties meeting the probabilities listed in paragraph (b), in and of itself defines the term "minimize the probability". Discussion resulted in recommendations that the first sentence of paragraph (b) be deleted. However, further discussion indicated the need to assure consistency between parts 23, 25, 27 and 29. The proposed change to § 23.613 closely agrees with changes currently proposed to § 25.613 (Notice 84–21, 49 FR 47365; December 3, 1984).

Two commenters took exception to the specific wording in paragraph (b) of conference proposal 233. They contended that load does not "eventually distribute" through a member or even "distribute" through a member; the load "concentrates" in a member. These two commenters recommended that the proposed change to § 23.613 be revised to reflect this point and they both voiced support, in general, for conference proposal 233.

One commenter contended that upon adopting conference proposal 233, which eliminated reference to a specific list of publications, it would be appropriate to list those publications (e.g., MIL–HDBK–5) in an advisory circular. This position was supported by one other commenter.

One commenter noted that if conference proposal 237 is accepted and existing § 23.615 is deleted in its entirety, the content of paragraph (c) of existing § 23.615 will be lost. Post conference review indicates that the proposed change to § 23.307 addresses the need for material correction factors.

References: Conference proposals 233 through 239.

§ 23.615 [Removed]

50. Section 23.615 is removed.

Explanation: See proposed change to § 23.613.

Reference: See proposal for § 23.613.

51. Section 23.621 is amended by revising paragraphs (c)(1) and (d) introductory text, and by adding a new paragraph (e) to read as follows:

§ 23.621 Casting factors.

* * * * *

(c) * * *

(1) Each critical casting must either—

(i) Have a casting factor of not less than 1.25 and receive 100 percent inspection by visual, radiographic, and magnetic particle or penetrant inspection methods or approved equivalent nondestructive inspection methods; or

(ii) Have a casting factor of not less than 2.0 and receive 100 percent visual inspection and 100 percent approved nondestructive inspection. When an approved quality control procedure is established and an acceptable statistical analysis supports reduction, nondestructive inspection may be reduced from 100 percent, and applied on a sampling basis.

* * * * *

(d) *Non-critical castings.* For each casting other than those specified in paragraphs (c) or (e) of this section, the following apply:

* * * * *

(e) *Non-structural castings.* Castings used for non-structural purposes do not require evaluation, testing or close inspection.

Explanation: There are three conference proposals directed toward § 23.621. This proposal is in two parts and was developed from conference proposals 241 and 242 respectively. Conference proposal 240 was withdrawn during the conference in favor of conference proposal 241.

The first part of this proposal would provide relief from the 100 percent radiographic inspection requirement for critical castings, when the casting factor is increased to a value not less than 2.0, by no longer specifying a radiographic inspection and allowing the use of any approved nondestructive testing method. Also, for castings having a casting factor of not less than 2.0, the nondestructive inspection may be reduced from 100 percent and applied on a sampling basis if approved quality control procedures are established and acceptable statistical analysis supports the reduction.

Critical structural castings were first addressed in Civil Air Regulation (CAR) 3 by amendment 3–7, effective May 3, 1962, as a result of the first Federal Aviation Agency Airworthiness Review. Prior to amendment 3–7, all castings having a casting factor (then called variability factor) of 2.0 required only a visual inspection. Reduced factors of 1.25 for ultimate load and 1.15 for limit load were allowed if all productive castings were both visually and radiographically inspected. As a result of the airworthiness review, CAR 3 was revised to require all critical castings to have a casting factor of at least 1.25, to require a 100 percent visual, a 100 percent radiographic, a 100 percent magnetic particle inspection, a penetrant inspection, or other approved nondestructive method inspection. Casting factors of 2.0 or higher were not addressed by amendment 3–7. Current § 23.621 requirements are essentially the same as those promulgated by amendment 3–7.

The FAA recognizes that fewer inspections may be necessary for castings manufactured under approved quality controls and/or designed with higher margins. The proposed change to § 23.621 allows for reductions accordingly. The first part of this proposal was developed from conference proposal 241 and was discussed without opposition at the conference.

The second part of this proposal would add a new paragraph (e) *Non-structural castings.* Non-structural castings are not specifically addressed in part 23. One commenter interpreted this to mean that there is no provision for using non-structural castings in airplanes. This proposal clarifies the amount of evaluation, testing, and inspection required for nonstructural castings. This proposal was developed from conference proposal 242 and was discussed without opposition.

Reference: Conference proposals 241 and 242. Conference proposal 240 was withdrawn at the conference.

52. Section 23.629 is amended by revising paragraph (d)(1) and by adding new paragraphs (g) and (h) to read as follows:

§ 23.629 Flutter.

* * * * *

(d) * * *

(1) V_D for the airplane is less than 260 knots (EAS) at altitudes below 14,000 feet and less than Mach 0.5 at altitudes at and above 14,000 feet,

* * * * *

(g) For airplanes showing compliance with the fail-safe criteria of §§ 23.571 and 23.572, the airplane must be shown by analysis to be free from flutter to V_D after fatigue failure, or obvious partial failure of a principle structural element.

(h) For airplanes showing compliance with the damage-tolerance criteria of § 23.573, the airplane must be shown by analysis to be free from flutter with the extent of damage for which residual strength is demonstrated.

Explanation: This proposal adds a subscript "D" following the letter "V" in the first line of existing § 23.629(d)(1) to clarify the airspeed as design dive speed, thereby correcting an inadvertent error introduced in amendment 7 to part 23. The proposal also reduces the Mach number from 0.6 to 0.5 to eliminate a discontinuity between 260 knots (EAS) and Mach number at 14,000 feet.

Finally, the proposal introduces flutter criteria for damaged structure. There are three conference proposals directed at § 23.629. Conference proposal 245 proposes to amend § 23.629(a) by requiring flight flutter testing as the final proof that the airplane is free from flutter, control reversal, and divergence. The proposed flight testing would be in addition to either an analysis or the simplified flutter prevention criteria. Existing § 23.629 allows the applicant to choose either analysis, simplified flutter prevention criteria (if appropriate), flight testing, or a combination of those methods as proof that the airplane is free from flutter, control reversal, and divergence.

In support of conference proposal 245, the submitter contends that flight flutter testing is the most satisfactory way of demonstrating freedom from flutter. Several commenters stated that they were not aware of any recent airplane being initially certificated without some sort of flight flutter testing.

One commenter was concerned that conference proposal 245 would eliminate any choice by the applicant and would require flight flutter tests regardless of the extent of the analysis done on the airplane. That commenter noted that conference proposal 245 would apply to amended type certificates and would require flight flutter tests regardless of whether the changes made were critical to flutter.

The FAA agrees that a properly instrumented flight flutter test program based on reliable analysis and ground testing provides the most accurate proof that a newly designed airplane is free from flutter, control reversal, and divergence. Although flight flutter testing without previous analysis is allowed by the current rule, the FAA recommends that flight flutter tests be conducted only after appropriate analysis has been performed, and then only on properly instrumented airplanes. The FAA recognizes that the risk and scope of flight flutter testing increases significantly when conducted without the benefit of previous analysis and ground testing. Analysis, ground testing, and flight flutter testing in combination are encouraged on new certificates.

In cases where airplanes are being modified and where accurate analysis predicts, by sufficient margins, that the modification would not adversely affect the flutter speed, existing § 23.629 allows approval without flight test. However, conference proposal 245 would require flight test in all cases regardless of the modification, the extent and result of the analysis, or the experience of the applicant. Since adoption of conference proposal 245 would have little impact on new certifications, but could have extensive impact on the cost of modifications, the FAA does not propose changing § 23.629(a).

Conference proposal 246 is directed toward § 23.629(d)(1). The use of simplified flutter prevention criteria is limited by existing § 23.629(d)(1) to airplanes having a design dive speed of no more than 260 knots up to 14,000 feet and Mach 0.6 above 14,000 feet. Conference proposal 246 proposes to amend § 23.629(d)(1) by reducing that maximum speed to 200 knots.

