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Small Airplane Airworthiness Review Program Amendment No. 2; Final Rule

DEPARTMENT OF TRANSPORTATION
Federal Aviation Administration

14 CFR Parts 1 and 23

[Docket No. 25811; Amdt. Nos. 1-37 and 23-42]

RIN 2120-AC15

Small Airplane Airworthiness Review Program Amendment No. 2

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Final rule.

SUMMARY: This final rule upgrades the airworthiness standards for normal, utility, acrobatic, and commuter category airplanes. This amendment provides airworthiness standards for advancements in technology being incorporated in current designs, permits type certification of spin resistant airplanes, and reduces the regulatory burden in showing compliance with some of the requirements for the design and type certification of small airplanes. These new and amended airworthiness standards also result in the need for new definitions. As a result, new definitions are added.

DATES: February 4, 1991.

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SUPPLEMENTARY INFORMATION:

Regulatory History

This amendment is based on Notice of Proposed Rulemaking (NPRM), Notice No. 89-5, (54 FR 9276, March 6, 1989). All comments received in response to Notice No. 89-5 have been addressed in the adoption of this amendment.

Related Activity

The FAA announced the Small Airplane Airworthiness Review Program on January 31, 1983 (48 FR 4290), and invited all interested persons to submit proposals for consideration. The goal of the review program was to provide an opportunity for the public to participate in improving, updating and developing the airworthiness standards applicable to small airplanes, as set forth in part 23 of the Federal Aviation Regulations (FAR). Where applicable, the review program was extended to the new commuter category requirements because the commuter category incorporated existing small airplane requirements as set forth in amendment 23-34 (52 FR 1806, January 15, 1987). Approximately 560 proposals were received in response to the request for proposals.

Following receipt of the proposals, the FAA published Notice No. CE-84-1 (49 FR 30053, July 25, 1984), containing the availability of agenda, compilation of proposals, and announcement of the Small Airworthiness Review Program conference. That 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 FAA Regulatory Docket 23494.

After reviewing the proposals and the public comments received at the conference, the FAA's first related rulemaking action concentrated on updating safety standards related to cabin safety and improved crashworthiness. On August 15, 1988 (53 FR 30802), in amendment 23-36, the FAA upgraded the standards for cabin safety and occupant protection during emergency landing conditions, which included dynamic testing requirements for the seat/restraint systems of small airplanes.

After further review of the conference proposals and the comments received at the conference, the FAA concluded that Small Airplane Airworthiness Review Program Notices No. 2 and 5 were next in priority. These two notices were published on the same date, March 6, 1989, as Notice No. 89-5 (54 FR 9276) and Notice No. 89-6 (54 FR 9338). Action on Notice No. 89-6 will be accomplished in a separate final rulemaking document. This final rulemaking action, resulting from Notice No. 89-5, considers all comments received on that notice.

Discussion of Comments

General

Interested persons were invited to participate in the development of these final rules by submitting written data, views, or arguments to the regulatory docket. Seven commenters responded to Notice No. 89-5. Substantive changes and editorial changes have been made to the proposed rules based on relevant comments received and on further review by the FAA. Two of these commenters strongly support the adoption of these proposals and commend the FAA for this needed upgrading of the regulations.

One commenter believes that the ongoing rulemaking actions have resulted in a continuing increase in the cost and complexity of certification requirements for general aviation airplanes. This commenter cites, as an example of this increased cost, the "dynamic testing of an airplane to prove it will meet the new certification requirements," and states that "For a small airplane, this test would mean the destruction of a minimum of 3 to 9 fuselages costing a total of from one to two million dollars." consequently, this commenter expresses support for the primary category rulemaking (54 FR 9738, March 7, 1989) and urges expeditious adoption of that rulemaking action.

Proposals in this rulemaking action respond to changes in design technology that were not envisioned in the current airworthiness standards and provide an acceptable level of safety for that new technology. Any additional airplane costs that may occur from these proposed new requirements are the result of an airplane manufacturer's selection of the technology for a new airplane design. In regard to the commenter's example of dynamic testing requirements that would require the destruction of several fuselages, the FAA has not been able to identify dynamic requirements that would require the destruction of a single fuselage. The FAA believes that this comment refers to the recently adopted dynamic seat testing requirements of amendment 23-36. The new seat design and dynamic testing needed to establish compliance may exceed the cost of the seat design and static test needed to show compliance with older requirements; however, the net benefits to be realized from the reduction in occupant fatalities and injuries are expected to exceed the increase in cost. Finally, this commenter's recommendation on the expeditious adoption of the proposed primary category aircraft rule is being addressed in a separate rulemaking action.

Discussion of Comments to Specific Sections of Part 23

The following comments and discussions are keyed to like-numbered proposals in Notice No. 89-5 with the exception of proposal 27-1 that was inadvertently omitted from the notice. Comments of an editorial nature are not included in the discussion.

Proposals 1, 3. These proposals contain the authority citations for parts 1 and 23. No comments were received on these proposals.

Proposal 2. This proposal would adopt generally accepted terminology into part 1, "Definitions and Abbreviations," to define airplane components and configurations that have come into use with new airplane designs and advanced technology. No substantive comments were received on this proposal and it is adopted as proposed.

Proposal 4. This proposal, which is applicable to normal, utility, and

acrobatic category airplanes, would establish a climb gradient in § 23.67 as the performance requirement for the one-engine-inoperative flight condition in place of the current rate of climb requirement. It is based upon the airplane's landing configuration stalling speed and would consolidate the airplane configuration requirements for determining climb gradients into one paragraph rather than three paragraphs, as currently stated.

One commenter states that presenting climb requirements as a climb gradient, instead of the rate of climb, is a step forward and that the climb gradient could be used directly to determine takeoff obstacle clearance performance. However, the commenter is concerned that all airplanes with a V_{S1} of 61 knots or less, and 6,000 pounds or less maximum weight, were excluded because of the retention of the words "rate of climb." The FAA agrees that the change would be consistent with the other climb requirements. Therefore, the word "rate" in § 23.67(b)(2) has been replaced with the word "gradient".

The same commenter states that, in § 23.67 (b)(1), (c)(2)(i), and (c)(2)(ii), the gradient should be expressed as a ratio of 1:67 instead of 1.5 percent (or 1:133 instead of .75 percent) for consistency with the other part 23 climb requirements. The FAA agrees with maintaining consistency, where possible, but the current expression of climb gradient for commuter category airplanes is expressed as a percentage, i.e., 1.2 percent rather than a ratio of 1:83. Therefore, the FAA is adopting this requirement as proposed to be consistent with commuter category airplane requirements. At some future date, a revision may be considered to change the ratios in §§ 23.65(a) and 23.77(a) to percentages.