In support of conference proposal 246, the submitter contends that control system failures, even on entirely conventional airplanes, often produce flutter speeds well below 260 knots. During discussion at the conference, the submitter explained the actual intent of conference proposal 246 was to impose the fail-safe flutter requirement of § 23.629(f)(2) to airplanes having design speeds of over 200 knots.

Section 23.629(f)(1) applies to airplanes certificated using the simplified flutter prevention criteria of Airframe and Engineering Report No. 45 and requires freedom from flutter, control reversal, and divergence after failure, malfunction, or disconnection of any single element in any tab control system. Section 23.629(f)(2) applies to all other airplanes and adds primary control systems and flutter dampers to the systems requiring failure demonstration.

Airframe and Engineering Report No. 45, "Simplified Flutter Prevention Criteria" has been used successfully on the certification of conventional airplanes since 1952. The single failure criteria referred to in § 23.629 (f)(1) and (f)(2) became effective in 1978 and as such, does not apply to a large percentage of airplanes currently operating. The FAA has no basis to support conference proposal 246.

Reference: Conference proposals 245 and 246. Conference proposal 244 was deferred for discussion under the issues applicable to the "primary category" airplane.

53. Section 23.655 is amended by revising paragraph (a) to read as follows:

§ 23.655 Installation.

(a) Movable surfaces must be installed so that there is no interference between any surfaces, their bracing, or adjacent fixed structure, when one surface is held in its most critical clearance positions and the others are operated through their full movement.

* * * * *

Explanation: This proposal extends the installation requirements currently applicable only to the tail surfaces to include all control surfaces. Current § 23.655 prohibits interference between movable tail surfaces (e.g. rudder and elevator) when these surfaces are operated throughout their full angular movement. Conference proposal 247 would expand this prohibition to all control surfaces, and proposes a new requirement for control surface clearance from adjacent structure.

One commenter suggested that the proposal would be more general if it addressed movable surfaces rather than control surfaces. That commenter stated that such wording would then apply to movable wings as well as control surfaces. Another commenter expressed the opinion that since the introductory title preceding § 23.651 was "Control Surfaces," any changes placed in § 23.655 would not apply to wings. A third commenter was concerned that interference of control surfaces might occur when one surface was held at some position other than the extreme, while the other is moved. That commenter expressed the concern that some interference might occur at intermediate locations. The proposed addition of a requirement to prohibit interference with adjacent fixed structure was not discussed at the conference.

The FAA has determined that requirements added to § 23.655 should only apply to control surfaces. The FAA has limited experience in the certification of movable wings and has decided that changes to part 23 envisioning such are not appropriate at this time. Administration of existing § 23.655 has produced non-interfering movable tail surfaces, therefore, the wording of the proposal remains similar to existing § 23.655.

Reference: Conference proposal 247.

54. A new § 23.672 is added to read as follows:

§ 23.672 Stability augmentation and automatic and power-operated systems.

If the functioning of stability augmentation or other automatic or power-operated systems is necesssry to show compliance with the flight characteristics requirements of this part, such systems must comply with § 23.671 and the following:

(a) A warning, which is clearly distinguishable to the pilot under expected flight conditions without requiring the pilot's attention, must be provided for any failure in the stability augmentation system or in any other automatic or power-operated system that could result in an unsafe condition if the pilot were not aware of the failure. Warning systems must not activate the control system.

(b) The design of the stability augmentation system or of any other automatic or power-operated system must permit initial counteraction of failures without requiring exceptional pilot skill or strength, by either the deactivation of the system, or a failed portion thereof, or by overriding the failure by movement of the flight controls in the normal sense.

(c) It must be shown that after any single failure of the stability augmentation system or any other automatic or power-operated system—

(1) The airplane is safely controllable when the failure or malfunction occurs at any speed or altitude within the approved operating limitations that is critical for the type of failure being considered;

(2) The controllability and maneuverability requirements of this part are met within a practical operational flight envelope (for example, speed, altitude, normal acceleration, and airplane configuration) that is described in the Airplane Flight Manual; and

(3) The trim, stability, and stall characteristics are not impaired below a level needed to permit continued safe flight and landing.

Explanation: This proposal would provide criteria for approval of those stability augmentation, automatic and power-operated systems whose performance is essential to flight safety. The proposed § 23.672 is similar to § 25.672 and, as in part 25, the warning system requirement relating to control system activation is not intended to preclude installing tactile warning devices, such as control system shakers activated independently for other purposes.

One commenter agreed with the concept of the proposal but suggested that paragraph (c) be rewritten to read, "It must be shown that after any single failure of the stability augmentation system or any other automatic or power-operated system the controllability is not impaired below a level needed to permit continued safe flight and landing." The commenter contended that the purpose of this proposal was to maintain controllability of the airplane, and that replacement of paragraphs (c)(1) and (c)(2) by the suggested paragraph accomplished that purpose.

After consideration of the content of the modified proposal, the FAA has determined that the controllability requirements defined in paragraphs (c)(1) and (c)(2) act to clarify the intent of the proposal. The trim, stability, and stall characteristics of paragraph (c)(3) are not addressed in the commenter's modified proposal. Therefore, the unmodified proposal is presented herein.

Another commenter argued that systems similar to those addressed in this proposal are presently installed on airplanes. The commenter was not aware of any problems on those systems and questioned the need to complicate and increase the cost of certification unless justified by some unsafe condition related to those systems.

A third commenter noted that this proposal was taken verbatim from § 25.672.

Reference: Conference proposal 249.

55. Section 23.679 is revised to read as follows:

§ 23.679 Control system locks.

If there is a device to lock the control system on the ground or water:

(a) There must be a means to—

(1) Automatically disengage the device when the pilot operates the primary flight controls in a normal manner; or

(2) Limit the operation of the airplane so that when the device is engaged, the pilot receives unmistakable warning at the start of the takeoff.

(b) The device must have a means to preclude the possibility of it becoming indavertently engaged in flight.

Explanation: This proposal revises § 23.679 to add a new requirement to either automatically disengage the control system lock when the pilot operates the primary flight controls in the normal manner or to limit the operation of the airplane so that when the lock is engaged, the pilot receives unmistakable warning of this at the start of takeoff. Additionally, this proposal rephrases

the requirement of existing § 23.679(b) from "prevent the lock from engaging in flight" to read "preclude the possibility of the lock becoming inadvertently engaged in flight." Both the existing rule and this proposed change are applicable only if means are provided to lock the control system.

There are three conference proposals directed toward § 23.679. This proposal was developed primarily from conference proposal 253, as corrected at the conference. Conference proposal 252 was withdrawn at the conference in favor of conference proposal 253. Conference proposal 254 was also withdrawn at the conference but was the subject of further discussion after withdrawal.

One commenter stated that the phrase "prevent the lock from engaging in flight" lacked clarity and felt that "inadvertent engagement in flight was more objective.

Several commenters discussed the intent of conference proposal 254, paragraph (b), which would have required that the airplane be designed such that it could not become airborne with the control locks engaged.

Several commenters discussed whether a warning by itself was sufficient instead of restricting takeoff of the airplane, and whether that warning should take place prior to becoming airborne, prior to takeoff roll, or at some earlier time.

One commenter cautioned that should the control lock requirements become too complicated, manufacturers may choose not to install them. The commenter was concerned that operators might then install homemade devices that could remain engaged after takeoff. The commenter stressed that any rule change should simplify methods of compliance and administration.

One commenter asked the FAA to be very cautious when making any changes to the current rule.

Reference: Conference proposal 253. Conference proposals 252 and 254 were withdrawn at the conference.

56. Section 23.729 is amended by revising paragraphs (f)(1) and (f)(2) to read as follows:

§ 23.729 Landing gear extension and retraction system.

* * * * *

(f) * * *

(1) A device that functions continuously when one or more throttles are closed beyond the power settings normally used for landing approach if the landing gear is not fully extended and locked. A throttle stop may not be used in place of an aural device. If there is a manual shutoff for the warning device prescribed in this paragraph, the warning system must be designed so that when the warning has been suspended after one or more throttles are closed, subsequent retardation of any throttle to or beyond the position for normal landing approach will activate the warning device.

(2) A device that functions continuously when the wing flaps are extended beyond the approach flap position, using a normal landing procedure, if the landing gear is not fully extended and locked. There may not be a manual shutoff for this warning device. The flap position sensing unit may be installed at any suitable location. The system for this device may use any part of the system (including the aural warning device) for the device required in paragraph (f)(1) of this section.

Explanation: This proposal revises § 23.729(f) (1) and (2) by changing the power and flap settings necessary to activate the device that warns the pilot that the landing gear is not fully extended and locked. The power setting necessary to activate the warning device is changed from when one or more "throttles are closed" to when one or more "throttles are closed beyond the power settings normally used for landing approach." The flap setting necessary to activate the warning device is changed from "flaps are extended to or beyond the approach flap position" to "flaps are extended beyond the approach flap position."

In a recent certification review of a small, multiengine, turboprop airplane, it was found that 15 percent of the total reported accidents were caused by inadvertent gear-up landings. The basic landing gear warning system was designed to comply with the current CAR and FAR requirements and to function when the throttles were "closed". In review of the accident reports, it was noted that most of the accidents resulted when the airplane was making an approach using instrument procedures that required a modest amount of engine power to maintain the required stabilized approach angle in a high drag configuration. This normally used power and airplane configuration negated the gear warning system, which was designed to function with throttles closed until just before touchdown, thereby rendering it too late to prevent an inadvertent gear-up landing. The proposed revision would require determining the normally used approach configurations, appropriate power conditions and throttle settings necessary to provide a timely warning of inappropriate landing gear position.

There are four conference proposals directed toward § 23.729. This proposal was developed from conference proposals 259 and 260. Conference proposal 261 was withdrawn at the conference and conference proposal 262 was withdrawn at the conference in favor of conference proposal 260. Conference proposal 259 initially proposed to change the first sentence in § 23.729(f)(1) to state that the warning device must activate "when one or more throttles are closed beyond the critical power settings for all probable approach configurations." One commenter stated that the terms "critical" and "probable" were confusing and proposed replacements similar to those proposed herein. The FAA agrees and has adjusted this proposal accordingly.

Conference proposal 260 recommends changing the first sentence of § 23.729(f)(2) to require activation of the warning device when the wing flaps are extended beyond the approach flap position. The existing § 23.729(f)(2) requires activation when the wing flaps are extended "to or beyond" the approach flaps setting. One commenter stated that the existing rule was sufficient. Another commenter pointed out that under the current rule, when the flap is put in the approach position and the landing gear is still retracted, the gear warning can activate all the way inbound from the outer marker. Additionally, if the approach flap setting is the same as the takeoff flap setting, when the gear is retracted, the gear warning activates. This commenter favored conference proposal 260 because it was the same as current part 25 language.

Reference: Conference proposals 259 and 260. Conference proposals 261 and 262 were withdrawn at the conference.

57. Section 23.731 is amended by removing paragraph (a); by redesignating paragraphs (b) and (c) as paragraphs (a) and (b), respectively.

Explanation: Existing § 23.731(a) requires that each main and nose wheel must be approved. The FAA has determined that this rule is redundant to the basic requirement that the complete airplane must be approved, including all components, parts, and appliances. In addition, the FAA concludes that the regulation implies that unapproved equipment can be installed. Although omitted from conference proposal 523 in error, § 23.731 is included here as a part of conference proposal 523.

Reference: Conference proposal 523. Conference proposal 263 was deferred for discussion under the issue applicable to the "primary category" airplane currently being considered by the FAA.

58. Section 23.733 is amended by revising paragraph (a) to read as follows:

§ 23.733 Tires.

(a) Each landing gear wheel must have a tire whose approved tire ratings (static and dynamic) are not exceeded—

(1) By a load on each main wheel tire (to be compared to the static rating approved for such tires) equal to the corresponding static ground reaction under the design maximum weight and critical center of gravity; and

(2) By a load on nose wheel tires (to be compared with the dynamic rating approved for such tires) equal to the reaction obtained at the nose wheel, assuming the mass of the airplane to be concentrated at the most critical center of gravity and exerting a force of 1.0 W downward and 0.31 W forward (where W is the design maximum weight), with the reactions distributed to the nose and main wheels by the principles of statics and with the drag reaction at the ground applied only at wheels with brakes.

* * * * *

Explanation: This proposal eliminates the current reference in part 23 to the Tire and

Rim Association by simply stating that tire ratings must be approved, requires that static and dynamic ratings be established and defines the conditions where those ratings are to be used. This proposal is based on conference proposals 264 and 265. Conference proposal 264 recommends eliminating reference to the Tire and Rim Association so that the certificating authority can consider other ratings. Discussion at the conference indicated that the addition of the word "approved" preceding "tire rating" would sufficiently clarify the intent of the requirement. The FAA recognizes the contribution of the Tire and Rim Association and will continue to use those ratings as a basis for approval; however, the FAA intends to consider other recognized organizations, as appropriate.

Conference proposal 265 recommends that the FAA adopt a firm number of 1.45 as a multiplier for the static tire rating to derive the dynamic tire rating where a more accurate dynamic tire rating is not available. In support of this proposal, the submitter stated that current publications by the Tire and Rim Association no longer list dynamic ratings but that comparison between static and dynamic ratings in previous publications indicates that the dynamic ratings did not exceed 1.45 times the static rating. The FAA recognizes that such an approach may be appropriate in some cases, but disagrees that such a multiplier should be regulatory. Instead, this proposal requires approval of both static and dynamic ratings. The approval is to be based on the most accurate information available to the applicant.

Reference: Conference proposals 264 and 265. Conference proposal 266 was withdrawn at the conference.

59. Section 23.737 is revised to read as follows:

§ 23.737 Skis.

The maximum limit load rating for each ski must equal or exceed the maximum limit load determined under the applicable ground load requirements of this part.

Explanation: This proposal eliminates the first sentence in existing § 23.737; i.e., "Each ski must be approved." The FAA has concluded that this requirement is redundant to the basic requirement that the complete airplane must be approved, including all components, parts, and appliances. In addition, the FAA has determined that it implies that unapproved equipment can be installed.

Reference: Conference proposals 269 and 523.

60. Section 23.751 is amended by revising paragraph (a) to read as follows:

§ 23.751 Main float buoyancy.

(a) Each main float must have—

(1) A buoyancy of 80 percent in excess of the buoyancy required by that float to support its portion of the maximum weight of the seaplane or amphibian in fresh water; and

(2) Enough watertight compartments to provide reasonable assurance that the seaplane or amphibian will stay afloat without capsizing if any two compartments of any main float are flooded.

* * * * *

Explanation: This proposal revises § 23.751 to clarify the buoyancy requirements for main floats in paragraph (a)(1) by specifying an 80 percent excess in buoyancy for each main float above the buoyancy required by that float to support the maximum weight of the seaplane. Additionally, the words "without capsizing" are added to paragraph (a)(2) to clarify the extent of flotation necessary after main float compartment flooding.

A strict interpretation of existing § 23.751(a)(1) results in a buoyancy excess of 80 percent of the maximum weight of the seaplane when the design consists of only one main float, or a total of 180 percent of the maximum weight. However, on seaplanes having two main floats, *each float* would be required to have buoyancy of 80 percent in excess of that necessary to support the seaplane, or 180 percent of the maximum weight of the seaplane; for a total of 360 percent of the maximum weight. For designs having three floats, each float would be required to support 180 percent of the maximum weight for a total of 440 percent. This is neither the intent of the rule nor the practice of industry.

The change to paragraph (a)(2) is intended to clarify the fact that the seaplane be afloat in the upright condition.