One commenter states that, although there is explanatory language to the contrary, the one-engine-inoperative minimum climb requirements are being raised and no justification is given for this increase. Another commenter states that the change in minimum climb requirements for one-engine-inoperative reciprocating engine powered airplanes of more than 6,000 pounds is without foundation. This commenter refers to the NPRM discussion of one-engine-inoperative accidents and states that the FAA makes no correlation between the accidents and one-engine-inoperative performance. The commenter concludes that the regulatory increase is arbitrary.

While a perfect correlation between accidents and one-engine-inoperative performance does not exist, the FAA has determined that sufficient correlation exists to justify an increase in the minimum performance requirements of § 23.67. However, the increase is not significant when compared to the actual performance achieved by current type certificated designs. The proposal also would establish a uniform minimum performance standard for one-engine-inoperative climb for all multiengine airplanes with maximum weights of 6,000 pounds or more, or stall speeds in excess of 61 knots. This performance standard is unrelated to the landing configuration stall speed and requires a minimum climb gradient. Accordingly, the proposed gradients are adopted as proposed.

Contrary to one commenter's statement that the proposal would unnecessarily limit the payload capability of aircraft with stall speeds of 61 knots or less, the climb performance requirements for airplanes with a stall speed of less than 61 knots are not being changed by this proposal. This proposed regulation would change only the climb performance measurement from rate of climb to climb gradient.

One commenter does not believe that the phrase proposed in § 23.67(a) "* * * at each weight established as an operational limit * * *" should apply to the one-engine-inoperative climb performance of reciprocating multiengine airplanes. The FAA agrees with the commenter and § 23.67(a) is changed accordingly by removing this phrase. However, the weight, altitude, and temperature requirements for turbine-powered airplanes are retained in § 23.67(c)(1).

In the NPRM, the minimum speed requirement to maintain the steady climb gradient performance requirement was inadvertently omitted from the proposal. The last sentence of the explanation for this proposal in the NPRM demonstrates that the FAA's intent was to require compliance with the climb gradients of § 23.67 at a speed not less than 1.2 V_{S1}. No comments were received concerning this omission. Consequently, § 23.67 (b)(1), (b)(2), (c)(2)(i), (c)(2)(ii) has been changed to add the phrase "at a speed not less than 1.2 V_{S1}.

After further examination of this rulemaking action, it was noted that the references to § 23.67 in § 23.1047 were not addressed in the NPRM. With the changes to § 23.67, conforming revisions must also be made to § 23.1047 (d), (d)(1), (d)(5), and (e). This proposal is adopted with the aforementioned changes.

Proposal 5. This proposal would revise § 23.75 and require that landing distances be determined for all airplanes by using a steady approach at a gradient of descent of 5.2 percent. It also would require that landing distances for airplanes with short field landing features be determined at the maximum steady approach gradient selected by the applicant as an operating limitation. It would require that if any device used in determining the landing distance is dependent on the operation of any individual engine, the distance with that engine inoperative must be determined. If the use of other compensating means would result in a landing distance not more than that with all engines operating, then the all engine operating distance may be used. The landing should not require more than average piloting skills under the operating conditions expected in service.

One commenter states that it is impractical to eliminate idle power approaches for light, single-engine aircraft. The commenter maintains that, although acceptable for heavier single-engine airplanes and for most twin-engine airplanes, use of a steady, closed-throttle glide should continue to be permitted as a landing procedure for light, single-engine airplanes. The FAA agrees that idle power approaches should not be eliminated as an additional alternate approach condition if landing distance data is provided using a 5.2 percent gradient approach. This method will provide landing distance data for the normal approach and landing environment from a standard instrument landing system in which all airplanes may be required to operate. Section 23.75(a)(2) has been changed to clarify that the landing distance data, at other than a 5.2 percent gradient, is optional data in addition to the 5.2 percent gradient data. Section 23.75(a)(2) permits idle power approaches for all airplanes, including those with short field landing features, such as light, single-engine airplanes.

Two commenters state that, as proposed in the notice, § 23.75(a)(2) is not clear in which would be considered short field landing features. One of these commenters further states that additional clarification is needed on how a maximum steady approach gradient can be a defined operating limitation in a basic airplane. In consideration of these comments, and after further consideration of the explanation material in the NPRM, the words "short field landing features" have been removed from § 23.75(a)(2). In addition to approaches using the 5.2 percent gradient landing data, this section permits approaches at a gradient steeper than 5.2 percent, regardless of the airplane's landing features. The

applicant must demonstrate that these steeper approaches are safe and can be executed by pilots of average skill. A change to § 23.75(a)(2) has been made in response to the comment about defining an operating limitation. Any operating limitations that are required for the approach should be displayed to the pilot through the use of the cockpit instruments. When the approach gradient in steeper than 5.2 percent, a maximum rate of descent gradient must be used to provide an acceptable limitation, provided that an appropriate indication is available to the pilot.

One commenter is concerned about the increasing conservatism for determining landing distances, especially in regard to atmospheric conditions. The commenter states that an FAA advisory circular recommends procedures to be used for generation of landing performance data based on the most conservative atmospheric conditions; the commenter believes that these procedures are incorrect. Proposed § 23.75(b) states that "the landing may not require more than average piloting skill or conditions." The FAA agrees that the proposed change to § 23.75(b), as stated in the NPRM, needs clarification. Accordingly, § 23.75(b) has been changed to "the landing may not require more than average piloting skill when landing during the atmospheric conditions expected to be encountered in service, including crosswinds and turbulence."

Proposed § 23.75(h) has been adopted as § 23.75(g) and the present § 23.75(g), which contains additional requirements for commuter category airplanes, has been redesignated as § 23.75(h). This proposal is adopted with the aforementioned changes.

Proposal 6. The proposal would amend § 23.161 by establishing airworthiness standards for those airplanes for which a maximum operating limit speed, V_{MO}, has been established in accordance with § 23.1505(c). In addition, the proposal addresses additional flight conditions for which, as a minimum requirement, the airplanes need to be trimmed.