Reference: Conference proposals 270 and 271.

61. Section 23.753 is revised to read as follows:

§ 23.753 Main float design.

Each seaplane main float must meet the requirements of § 23.521.

Explanation: This proposal eliminates the phrase "must be approved" from existing § 23.753. The FAA has determined that this requirement is redundant to the basic requirement that the complete airplane must be approved, including all components, parts, and appliances. In addition to being redundant, the FAA has concluded that it implies that unapproved equipment can be installed.

Reference: Conference proposal 523.

62. Section 23.755(a) introductory text is amended by inserting the words "without capsizing" between the words "afloat" and "in".

Explanation: See proposal for § 23.751.

Reference: See proposal for § 23.751.

63. Section 23.773 is revised to read as follows:

§ 23.773 Pilot compartment view.

(a) Each pilot compartment must be—

(1) Arranged with sufficiently extensive, clear and undistorted view to enable the pilot to safely taxi, takeoff, approach, land and perform any maneuvers within the operating limitations of the airplane.

(2) Free from glare and reflections that could interfere with the pilot's vision. Compliance must be shown in all operations for which certification is requested; and

(3) Designed so that each pilot is protected from the elements so that moderate rain conditions do not unduly impair the pilot's view of the flight path in normal flight and while landing.

(b) Each pilot compartment must have a means to either remove or prevent the formation of fog or frost on an area of the internal portion of the windshield and side windows sufficiently large to provide the view specified in paragraph (a)(1) of this section. Compliance must be shown under all expected external and internal ambient operating conditions, unless it can be shown that the windshield and side windows can be easily cleared by the pilot without interruption of normal pilot duties.

Explanation: This proposal is based in part on conference recommendation 272, on conference comments, and on a post conference review of the adequacy of previous certifications, which establishes a precedent for compliance with existing § 23.773. It is not the intent of this proposal to require windshield heat on all small airplanes, to preclude open cockpit designs or to prohibit the pilot from using a cloth to wipe the windows. It does, however, define requirements to assure that a means exists to remove or prevent the formation of fog or frost on the inside of the windshield, specifies the extent of credit to be given to pilot actions and defines the area of windshield and windows to be kept clear.

Paragraph (a)(1) of this proposal requires an extensive, clear, and undistorted view sufficient to enable the pilot to perform any maneuvers within the operating limitations of the airplane, and specifies particular operations, such as taxi, takeoff, approach and landing to clarify the extent of view necessary for safe operation.

Paragraph (b) of this proposal is included to address the condition where an airplane is operated at high altitudes, becomes cold-soaked, and is then descended into warm, moist air. Such conditions have resulted in the formation of frost on the inside surface of the windshield and crew compartment windows, which resulted in a limited or completely obscured view. Since, in such cases, compliance has been shown for the current § 23.773(a)(3), a rule change is appropriate to address this condition. The FAA proposes to revise § 23.773 to identify this condition and to clarify the extent of actions taken by the pilot to remove such moisture.

Reference: Conference proposal 272.

64. Section 23.775 is amended by adding new paragraphs (f) and (g) to read as follows:

§ 23.775 Windshields and windows.

* * * * *

(f) Unless operation in known or forecast icing conditions is prohibited by operating limitations, a means must be provided to prevent or to clear accumulations of ice from the windshield so that the pilot has adequate view for takeoff, approach, landing, and taxi.

(g) In the event of any probable single failure, a transparency heating system must be incapable of raising the temperature of any windshield or window to a point where there would be a danger of fire or structural failure as to adversely affect the integrity of the cabin.

Explanation: This proposal is intended to clarify the criteria for determining the cleared windshield area the FAA deems necessary to assure safe operation for icing certification. By specifically identifying the operational phases of takeoff, approach, landing, and taxi, this proposal is intended to prevent the past practices of certifying airplanes for operation in known icing conditions, with panels too small and too far in front of the pilot (in some cases, a single small panel centered on the windshield to be used from either pilot seat) to allow full operation of the airplane. In such cases, the runway is not always visible during approach when crosswinds result in large crab angles. Additionally, upon landing, the ability to locate and safely use taxiways is hampered because of the restricted view available to the pilot through the small panel. This proposal is not intended to preclude the use of such panels, but does identify the criteria for determining the size, location, and, if necessary, the number of the panels.

In addition, a proposal is made to require that the probable single failure of transparency heating systems not adversely affect the integrity of the airplane cabin. Such failures do occur and consideration of such occurrences is necessary as a minimum requirement for the type certification of new airplane designs.

Conference proposal 272a recommends deletion of the current 70% luminous transmittance requirement of § 23.775(d). It was the consensus of the conference, and the FAA agrees, that the 70% luminous transmittance requirement be retained.

Conference proposal 273 recommends that § 23.775(e) be revised by removing the altitude limitation of 25,000 feet for single pane windows, and by relaxing the criteria to allow the applicant to establish the integrity of the windows and windshield at higher altitudes. Conference discussion was mixed on this proposal. One commenter notes that the proposal is relaxatory for windows and windshields above 25,000 feet, but more restrictive below 25,000 feet. The service history does not support the need to change the existing requirement and, in addition, the specific wording of the proposed change would be difficult to administer. The FAA agrees and does not propose to change § 23.775(e) accordingly.

There are three conference proposals recommending the inclusion of bird-strike windshield requirements for part 23 airplanes. Prior to the issuance of Notice 83-17 (48 FR 52010), which resulted in establishment of the commuter category by amendment 23-34, the FAA considered establishing windshield bird strike criteria for airplanes of the type used in commuter service. The FAA conducted an initial economic evaluation that showed that the costs of imposing such requirements far outweighed the benefits projected from historical service history. As a result, the proposed bird-strike criteria was withdrawn by the FAA prior to establishment of a formal notice of proposed rulemaking.

Reference: Conference proposals 272, 273, 274, 275, 276, and 276a.

65. Section 23.851 is revised to read as follows:

§ 23.851 Fire extinguishers.

(a) There must be at least one hand fire extinguisher located conveniently in the pilot compartment.

(b) For commuter category, there must be at least one hand fire extinguisher located conveniently in the passenger compartment.

(c) For hand fire extinguishers, the following apply:

(1) The types and quantities of each extinguishing agent used must be appropriate to the kinds of fire likely to occur where that agent is to be used.

(2) Each extinguisher for use in a personnel compartment must be designed to minimize the hazard of toxic gas concentrations.

Explanation: This proposal extends the commuter category requirement for a hand fire extinguisher in the pilot compartment to all small airplane categories. Additionally, this proposal provides minimum acceptable standards for on-board hand fire extinguishers.

This proposal is based in part on conference proposal 300, which recommends requirements for part 23 substantially the same as those for part 25.

One commenter noted that a rule change adding hand fire extinguishers had merit.

Reference: Conference proposal 300.

66. Section 23.865 is revised to read as follows:

§ 23.865 Fire protection of flight controls, engine mounts, and other flight structure.

Flight controls, engine mounts, excluding those portions that are certificated as part of the engine, and other flight structure located in the engine compartment must be constructed of fireproof material or shielded so that they are capable of withstanding the effects of a fire. Engine vibration isolators must incorporate suitable features to ensure that the engine is retained if the non-fireproof portions of the isolators deteriorate from the effects of a fire.

Explanation: This proposal clarifies existing § 23.865 by excluding those portions of the engine mount certificated with the engine from this section. Additionally, a clarification is provided to address the allowable damage expected on engine isolators.

In support of this proposal, the submitter contended that there had been some confusion in the past regarding whether the rubber engine isolators must be fireproof. The submitter noted that the rubber isolators are not fireproof, but that the isolators could have limited protection. Additionally, since particular parts of the engine mounting system are approved as part of the engine, those portions are excluded from § 23.865.

No objection to this proposal was voiced at the conference.

Reference: Conference proposal 303.

67. Section 23.1507 is revised to read as follows:

§ 23.1507 Maneuvering speed.

(a) The maximum operating maneuvering speed, V_O, speed must be established as an operating limitation.

(b) The maximum operating maneuvering speed, V_O, shall not be greater than $V_S\sqrt{n}$ where—

(1) V_S is the computed stalling speed with flaps retracted at the design weight, normally based on the maximum airplane normal force coefficients, C_{NA}; and

(2) n is the limit maneuvering load factor used in design.

Explanation: This proposal establishes an operating maneuvering speed different from that established by § 23.335(c). The operating maneuvering speed is that speed at which the pilot can be assured of not exceeding the design limit load factor during maneuvers. For further explanation, see § 23.335, as listed in the "Background" section of this notice, and § 23.1563.

Reference: Conference proposal 187.

68. A new § 23.1516 is added to read as follows:

§ 23.1516 Safe, intentional, one-engine-inoperative speed.

The safe, intentional, one-engine-inoperative speed, V_{SSE}, determined in § 23.149 must be established as a separate limitation.

Explanation: See proposal for § 23.149.

Reference: See proposal for § 23.149.

69. Section 23.1521 is amended by revising paragraph (a) to read as follows:

§ 23.1521 Powerplant limitations.

(a) *General.* The powerplant limitations prescribed in this section must be established so that they do not exceed the corresponding limits for

which the engines or propellers are type certificated. In addition, other powerplant limitations used in determining compliance with this Part must be established.

* * * * *

Explanation: This proposal clarifies existing § 23.1521 to assure that powerplant limitations established for airplane certification do not exceed those established during the certification of the engine or the propeller. It was the consensus at the conference that this recommendation be proposed in an NPRM. Currently, § 23.1521 specifies powerplant limitations established during the type certification of the engines or propellers but does not consider limitations established during the type certification of the airplane.

The FAA is proposing a requirement that other powerplant limitations used in determining compliance with the airworthiness standards of part 23 also be established.

Reference: Conference proposal 476.

70. A new § 23.1522 is added to read as follows:

§ 23.1522 Auxiliary power unit limitations.

If an auxiliary power unit is installed, the limitations established for the auxiliary power unit must be specified in the operating limitations for the airplane.

Explanation: This proposal establishes new minimum requirements for auxiliary power units (APU). Applications for approval of APU installations have been received by the FAA. Little discussion ensued at the conference on this subject; however, the FAA concludes that applicants for approval of APU installations should be informed of the requirements applicable to these installations. Refer to proposed changes to § 23.1549.

Reference: Conference proposal 477.

71. Section 23.1525 is amended by adding the sentence, "The kinds of operation authorized must be established and this information furnished in the Airplane Flight Manual (AFM) as required by § 23.1583", following the existing sentence.

Explanation: This proposal clarifies existing § 23.1525. It is contended that the current paragraph is vague, brief, and does not contain the kinds of operation limitations required in the Airplane Flight Manual as specified by § 23.1583(h). There was no discussion of this proposal at the conference.

Reference: Conference proposal 479.

72. Section 23.1527 is amended by removing the phrase "For turbine engine powered airplanes and turbosupercharged airplanes," from the first part of paragraph (b) and capitalizing the letter "T".

Explanation: This proposal will make it clear that the maximum operating altitude allowed for any part 23 airplane must be established based on those limitations determined by flight, structural, powerplant, functional, or equipment characteristics. This change would be consistent with § 23.141 as proposed in this notice.

Reference: See proposed § 23.141.

73. Section 23.1545 is amended by removing paragraph (b)(6).

Explanation: This proposal deletes the current section requiring a red radial mark on the airspeed indicator to identify the minimum control speed with the critical engine inoperative, V_{MC}, on multiengine airplanes. The FAA considers this marking unnecessary. It can oftentimes be misused, or misunderstood when placed on the airspeed indicator. Deleting this requirement does not imply that V_{MC} will not be measured. Section 23.1513 requires that the minimum control speed, V_{MC}, be established as an operating limitation and will, therefore, be presented in the Airplane Flight Manual Limitation section. It was the consensus at the conference that the marking requirement on the airspeed indicator for V_{MC} should be deleted. Conference proposals 482 and 484 were substantially the same but from different submittals to the conference. Conference proposal 483 is addressed in Notice No. 2.

Reference: Conference proposals 482, 483, 484, and 485.

74. Section 23.1549 is amended by revising the heading, introductory text of the section, and paragraph (d) to read as follows:

§ 23.1549 Powerplant and auxiliary power unit instruments.

For each required powerplant and auxiliary power unit instrument, as appropriate to the type of instruments—

* * * * *

(d) Each engine, auxiliary power unit, or propeller range that is restricted because of excessive vibration stresses must be marked with red arcs or red lines.

Explanation: This proposal expands the current powerplant instrument requirements to include auxiliary power units (APU). Applications for approval of APU installations have been received by the FAA. Applicants need to be informed of the requirements for these installations necessary to maintain the level of safety established by the airworthiness standards of part 23 instead of utilizing special conditions after the type certification program has begun. There was no discussion at the conference on this proposal. Refer to proposed changes to § 23.1522.

Reference: Conference proposal 486.

75. Section 23.1557 is amended by removing paragraph (f) and by revising paragraph (c) to read as follows:

§ 23.1557 Miscellaneous markings and placards.

* * * * *

(c) Fuel, oil, and coolant filler openings. The following apply:

(1) Fuel filler openings must be marked at or near the filler cover with—

(i) For reciprocating engine-powered airplanes—

(A) The word "Avgas"; and

(B) The minimum fuel grade.

(ii) For turbine engine-powered airplanes—

(A) The words "Jet Fuel"; and

(B) The permissible fuel designations, or references to the Airplane Flight Manual (AFM) for permissible fuel designations.

(iii) For pressure fueling systems, the maximum permissible fueling supply pressure and the maximum permissible defueling pressure.

(2) Oil filler openings must be marked at or near the filler cover with the word "Oil".

(3) Coolant filler openings must be marked at or near the filler cover with the word "Coolant".

* * * * *

Explanation: This proposal clarifies the marking requirements for filler openings. The current requirement, which states that fuel filler openings be marked at or near the filler cover with the word "fuel", has resulted in some airplanes being fueled with an improper fuel. This proposal will differentiate fuels by requiring that the filler openings for reciprocating engine-powered airplanes be marked with the word "Avgas" and that the filler openings for turbine engine-powered airplanes be marked with the words "jet fuel". It is considered impractical to require a marking of all permissible jet fuels for turbine engines at or near the filler opening. The requirement states that an acceptable method of determining the permissible jet fuels is by reference to the Airplane Flight Manual. There was a consensus of agreement with the proposal submitted at the conference when the word "fuel" as applicable to reciprocating engine-powered airplanes was changed to the word "Avgas". The FAA concurs with this change.

The current requirements are silent on the marking of filler openings for coolants. Therefore, it is proposed to require a marking for the coolant filler opening in a manner similar to the requirements for fuels and oil.

The FAA is proposing to delete paragraph (f) because this information is provided to the pilot in the AFM and the fuel quantity indicator is required to be marked at the unusable fuel level by § 23.1553. The FAA considers the current requirement as redundant and will simplify the instrument panel arrangement, resulting in a clearer, more easily scanned instrument panel. It was the consensus at the conference that the current requirement of paragraph (f) should be deleted from the airworthiness standards.

Reference: Conference proposals 488 and 489.

76. Section 23.1563 is amended by revising paragraph (a) to read as follows:

§ 23.1563 Airspeed placards.

* * * * *

(a) The operating maneuvering speed, V_o; and

* * * * *

Explanation: Refer to §§ 23.335 and 23.1507.

Reference: Conference proposals 187 and 491.

77. Section 23.1581 is amended by adding a new paragraph (f) to read as follows:

§ 23.1581 General.

* * * * *

(f) *Log of revisions.* Each Airplane Flight Manual (AFM) must contain a means for recording the incorporation of revisions and/or amendments.