Concerning proposed § 23.161(c)(2)(ii), one commenter states that the current rule, which partially ties approach trim to the landing performance requirements of § 23.75, is preferred for safety reasons. The FAA agrees with the commenter that the current rule provides an approach trim requirement, which accounts for the landing flap setting(s) and speeds. After further consideration of the proposed change, the FAA recognizes that the proposed rule would not provide an approach trim requirement that is appropriate for those applicants who may wish to demonstrate landing distance at speeds greater than 1.3 V_{SO}. Therefore, the proposed change to § 23.161(c)(2)(ii) is withdrawn and the current rule is retained.

Concerning proposed § 23.161(c)(3)(i), one commenter states that V_H is not a typical "sustained cruise speed" for non-turbine-powered airplanes. The commenter recommends that .9V_H be used (rather than V_H), as in proposed § 23.161(b)(1). The FAA agrees that the maximum speed in level flight at maximum continuous power (V_H) is not a typical sustained cruise speed for reciprocating engine powered airplanes. However, after review of discussions conducted at the Small Airplane Airworthiness Review Conference, the FAA has determined that V_H can be a sustained cruise condition. Retention of the change to § 23.161(c)(3)(i) is essential, and this portion of the proposal is adopted without change.

One commenter states that one problem with the proposed change to § 23.161(d) is the requirement that the trim speed be "the speed used in complying with § 23.67." The commenter states that, before amendment 23–34, § 23.67 covered only the gear-up, flaps-up claim condition, and the speeds used in complying were close to the speed range called out in § 23.161. Amendment 23–34 added the commuter category one-engine-operative climb requirements to § 23.67, including the second segment climb requirements involving a flight condition at a speed of 1.2 V_{SI}, gear up, with takeoff flaps extended. This proposal, in conjunction with revised § 23.67, would cause the 3-axis trim requirement to be applied in a manner identical to the commuter category second segment climb condition. The proposed requirement for 3-axis trimmability at the second segment climb condition would be very difficult to achieve and is not a reasonable requirement. The FAA agrees that the proposed revision to § 23.161(d) was not intended to address trim requirements during the transitory commuter category second segment climb requirements. The FAA also agrees that it is not reasonable or necessary to achieve 3-axis trimmability during second segment climb. Therefore, proposed § 23.161(d) is revised to incorporate the commuter category longitudinal and directional trim requirements adopted in amendment 23–34.

The same commenter states that there are several possible climb speeds associated with current and proposed § 23.67 for all categories of airplanes. The commenter points out that current § 23.67(d) requires that, for all multiengine airplanes, the speed for best rate of climb with one-engine-inoperative must be determined; this requirement is common to all airplane categories and is the logical one-engine-inoperative trim speed to use. It is the same speed as V_Y in current § 23.161(d) and it provides some speed margin, which makes compliance somewhat easier. The commenter, therefore, recommends that the longitudinal and directional trim speed range be from V_Y to 1.4 V_{SI} with the critical engine inoperative and, if applicable, its propeller in the minimum drag position. The FAA does not agree with the commenter concerning normal, utility, and acrobatic category airplanes. As stated in the NPRM, testing at a trim speed more closely related to operational climb speeds is desirable. Accordingly, § 23.161(d) is adopted as proposed, except to specify its applicability only to normal, utility, and acrobatic category airplanes. Additionally, a review of the transcript of the Small Airplane Airworthiness Review Conference verifies that the FAA's intent with respect to the position of the inoperative propeller is that the propeller be in the minimum drag position. Therefore, § 23.161(d) has been changed to clarify the intent that the inoperative propeller be in the minimum drag position.

This commenter also states that clarification by an advisory circular is needed when the final rules are published with respect to the lateral trim force requirements not exceeding five pounds. The commenter states that this force is very small when compared to normal system friction and asks if this condition is for maximum lateral fuel imbalance. The FAA will revise Advisory Circular 23–8A, "Flight Test Guide for the Certification of Part 23 Airplanes," to describe an acceptable means of compliance with the lateral trim force requirements. Concerning the commenter's question on lateral fuel imbalance, § 23.21(a) would require that compliance with § 23.161(d) be shown with maximum lateral fuel imbalance. This proposal is adopted with the aforementioned changes.

Proposal 7. This proposal would amend § 23.221 to allow certification of single-engine, normal category airplanes as spin resistant, an alternative to the current requirement of being recoverable from a one turn spin.

One commenter states that spin treatment proposed in the notice would deprive the flying public of safety that has been available for over 50 years. Also, the technology that led to the proposal for a "spin-resistant" class of

airplanes would contribute to a genuine advance in safety if applied to eliminating spins. The commenter recommends that § 23.221(a) be changed to read, "Normal Category airplanes shall be incapable of spinning." The commenter's suggested change would require a significant change in the existing technology and is, therefore, not being considered by the FAA at this time. Accordingly, the proposal is adopted without change.

One commenter supports proposed § 23.221(a)(1)(iii), which states that any use of primary flight or engine power controls should not result in an irrecoverable spin situation. However, this commenter also advocates special consideration of the reversed spin recovery case, which is defined as applying elevator before rudder. In the commenter's experience, this is a situation that is likely to be abused and one that merits special attention by the pilot. The subject of reversed recovery was discussed in detail during the Small Airplane Airworthiness Review Conference. As concluded in the NPRM, the proposed rule concerning misuse of controls during spin recovery includes reversed spin recovery, and a specific requirement for reversed recovery is not necessary. The proposed rule on misuse of controls is changed only slightly from the existing rule, which has a long history of satisfactory airplane service experience. Accordingly, § 23.221(a)(1)(iii) is adopted as proposed.

Concerning § 23.221(c)(3), one commenter states that this proposal appears to require exploration of power effects throughout acrobatic spins and that previous guidance was to explore power only through the first turn. The commenter believes that the rule was expanded without justification. This commenter is correct that the proposal requires the exploration of power effects throughout the acrobatic spin. As discussed at the Small Airplane Airworthiness Review Conference, the intent of the proposal is to make it impossible to obtain irrecoverable spins with any use of flight controls or engine power controls. As noted in the NPRM, the inclusion of the reference to engine power controls was accepted without comment at the conference. Following the review of the conference proposals and comments offered at the conference, the FAA has determined that engine power controls should be considered and this proposal is adopted as proposed.

Proposal 8. This proposal would establish § 23.301 criteria for determining loan intensities and distributions for airplanes with canard and tandem wing configurations. No comments were received on this proposal and it is adopted as proposed.