Explanation: This proposal establishes a new requirement for providing a means to record updates to the Airplane Flight Manual. There are three proposals directed at § 23.1581. Conference proposal 492 recommends adoption of requirements for flight manuals substantively identical to existing § 25.1581, 27.1581 and 29.1581. Existing § 23.1581 is unique in that it permits the information in the Airplane Flight Manual to be organized in a form suitable for the pilot's needs. Under this regulation, only those pages containing the operating limitations for the airplane must be approved, identified and distinguished from other pages in the manual. The operating procedures, performance, and loading sections of the manual can, at the option of the applicant, be presented in any manner acceptable to the Administrator as long as the required information is determined in accordance with the applicable requirements. No such option exists in parts 25, 27, and 29. In those requirements, the AFM contains approved data for operating procedures, performance and loading procedures in addition to the operating limitations data.

Discussions at the conference indicated fundamental opposition to conference proposal 492. One commenter noted that segregating required FAA information in a separate section implies that other information presented elsewhere is somehow less safe or less accurate. That commenter noted that the FAA has the responsibility and authority to prohibit any information, approved or unapproved, from being included in the AFM if it is considered inappropriate, inaccurate or unsafe—or for any other justifiable reason. The commenter further noted that the concept of combining approved and unapproved information in the AFM has been used by the General Aviation Manufacturers Association (GAMA) members since the "GAMA Specification for Pilots Operating Handbook" (GAMA Specification No. 1) was finalized. That commenter was unaware of any major problems associated with such use and noted that the additional information required by GAMA Specification No. 1 tends to enhance safe operation by including more information than is specifically required by the regulations.

Conference proposal 492 recommends separate AFM requirements for airplanes having maximum weights below 3,000 pounds. Conference proposal 493 was deferred for possible inclusion in the primary category regulations currently under consideration by the FAA. Conference proposal 494 recommends (1) eliminating of the applicant's option for the extent of approved data, (2) specifically prohibiting reference to specific operating rules, and, (3) requiring that each AFM contain a means for recording and incorporating revisions and/or amendments to that AFM.

Conference comments were mixed relative to the recommendation to prohibit reference to operating rules in the AFM. Objections to incorporation of operating rules in the AFM centered around foreign operation and the inapplicability of the listed operating rules in such operations. Additionally, one commenter objected because the operating rules change over the years making certain citations in the AFM obsolete.

Other commenters cited reference to the performance requirements of part 135, appendix A, as a typical AFM supplement that becomes part of the certification basis of the airplane.

Post conference review indicates that certain references in the AFM to operational rules of one airworthiness authority are appropriate and provide a standard for comparison to the rules of another airworthiness authority. ICAO Annex 8 performance supplements are examples of such cases. The FAA has concluded that such references are appropriate and should not be prohibited in the AFM.

Further, the FAA recognizes the advantage of proper AFM revision/amendment control. Section 23.1581 is revised accordingly.

Reference: Conference proposals 492 and 494.

Conference proposal 493 was deferred for discussion under the issues applicable to the "primary category" airplane currently being considered by the FAA.

78. Section 23.1583 is amended by adding introductory text to the section, by revising paragraphs (a)(2) and (h), and by adding a paragraph (m) to read as follows:

§ 23.1583 Operating limitations.

Operating limitations determined during type certification of each airplane must be stated, including the following:

(a) * * *

(2) The speeds V_{MC}, V_O, V_A, V_{LE}, V_{LO}, and V_{SSE} (if established), and their significance.

* * * * *

(h) *Kinds of operation.* The kinds of operation, such as VFR, IFR, day, or night, in which the airplane is type certificated and in which it may or may not be used, including the meteorological conditions in which it may or may not be used, must be furnished. Installed equipment that affects any operating limitation must be listed and identified as to the equipment's required operational status for the kinds of operation for which approval is requested.

* * * * *

(m) *Allowable lateral fuel loading.* The maximum allowable lateral fuel loading differential must be furnished if less than the maximum possible.

Explanation: The FAA is proposing an introductory sentence to the section because during the type certification procedures there are nearly always limitations required other than those specified by the specific requirements in this section. It was the consensus that this introductory sentence should be a part of the airworthiness standards. Paragraph (a)(2) revises the operating limitations to add the operating maneuvering speed and the safe, intentional, one-engine-inoperative speed that were identified in the proposed changes to §§ 23.149 and 23.335, respectively.

The FAA is proposing to expand paragraph (h) to identify the kinds of operation that were type certificated, such as icing certification, and to identify the operational status of installed equipment as a limitation that must function in that kind of operation.

The FAA is proposing a new paragraph (m). Although generally covered by § 23.23, Load distribution limits, the effects of an asymetric fuel load is not emphasized and, although lateral center of gravity limits must be furnished in the Airplane Flight Manual (AFM), the effects of lateral fuel imbalance is not usually addressed. It was the consensus at the conference that this is currently being done during type certification on an airplane by airplane basis but a requirement of general applicability should be proposed by the FAA for small airplanes. One attendee noted that the imbalance limitation should also include luggage compartments in the wings, and in response to this concern, reference to § 23.23 was cited as presently addressing the luggage compartment issue.

Reference: Conference proposals 495, 496, 497, and 498.

79. Section 23.1585 is amended by revising paragraphs (a) and (c) and adding paragraph (b) to read as follows:

§ 23.1585 Operating procedures.

(a) For each airplane, information concerning normal, abnormal, and emergency procedures and other pertinent information necessary for safe operation and the achievement of the scheduled performance must be identified and segregated, including—

(1) The maximum demonstrated values of crosswind velocity for takeoff and landing and procedures and information pertinent to operations in crosswinds;

(2) The speeds, configurations, and procedures for making a normal takeoff and the subsequent climb;

(3) Procedure for abandoning a takeoff due to engine failure or other cause;

(4) The recommended climb speeds, and any variation with altitude;

(5) The speeds, configurations, and procedures for making a normal approach and landing, and a transition to the balked landing condition;

(6) An explanation of significant or unusual flight or ground handling characteristics of the airplane; and

(7) A recommended speed for flight in rough air. This speed must be chosen to protect against the occurrence, as a result of gusts, of structural damage to the airplane and loss of control (e.g., stalling).

(b) For single-engine airplanes, the procedures, speeds, and configurations for a glide following an engine failure and subsequent forced landing.

(c) For multiengine airplanes, the information must include—

(1) Procedures and speeds for continuing a takeoff following failure of the critical engine and the conditions under which takeoff can be safely continued, or a warning against attempting to continue the takeoff;

(2) Procedures, speeds, and configurations for continuing a climb following engine failure after takeoff or en route;

(3) Procedures, speeds, and configurations for making an approach and landing with one engine inoperative;

(4) Procedures, speeds, and configurations for making a go-around with one engine inoperative and the conditions under which the go-around can safely be executed, or a warning against attempting the go-around maneuver; and

(5) Procedures for maintaining or recovering control of the airplane with one engine inoperative at speeds above and below V_{MC}.

(6) Procedures for restarting engines in flight, including the effects of altitude, must be set forth in the Airplane Flight Manual.

* * * * *

Explanation: Proposals made under this heading are confined to flight procedures and scheduled speeds that are essential for the safe operation of the airplane and the achievement of the scheduled performance. Much of the material is based on § 23.1535, or § 23.1587 in the case of stalling and some other speeds.

The usefulness of data on maximum height loss and pitch attitude excursions in the stall, required by § 23.1587 (a)(1) and (c)(1), is doubted and such requirements have not been included in these proposals. The requirement of § 23.1585(c)(1) relating to lateral/directional controllability above and below V_{MC} is considered to be within the scope of basic airmanship. Detailed procedures related to the fuel and electrical system, such as in existing § 23.1585 (d) through (g) are considered to fall outside the redefined scope of this proposed § 23.1585, which deals only with flight operating procedures.

An attempt has been made to organize this proposed requirement for the provision of information on flight procedures and speeds into a logical sequence, calling up the data in the order in which its determination is called for in subpart B of part 23. The material is subdivided into data applicable to all airplanes, glide data that is specified to single-engine airplanes and additional data appropriate only to twin-engine airplanes. Finally, the procedure for starting engines in flight is considered necessary for all airplanes and has been determined by § 23.903(f). Therefore, reference to commuter category and to turbine engines has been eliminated.

Reference: Conference proposals 499, 501, 502, and 521. Conference proposal 500 was deferred for discussion under the issue applicable to the "primary category" airplane currently under consideration by the FAA.

80. Section 23.1587 is amended by revising paragraphs (a), (b), and (c) to read as follows:

§ 23.1587 Performance information.

The following information must be furnished:

(a) For normal, utility, and acrobatic category airplanes:

(1) The takeoff distance determined under § 23.51; and the kind of runway surface used in the tests.

(2) The climb gradient determined under §§ 23.65 and 23.77, the airspeed, power and the airplane configuration.

(3) The landing distance determined under § 23.75.

(4) For multiengine airplanes, the one engine inoperative en route climb/descent gradients determined under § 23.67.

(5) The calculated approximate effect on takeoff distance, landing distance, and climb performance for variations in—

(i) Altitude from sea level to 10,000 feet in a standard atmosphere and cruise configuration; and

(ii) Temperature, at those altitudes from 60° F below standard to 40° above standard.

(b) For skiplanes, a statement of the approximate reduction in climb performance may be used instead of complete new data for the skiplane configuration if—

(1) The landing gear is fixed in both the landplane and skiplane configurations;

(2) The climb performance is not critical, and;

(3) The climb reduction in the skiplane configuration does not exceed 50 feet per minute.

(c) For each airplane:

(1) Any loss of altitude more than 100 feet, or any pitch more than 30 degrees below level flight attitude, occurring during the recovery part of maneuvers prescribed in §§ 23.201(c) and 23.205, if applicable.

(2) The stalling speed, V_{SO}, at maximum weight.

(3) The stalling speed, V_{SI}, at maximum weight and with the landing gear and wing flaps retracted and the effect upon this stalling speed of angles of bank up to 60 degrees.

(4) The speed used in showing compliance with the cooling and climb requirements of §§ 23.1041 through 23.1047 if this speed is greater than the best rate of climb with one engine inoperative for multiengine airplanes and the maximum atmospheric temperature at which compliance with the cooling requirements has been shown.

* * * * *

Explanation: The FAA is proposing a substantial reorganization and simplification of the performance information requirements to be included in the Airplane Flight Manual (AFM). It was the consensus at the conference that these actions would clarify the requirements by following the sequence as set forth in subpart B of part 23. It was agreed that some of the information currently required in the performance information section was not related to performance and should be stated elsewhere; for example, the conditions under which the full amount of usable fuel in each tank could be safely used. One significant change agreed to by the attendees at the conference was an increase from 8,000 feet to 10,000 feet for calculation of performance information because of the realistic operating environment of small airplanes. One proposal addresses the flight and ground handling characteristics. It was generally agreed, and the FAA concurs, that this requirement belongs in the operating procedures portion of the AFM. Another proposal recommends the use of density altitude. This recommendation was rejected by the attendees at the conference and by the FAA, as was another recommendation for grass runway performance information data.

Reference: Conference proposals 504 through 510 and 521.

81. Section 23.1589 is amended by revising paragraph (a) to read as follows:

§ 23.1589 Loading information.

* * * * *

(a) The weight and location of each item of equipment that can be easily removed, relocated, or replaced and that is installed when the airplane was weighed under the requirement of § 23.25.

* * * * *

Explanation: Section 23.1589(a) in conjunction with § 23.25 relates back to

§ 23.29(b), which requires that "the condition of the airplane at the time of determining empty weight must be one that is well defined and can be easily repeated."

The word "condition" referred to in § 23.29(b) is not specific in meaning. "Well defined" and "easily repeated" are qualitative and general, but a requirement is clearly inferred that an "empty weight reference condition" can be verified as representative of the airplane. This "empty weight reference condition" is partially defined by § 23.29(a). It is further defined in § 23.1589(a), which requires that weight and location of "each" item of equipment be furnished. Furthermore, it is customary for the manufacturer to further define this condition by specifying variable factors, such as leveling procedures, cautions on the effect of moving air in the weighing procedures, adjustable seat positions, the position of flight controls.

In practice, the requirement of § 23.1589(a) is seldom met. The reasons for this are:

1. No one, especially the pilot, needs to know the weight and location of "each" item of equipment.

2. It is difficult for anyone, especially the pilot, to verify the weight and location or even the installation of "each" item of equipment.

3. It is difficult and expensive for the manufacturer to prepare and maintain this data for each item of equipment.

The word "each" provides no limit to the extent that items of structure, systems and installations should be included. In addition, the interpretation of the existing requirement has been very inconsistent. Actually, the word "each" is neither functional in purpose nor practical in application as it presently stands. A more usable requirement is needed.

The manufacturer provides the empty weight and balance data when an airplane is granted its Certificate of Airworthiness. Whenever an alteration is made to that airplane that affects its weight and balance, the person responsible for making the alteration is required to provide a new set of empty weight and balance data. This regulatory procedure provides a continuum of the "empty weight reference condition" that is sufficiently adequate and practical regardless of whether there is a weight and location given for "each item of equipment.

The empty weight information the pilot needs for calculating a proper weight and balance is:

1. The empty weight and balance data originally provided for the airplane.

2. The weight and location of items of equipment included in the empty weight and balance of the airplane that can be easily removed, relocated, or replaced.

The items of equipment that are easily removed, relocated, or replaced might include such items as adjustable ballast, removable seats, portable oxygen systems, tow bars, removable cargo pads, life rafts, cockpit and cabin furnishings, batteries, etc.

The pilot does not need to know the weight and location of centers of gravity of engine, propeller, avionics, hydraulic components, wheels, tires, etc. A mechanic does not need to know the weight and center of gravity location of "each" item of equipment to maintain the continuum of the "empty weight reference condition". Any time that the empty weight and balance figures appear questionable, a new "empty weight reference condition" can be established by performing a new weight and balance calculation. This is frequently done, even though an itemized equipment list is provided.

It was noted at the conference that the current list of items is quite lengthy and complex and it was the consensus that the proposal should be set forth in an NPRM by the FAA and the FAA concurs.

Reference: Conference proposal 511.

82. Appendix D of part 23 is amended by revising the heading and by adding a new paragraph (c) to read as follows:

Appendix D to Part 23—Wheel Spin-Up and Spring-Back Loads

* * * * *

(c) Dynamic spring-back of the landing gear and adjacent structure at the instant just after the wheels come up to speed may result in dynamic forward acting loads of considerable magnitude. This effect shall be determined, in the level landing condition, by assuming that the wheel spin-up loads calculated by the methods of this appendix are reversed. Dynamic spring-back is likely to become critical for landing gear units having wheels of large mass or high landing speeds.

Explanation: For explanation, see § 23.479.

Reference: Conference proposals 213 and 513.