Proposal 9. This proposal would establish a new § 23.302 to require that airplanes with canard or tandem wing configurations meet all requirements of subpart C and subpart D applicable to a wing. This proposal is necessary because the forward structure of a canard or a tandem wing configuration performs both a control function and a lifting surface function similar to a main wing, and, therefore, it should meet both the wing and control surface requirements.

In the NPRM, the requirements in § 23.302(a) refer only to subpart C. One commenter states there could be confusion and recommends that subpart D be added to § 23.302(a); that is, subpart D is implied indirectly through reference to subpart C. For example, a forward wing of a canard configuration should also meet the requirements in § 23.641, subpart D. The FAA agrees with the commenter and, for clarity, § 23.302(a) is revised to add subpart D as a requirement. This proposal is adopted with the aforementioned changes.

Proposal 10. this proposal would correct an error in § 23.331(a) by changing the reference to § 23.331 to § 23.333 in existing paragraph (a). Also, a new paragraph (c) would be added to § 23.331 to ensure that flight loads applicable to horizontal surfaces in canard and tandem wing configurations are evaluated during the type certification process. No comments were received on this proposal and it is adopted as proposed.

Proposal 11. This proposal would establish gust load requirements in § 23.341 that must be met by an airplane with canard or tandem wing configurations.

One commenter provides the following analysis in regard to gust loads requirements. It has been shown many times, on a wide range of conventional airplanes, that wing gust loads can be accurately or conservatively estimated from the results of the current load factor formula of § 23.341. The accuracy of this approximation is dependent upon well-proven assumptions concerning the nature of the response of a conventional airplane to a vertical gust. For a canard configured airplane, some of these basic assumptions are not valid. In particular, the forward wing can impart a considerable nose-up pitch to the airplane before the main wing becomes immersed in the gust. This condition is likely to nullify the assumption that the response can be considered to be adequately represented only by the plunge motion of the airplane. Also, the downwash influence of the forward wing on the main wing can lead to significant redistribution of the aerodynamic loading across the wing span.

The commenter also points out that the inertia load factor on the canard configured airplane can be underestimated by the formula in existing § 23.341. In addition to the difference in inertia factors, the aerodynamic loads occur at different times than the peak inertia factor. This condition could result in substantially underestimating the net load on the main and forward wing if the formula assumption in existing § 23.341 was that the peak aerodynamic load and peak inertia load occurred simultaneously. This assumption is valid only for conventional airplanes. For canard configured airplanes, for both the main wing and the forward wing, the inertia relief is significantly below the value that would be computed using the peak acceleration at the center of gravity of the airplane.

The FAA agrees with the commenter and § 23.341(a) is revised to address, for a canard or tandem wing configured airplane, the concern that the relieving inertia load is not in phase with the forward wing load or the main wing load. The words, "to develop the gust loading on each lifting surface," were added to clarify that the gust load analysis must be performed considering each surface separately. This proposal is adopted with the aforementioned changes.

Proposal 12. This proposal would extend the yawing requirements in § 23.351, currently limited to vertical tail surfaces, to all vertical surfaces, such as winglets, in new airplane designs. This change is considered necessary to provide structural integrity for all vertical surfaces equivalent to that required for conventional vertical tail surfaces. No comments were received on this proposal and it is adopted as proposed.

Proposal 13. The proposal would change the heading preceding § 23.421 of subpart C because the present heading implies the sections following it are limited to tail surfaces of conventional airplane designs. The sections under this heading, as amended, are also applicable to airplanes with canard and tandem wing configurations. No comments were received on this proposal and it is adopted as proposed.

Proposal 14. This proposal would extend the current horizontal tail balancing load requirements in § 23.421 for conventional configurations to airplanes with canard and tandem wing configurations and prohibit the use of figure B6 of appendix B for tail surface load distribution.

Two comments were received on the proposal to prohibit the use of figure B6 of appendix B. One of the commenters believes that the appendix B method provides inexpensive standardization and a proven method of compliance and recommends that it be retained. The other commenter agrees with prohibiting the use of the appendix B method since the criteria in appendix B are applicable only to a limited range of light airplane configurations and the technical capability of industry is now such that more realistic loads can be developed.

The FAA does not agree that the continued use of appendix B is appropriate for average load magnitudes and load distributions for control surfaces. Appendix B was provided originally to define loads information in the absence of a more rational analysis. The curves and distributions shown in appendix B represent average conditions that were considered conservative and, as such, are compromises based on typical airplanes and aeronautical knowledge available at that time. The information presented in appendix B has been part of the small airplane certification requirements since the early 1930's. Particular curves, for example the tail surface load distribution of figure B6, have remained unchanged. The FAA recognizes that the intent of appendix B is to provide conservative load information when more extensive analysis is beyond the technical capability of the applicant. The technical capability of the industry has increased such that more accurate and realistic loads can be readily developed for the specific airplane design under consideration without the compromises used in appendix B. In some cases, the use of appendix B does not provide the conservative results intended. Accordingly, the FAA is removing appendix B in its entirety from part 23.

Proposal 15. This proposal would extend the current maneuvering loads requirements of § 23.423 for conventional type airplanes to canard and tandem wing configurations and prohibit the use of appendix B methods for demonstrating compliance. Where the current requirements refer to control deflections and up and down loads, it is proposed to refer to the control movements as nose-up and nose-down pitching of the airplane. The reasons for prohibiting the use of appendix B are discussed in detail in the explanation for proposal 14.

One commenter provides the following analysis on the fundamental difference of a canard configured airplane and a conventional airplane in the response characteristics for pitching maneuvering loads. With a conventional airplane, nose-down pitching is achieved by producing an upload on the tail surface. This load tends to increase the airplane's normal overall acceleration. Wing aerodynamic loads can be reduced to avoid exceeding the limit maneuvering load factor, but the full maneuvering capability is ensured up to the prescribed level of normal acceleration. With a canard configured airplane, nose-down pitching will have a negative forward wing load, which will tend to decrease the airplane's normal acceleration. To allow the checked maneuver to reach the limit load factor, the main wing lift must be increased. This maneuver may lead to a critical loading condition of the rear wing. An equivalent level of safety between a canard configured airplane and a conventional airplane can be ensured if the main wing with pitch control is also designed to the checked pitching maneuver.