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Appendix H to Part 23—Seaplane Loads

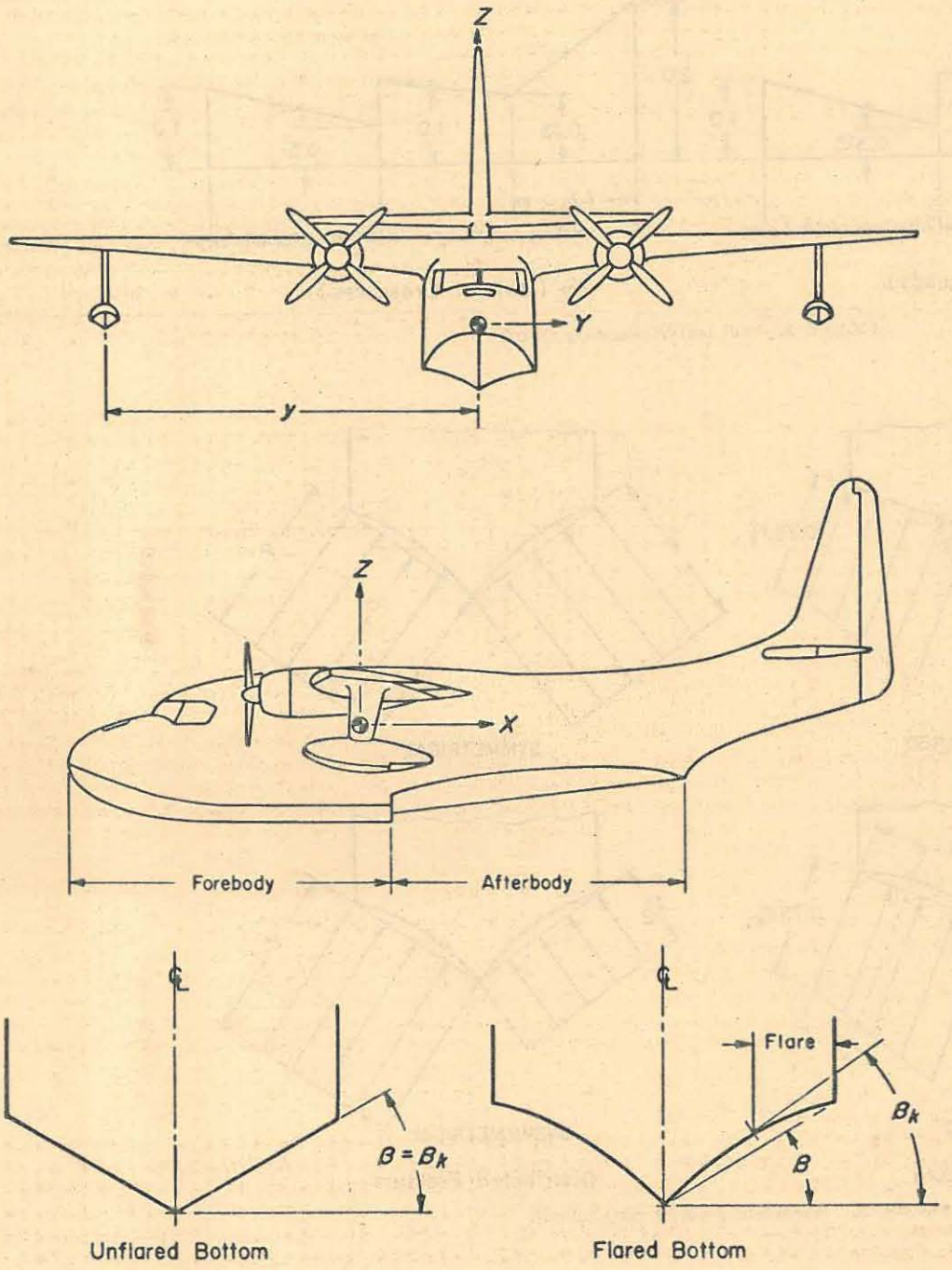

FIGURE 1. Pictorial definition of angles, dimensions, and directions on a seaplane.

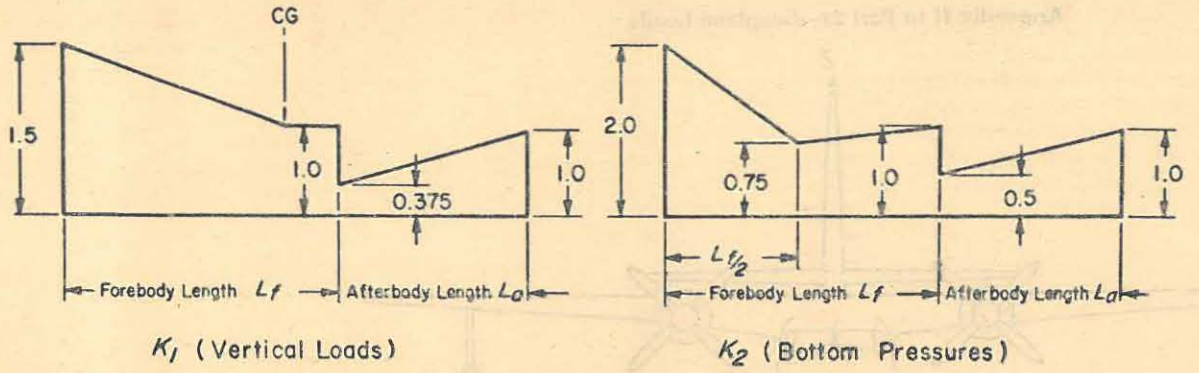

FIGURE 2. Hull station weighing factor

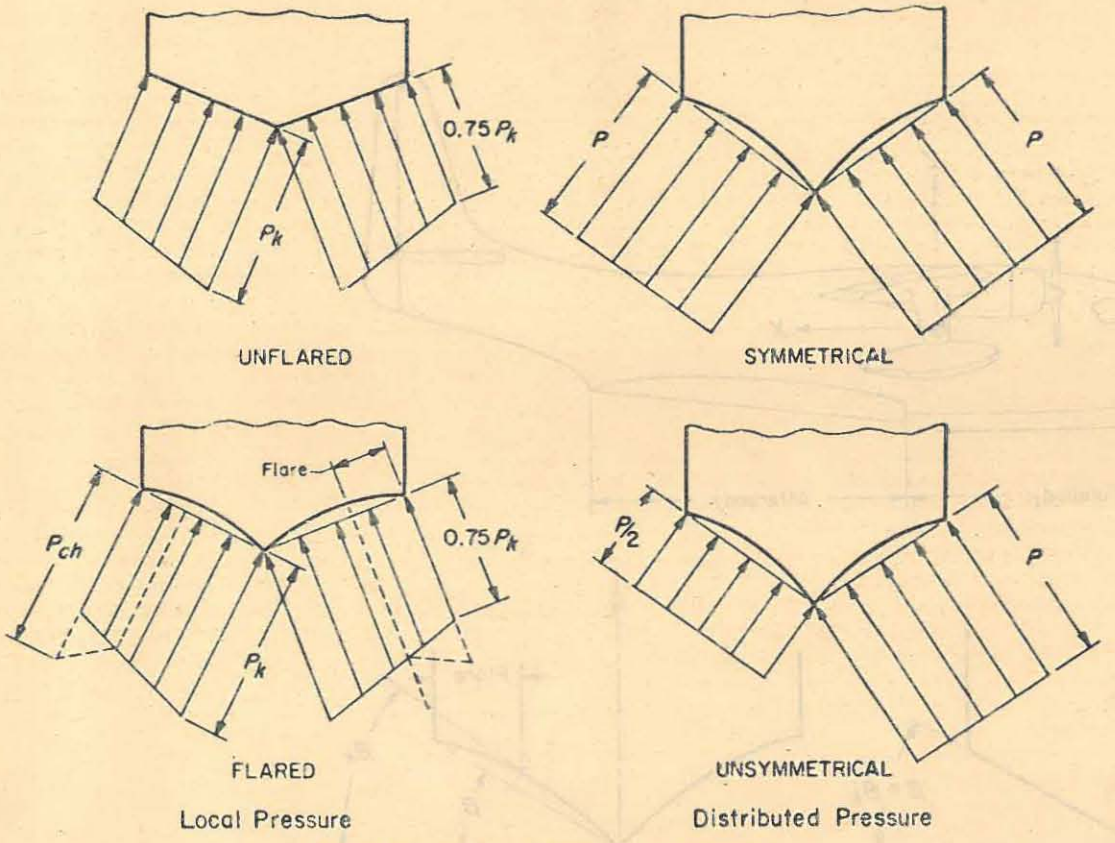

FIGURE 3. Transverse pressure distributions.

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Explanation: See proposal for § 23.521.

Reference: Conference proposal 519.

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