The FAA agrees with the comment that the proposal, as written in the NPRM, could be interpreted as not being applicable to the main wing of an airplane with a canard or tandem wing configuration. In the NPRM, the words "the main wing of a canard or tandem wing configuration" were added to the first sentence of § 23.423.

The commenter also states that the applicability of § 23.423 could be interpreted to exclude the supporting structure of the horizontal surface. The FAA agrees with this comment and the words "and its supporting structure" have been added to the first sentence of the proposal. The balance of this proposal addresses the maneuvering loads on the forward surface of a three-surface configuration airplane, such as a wing, canard configuration, with a conventional tail. This three-surface configuration could have a canard surface without pitch control. This proposal is adopted with the aforementioned changes.

Proposal 16. This proposal would amend § 23.425 by extending the current gust load requirements for the horizontal tail surface to airplanes with a canard and tandem wing configuration and prohibit the use of appendix B, as discussed in detail in proposal 14. No comments were received on this proposal and it is adopted as proposed.

Proposal 17. This proposal would extend the current § 23.427 unsymmetrical loads requirements for horizontal tail surfaces of conventional configurations to airplanes with canard and tandem wing configurations. No comments were received on this proposal and it is adopted as proposed.

Proposal 18. The proposal would remove the word "tail" from the heading preceding § 23.441 because the present heading implies that the sections following it are limited to tail surfaces of conventional airplane designs. The affected sections, as amended, would be applicable to design features of airplanes utilizing vertical surfaces at locations other than the tail of the airplane. No comments were received on this proposal and it is adopted as proposed.

Proposal 19. This proposal would extend the maneuvering loads requirements of § 23.441, which are currently limited to vertical tail surfaces, to all vertical surfaces, such as winglets, in new airplane designs. It also would prohibit the use of appendix B, as discussed in detail in proposal 14. No comments were received on this proposal and it is adopted as proposed.

Proposal 20. This proposal would extend the gust load requirements of § 23.443 for conventional airplanes to include the canard and tandem wing configuration and prohibit the use of appendix B, as discussed in detail in proposal 14. No comments were received on this proposal and it is adopted as proposed.

Proposal 21. This proposal would amend the outboard fin requirements in § 23.445 to include all loads that are likely to occur simultaneously. It would require that the rational analysis include all loads likely to be applied to horizontal surfaces, and the 1g unaccelerated normal horizontal surface loads during the maneuvering conditions specified in § 23.441. It also would extend the requirements to all vertical surfaces that are mounted on horizontal surfaces, including wings. No comments were received on this proposal and it is adopted as proposed.

Proposal 22. This proposal would prohibit the use of appendix B in § 23.455, as discussed in detail in proposal 14. No comments were received on this proposal and it is adopted as proposed.

Proposal 23. This proposal would extend the current requirements of § 23.677 for powered trim system runaways to all categories of part 23 airplanes. No comments were received

on this proposal and it is adopted as proposed.

Proposal 24. This proposal would update § 23.701 to include provisions for airplanes with a flap configuration other than one flap on each wing. Some airplanes currently being manufactured have two flaps on each side of the airplane and some are designed with flaps on canard and tandem wings. It also addresses the failure of any single element in the flap control system and would permit an equivalent alternate means to the mechanical interconnection of the flaps as required by the present rule. No comments were received on this proposal and it is adopted as proposed.

Proposal 25. This proposal would establish minimum airworthiness standards in § 23.735 for airplanes equipped with antiskid braking systems. No comments were received on this proposal and it is adopted as proposed.

Proposal 26. This proposal would extend the current § 23.831 requirements to provide for hazardous gas-free ventilating air and for smoke evacuation to all categories of part 23 pressurized airplanes. No comments were received on this proposal and it is adopted as proposed.

Proposal 27. This proposal would add a § 23.939 requirement for an in-flight investigation of turbocharged reciprocating engine operating characteristics. It also would make it clear that, for turbine engines, the airflow distortion must not cause vibration harmful to these engines.

One commenter questions why the proposal for § 23.939(b) is limited to turbocharged engines. The commenter does not provide a different proposal for extending the applicability to other engine types or provide any justification or recommendations to include other types of engines.

At the review conference, there was no recommendation to extend this requirement to other engine types. The existing paragraph § 23.939(a) provides in-flight investigation requirements for turbine engines. Proposed paragraph (b) would add similar requirements for turbocharged reciprocating engines. The FAA recognizes that there may be some merit to the comment, but the commenter does not suggest other engine types or offer supporting justification. The need to extend this requirement to other engine types was not discussed at the Small Airplane Airworthiness Review Conference. Adequate justification for changing the requirement from the proposal in the NPRM is not available at this time. The FAA will consider this comment in future rulemaking activities and § 23.969(b) is adopted as proposed.

In addition, based on further study by the FAA, it was determined that the references in § 23.1047(d), (d)(1), (d)(5), and (e) need to be changed to agree with the proposed changes to § 23.67.

Proposal 28. This proposal would add a new § 23.1109 that ensures clean air for the pressurized cabins of airplanes equipped with pressurization systems taking bleed air from turbocharger systems. This proposal would establish requirements similar to those required for bleed air from turbine engines, currently stated in § 23.1111.

A commenter requests guidance by asking two questions about the proposed rule: Whether the operating procedures for emergencies may be used to meet the rule, and whether the alternate induction air may still come from the engine compartment. Additional details on describing the entire system design are required to answer these questions. Since these questions are in the nature of seeking guidance, these issues will be addressed by a future policy letter or advisory circular after the rule is adopted. The proposal is adopted as proposed.

Proposal 29. This proposal would revise § 23.1163 to require that any accessory remotely driven by an engine of normal, utility, and acrobatic category airplanes must cease hazardous rotation following a malfunction. This requirement was adopted for commuter category airplanes in amendment 23–24. The proposal also would add torque limiting criteria for accessory drives of accessories mounted on engines and would add requirements for accessories driven by gearboxes. No comments were received on this proposal and it is adopted as proposed.

Proposal 30. This proposal would require a heated pitot tube, or an equivalent means of preventing malfunction due to icing, and would clarify the requirement that a heated pitot tube be part of the system approval for flight in icing conditions, pursuant to § 23.1419. No comments were received on this proposal and it is adopted as proposed.

Proposal 31. This proposal would revise § 23.1325 to allow airplanes that are prohibited from flight in instrument meteorological conditions (IMC) to be certificated without an alternate static air source. No comments were received on this proposal. However, since the reference to IMC includes icing conditions, the proposal has been modified to eliminate the unnecessary wording and is adopted as modified.

Proposal 32. This proposal would remove appendix B, as discussed in detail in proposal 14, and is adopted as proposed.

Regulatory Evaluation Summary

Introduction

This section summarizes the full regulatory evaluation prepared by the FAA that provides more detailed estimates of the economic consequences of this regulatory action. This summary and the full evaluation quantify, to the extent practicable, estimated costs to the private sector, consumers, Federal, State and local governments, as well as anticipated benefits.

Executive Order 12291, dated February 17, 1981, directs Federal agencies to promulgate new regulations or modify existing regulations only if potential benefits to society for each regulatory change outweigh potential costs. The order also requires the preparation of a Regulatory Impact Analysis of all "major" rules except those responding to emergency situations or other narrowly defined exigencies. A "major" rule is one that is likely to result in an annual effect on the economy of $100 million or more, a major increase in consumer costs, a significant adverse effect on competition, or is highly controversial.

The FAA has determined that this rule is not "major" as defined in the executive order; therefore, a full regulatory analysis, which includes the identification and evaluation of cost reducing alternatives to this rule, has not been prepared. Instead, the agency has prepared a more concise document, termed a "regulatory evaluation," that analyzes only this rule without identifying alternatives. In addition to a summary of the regulatory evaluation, this section also contains a regulatory flexibility determination required by the 1980 Regulatory Flexibility Act (Pub. L. 96–354) and an international trade impact assessment. If more detailed economic information is desired than is contained in this summary, the reader is referred to the full regulatory evaluation in the docket.

Benefit/Cost Comparison

This rule amends several airworthiness standards for small airplanes. The amendments are based on discussions at the Small Airplane Airworthiness Review Conference held in October 1984 in St. Louis.

Most of the amendments within this rule are directed at developing uniform airworthiness standards in addressing the design and incorporation of advanced technology in small airplanes. Many of the airworthiness standards

have been applied previously as special conditions in specific type certification programs. The amendment also facilitates the type certification of new designs, canard or tandem wing configurations. These amendments are of a cost-relieving nature because they eliminate the need for special conditions processing, which often involves costly and unnecessary delays. In addition, most of these amendments are optional in the sense that the manufacturers are not being directed to incorporate the newest technology in their future models but are instead being afforded a set of regulations to follow should they choose the applicable new equipment.

Furthermore, it was determined that four of the amendments to part 23 involve quantifiable benefits in the form of the prevention of fatalities, injuries, and aircraft damage over the 20-year study period. The combined net present value of the benefits expected to accrue from these amendments is estimated to be $3.1 million.

Note: Fatalities prevented represent the majority of the estimated benefits. In order to provide the public and government officials with a benchmark comparison of the expected safety benefits of rulemaking actions over an extended period of time with estimated costs in dollars, the FAA currently uses a minimum value of $1.5 million to statistically represent a human fatality avoided (in accordance with guidelines issued by the Secretary of Transportation on June 22, 1990).

The following table summarizes the benefits and costs associated with the amendments having quantifiable economic impacts.

SUMMARY OF ESTIMATED BENEFITS AND COSTS

[000's 1989 dollars]

Amendments to the rule	Estimated benefits		Costs
	Nondiscounted	Discounted	
23.221-23.445 Spin Resistant and Canard Configured Airplanes	$8,618	$2,795	Relieving.
23.785 Antiskid Braking Systems	310	101	Negligible.
23.831 Ventilation	349	113	Relieving.
23.1163 Powerplant Accessories	179	58	Relieving.
Total	$9,456	$3,067	

International Trade Impact Statement

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

Regulatory Flexibility Determination

The FAA has also determined that the rule changes will not 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 rule.

A review of domestic general aviation manufacturing companies indicates that only 2 companies meet the size threshold of 75 employees or fewer. The amendments to part 23 will, therefore, not affect a substantial number of small entities.

Federalism Implications

The regulations adopted herein will 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 final rule does not have sufficient federalism implications to warrant the preparation of a Federalism Assessment.

Conclusion

This document amends the airworthiness standards to provide for advancements in technology, including: Type certification of spin resistant airplanes; structures requirements for canard or tandem wing configurations; and requirements for antiskid braking systems. These airworthiness standards provide design options to the manufacturer that are not available under existing regulations. This document concerns rules that do not impose a burden, but merely afford an alternative, and they will not result in a major increase in consumer costs or have an annual effect on the economy of $100 million or more. The FAA has determined that this amendment is not major as defined in Executive Order 12291. For the same reason, this amendment is not considered to be significant as defined in Department of Transportation Regulatory Policies and Procedures (44 FR 11034, February 26, 1979). Since there are only two small entities affected by this rulemaking, it is certified that, under the criteria of the Regulatory Flexibility Act, this amendment will not have a significant economic impact, positive or negative, on a substantial number of small entities. In addition, this final rule will 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. A copy of the regulatory evaluation prepared for this project may be examined in the Rules Docket or obtained from the person identified under the caption "**FOR FURTHER INFORMATION CONTACT.**"

List of Subjects

14 CFR Part 1

Aircraft, Air transportation, Aviation safety, Safety.

14 CFR Part 23

Aircraft, Air transportation, Aviation safety, Safety.

The Amendment

In consideration of the foregoing, the Federal Aviation Administration amends parts 1 and 23 of the Federal Aviation Regulations (14 CFR parts 1 and 23), as follows:

PART 1—DEFINITIONS AND ABBREVIATIONS

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

Authority: 49 U.S.C. 1347, 1348, 1354(a), 1357(d)(2), 1372, 1421 through 1430, 1432, 1442,

1443, 1472, 1510, 1522, 1652(e), 1655(c), 1657(f); 49 U.S.C. 106(g).

2. Section 1.1 is amended by adding the definitions "Canard" and "Canard configuration" after "Calibrated airspeed"; "Forward wing" after "Foreign air transportation"; "Tandem wing configuration" after "Takeoff thrust"; and "Winglet or tip fin" after "VFR over-the-top" to read as follows:

§ 1.1 General definitions.

* * * * *

Canard means the forward wing of a canard configuration and may be a fixed, movable, or variable geometry surface, with or without control surfaces.

Canard configuration means a configuration in which the span of the forward wing is substantially less than that of the main wing.

* * * * *

Forward wing means a forward lifting surface of a canard configuration or tandem-wing configuration airplane. The surface may be a fixed, movable, or variable geometry surface, with or without control surfaces.

* * * * *

Tandem wing configuration means a configuration having two wings of similar span, mounted in tandem.

* * * * *

Winglet or tip fin means an out-of-plane surface extending from a lifting surface. The surface may or may not have control surfaces.

* * * * *

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

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

Authority: 49 U.S.C. 1344, 1354(a), 1355, 1421, 1423, 1425, 1428, 1429, 1430; 49 U.S.C. 106(g).

4. Section 23.67 is amended by revising paragraphs (a) introductory text, (a)(2), (a)(5), (b), and (c) to read as follows:

§ 23.67 Climb: One engine inoperative.

(a) For normal, utility, and acrobatic category, reciprocating engine-powered multiengine airplanes, one-engine-inoperative climb gradients must be determined with the—

* * * * *

(2) Remaining engines at not more than maximum continuous power or thrust;

* * * * *

(5) Means for controlling the engine cooling air supply in the position used in the engine cooling tests required by §§ 23.1041 through 23.1047.

(b) For normal, utility, and acrobatic category reciprocating engine-powered multiengine airplanes, the following apply:

(1) Each airplane with a V_{so} of more than 61 knots, or of more than 6,000 pounds maximum weight, must be able to maintain a steady climb gradient of at least 1.5 percent at a pressure altitude of 5,000 feet at a speed not less than 1.2 V_{s1} and at standard temperature (41 °F) with the airplane in the configuration prescribed in paragraph (a) of this section.

(2) Each airplane with a V_{so} of 61 knots or less and of 6,000 pounds or less maximum weight must have its steady climb gradient at a pressure altitude of 5,000 feet at a speed not less than 1.2 V_{s1} and at standard temperature (41 °F) determined with the airplane in the configuration prescribed in paragraph (a) of this section.

(c) For normal, utility, and acrobatic category turbine engine-powered multiengine airplanes the following apply:

(1) The steady climb gradient must be determined at each weight, altitude, and ambient temperature within the operational limits established by the applicant, with the airplane in the configuration prescribed in paragraph (a) of this section.

(2) Each airplane must be able to maintain at least the following climb gradients with the airplane in the configuration prescribed in paragraph (a) of this section:

(i) 1.5 percent at a pressure altitude of 5,000 feet at a speed not less than 1.2 V_{s1}, and at standard temperature (41 °F); and

(ii) 0.75 percent at a pressure altitude of 5,000 feet at a speed not less than 1.2 V_{s1} and 81 °F (standard temperature plus 40 °F).

(3) The minimum climb gradient specified in paragraphs (c)(2) (i) and (ii) of this section must vary linearly between 41 °F and 81 °F and must change at the same rate up to the maximum operating temperature approved for the airplane.

* * * * *

5. Section 23.75 is amended by redesignating paragraph (g) as (h); by revising paragraphs (a), (b), and (f)(3); and by adding a new paragraph (g) to read as follows:

§ 23.75 Landing.

* * * * *

(a) A steady approach with a calibrated airspeed of not less than 1.3 V_{s1} must be maintained down to the 50-foot height and—

(1) The steady approach must be at a gradient of descent not greater than 5.2 percent (3 degrees) down to the 50-foot height.

(2) In addition, an applicant may demonstrate by tests that a maximum steady approach gradient steeper than 5.2 percent, down to the 50-foot height, is safe. The gradient must be established as an operating limitation and the information necessary to display the gradient must be available to the pilot by an appropriate instrument.

(b) The landing may not require more than average piloting skill when landing during the atmospheric conditions expected to be encountered in service, including crosswinds and turbulence.

* * * * *

(f) * * *

(3) Is such that no more than average skill is required to control the airplane.

* * * * *

(g) If any device is used that depends on the operation of any engine, and the landing distance would be increased when a landing is made with that engine inoperative, the landing distance must be determined with that engine inoperative unless the use of other compensating means will result in a landing distance not more than that with each engine operating.

* * * * *

6. Section 23.161 is amended by revising paragraphs (b)(1), (c)(1), (c)(2) introductory text, (c)(2)(i), (c)(3)(i), (d) introductory text, (d)(1), and (d)(4); and by adding a new paragraph (c)(4) to read as follows:

§ 23.161 Trim.

* * * * *

(b) * * *

(1) For normal, utility, and acrobatic category airplanes at a speed of 0.9 V_H, V_C, V_{MO}, whichever is the lower; and

* * * * *

(c) * * *

(1) A climb with maximum continuous power at—

(i) The speed used in determining the climb performance required by § 23.65 of this part with the landing gear retracted, and the flaps in the takeoff position; and

(ii) The recommended all-engines-operating climb speed specified in § 23.1585(a)(2)(i) of this part.

(2) An approach at a gradient of descent of 5.2 percent (3 degrees) with the landing gear extended, and with—

(i) Flaps retracted and at a speed of 1.4 V_{s1}; and

* * * * *

(3) * * *

(i) For normal, utility, and acrobatic category airplanes, at any speeds from

the lesser of V_H and V_{NO} or V_{MO}, as applicable, to 1.4 V_{SI}; and

* * * * *

(4) A descent at 0.9 V_{NO} or 0.9 V_{MO}, whichever is applicable, with power off and with the landing gear and flaps retracted.

(d) In addition, each multiengine airplane must maintain longitudinal and directional trim, and the lateral control force must not exceed 5 pounds, at the speed used in complying with § 23.67 for normal, utility, and acrobatic categories and at a speed between V_Y and 1.4 V_{SI} for commuter category with—

(1) The critical engine inoperative, and if applicable, its propeller in the minimum drag position;

* * * * *

(4) Wing flaps in the position selected for showing compliance with § 23.67 for normal, utility, and acrobatic category airplanes and wing flaps retracted for commuter category airplanes.

* * * * *

7. Section 23.221 is amended by revising paragraphs (a), (b), and (c)(3) to read as follows:

§ 23.221 Spinning.

(a) *Normal category.* Except as provided in paragraph (d) of this section, a single-engine, normal category airplane must demonstrate compliance with either the one-turn spin or the spin-resistant requirements of this paragraph.

(1) One-turn spin. The airplane must recover from a one-turn spin or a three-second spin, whichever takes longer, in not more than one additional turn after the controls have been applied for recovery. In addition—

(i) For both the flaps-retracted the flaps-extended conditions, the applicable airspeed limit and positive limit maneuvering load factor must not be exceeded;

(ii) There must be no excessive back pressure during the spin or recovery;

(iii) It must be impossible to obtain unrecoverable spins with any use of the flight or engine power controls either at the entry into or during the spin; and

(iv) For the flaps-extended condition, the flaps may be retracted during the recovery, but not before rotation has ceased.

(2) Spin resistant. The airplane must be demonstrated to be spin resistant by the following:

(i) During the stall maneuvers contained in § 23.201, the pitch control must be pulled back and held against the stop. Then, using ailerons and rudders in the proper direction, it must be possible to maintain wings-level flight within 15 degrees of bank and to roll the airplane from a 30-degree bank in one direction to a 30-degree bank in the other direction;

(ii) Reduce the airplane speed using pitch control at a rate of approximately 1 knot per second until the pitch control reaches the stop; then with the pitch control pulled back and held against the stop, apply full rudder control in a manner to promote spin entry, for a period of 7 seconds or through a 360-degree heading change, whichever occurs first. If the 360-degree heading change is reached first, it must have taken no fewer than 4 seconds. This maneuver must be performed first with the ailerons in the neutral position, and then with the ailerons deflected opposite the direction of turn in the most adverse manner. Power or thrust and airplane configuration must be set in accordance with § 23.201(f) without change during the maneuver. At the end of 7 seconds or a 360 degree heading change, the airplane must respond immediately and normally to primary flight controls applied to regain coordinated, unstalled flight without reversal of control effect and without exceeding the temporary control forces specified by § 23.143(c); and

(iii) Compliance with §§ 23.201 and 23.203 must be demonstrated with the airplane in uncoordinated flight, corresponding to one ball width displacement on a slip-skid indicator, unless one ball width displacement cannot be obtained with full rudder, in which case the demonstration must be with full rudder applied.

(b) *Utility category.* A utility category airplane must meet the requirements of paragraph (a) of this section or the requirements of paragraph (c) of this section if approval for spinning is requested.

(c) * * *

(3) It must be impossible to obtain unrecoverable spins with any use of the flight or engine power controls either at the entry into or during the spin.

* * * * *

8. Section 23.301 is amended by revising paragraph (b) to read as follows:

§ 23.301 Loads.

* * * * *

(b) Unless otherwise provided, the air, ground, and water loads must be placed in equilibrium with inertia forces, considering each item of mass in the airplane. These loads must be distributed to conservatively approximate or closely represent actual conditions. Methods used to determine load intensities and distribution on canard and tandem wing configurations must be validated by flight test measurement unless the methods used for determining those loading conditions are shown to be reliable or conservative on the configuration under consideration.

* * * * *

9. Part 23 is amended by adding a new § 23.302 after § 23.301 to read as follows:

§ 23.302 Canard or tandem wing configurations.

The forward structure of a canard or tandem wing configuration must:

(a) Meet all requirements of subpart C and subpart D of this part applicable to a wing; and

(b) Meet all requirements applicable to the function performed by these surfaces.

10. Section 23.331 is amended in paragraph (a) by replacing "§ 23.331" with "§ 23.333" and by adding a new paragraph (c) to read as follows:

§ 23.331 Symmetrical flight conditions.

* * * * *

(c) Mutual influence of the aerodynamic surfaces must be taken into account when determining flight loads.

11. Section 23.341 is amended by designating the existing text as paragraph (b); by adding the words "for conventional configurations" after the word "analysis" in newly designated paragraph (b); and by adding a new paragraph (a) to read as follows:

§ 23.341 Gust load factors.

(a) The gust load for a canard or tandem wing configuration must be computed using a rational analysis, considering the criteria of § 23.333(c), to develop the gust loading on each lifting surface or may be computed in accordance with paragraph (b) of this section provided that the resulting net loads are shown to be conservative with respect to the gust criteria of § 23.333(c).

* * * * *

§ 23.351 [Amended]

12. Section 23.351 is amended by removing the word "tail".

Subpart C—[Amended]

13. Subpart C is amended by revising the heading preceding § 23.421 to read as follows:

Horizontal Stabilizing and Balancing Surfaces

§ 23.421 [Amended]

14. Section 23.421 is amended by removing the word "tail" in paragraph (a) and inserting in its place the word "surface"; by removing the word "tail" in paragraph (b) and adding in its place

the word "balancing"; and by removing the last sentence of paragraph (b).

15. Section 23.423 is revised to read as follows:

§ 23.423 Maneuvering loads.

Each horizontal surface and its supporting structure, and the main wing of a canard or tandem wing configuration, if that surface has pitch control, must be designed for the maneuvering loads imposed by the following conditions:

(a) A sudden movement of the pitching control, at the speed V_A, to the maximum aft movement, and the maximum forward movement, as limited by the control stops, or pilot effort, whichever is critical.

(b) A sudden aft movement of the pitching control at speeds above V_A, followed by a forward movement of the pitching control resulting in the following combinations of normal and angular acceleration:

Condition	Normal acceleration (n)	Angular acceleration (radian/sec$_2$)
Nose-up pitching	1.0	$+39n_m \div V \times (n_m - 1.5)$
Nose-down pitching.	n_m	$-39n_m \div V \times (n_m - 1.5)$

where—

(1) n_m = positive limit maneuvering load factor used in the design of the airplane; and

(2) V = initial speed in knots.

The condition in this paragraph involve loads corresponding to the loads that may occur in a "checked maneuver" (a maneuver in which the pitching control is suddenly displaced in one direction and then suddenly moved in the opposite direction). The deflections and timing of the "checked maneuver" must avoid exceeding the limit maneuvering load factor. The total horizontal surface load for both nose-up and nose-down pitching conditions is the sum of the balancing loads at *V* and the specified value of the normal load factor *n*, plus the maneuvering load increment due to the specified value of the angular acceleration.

16. Section 23.425 is amended by removing the text of current paragraph (b) and marking it "[Reserved]"; by revising paragraphs (a), (c), and (d) introductory text to read as set forth below; and by revising definitions of a_{ht} and S_{ht} in the formula following paragraph (d) from "a_{ht} = Slope of horizontal tail lift curve (per-radian)" to "a_{ht} = Slope of aft horizontal lift curve (per radian)" and "S_{ht} = Area of horizontal tail (ft^2); and" to "S_{ht} = Area of aft horizontal lift surface (ft^2); and".

§ 23.425 Gust loads.

(a) Each horizontal surface, other than a main wing, must be designed for loads resulting from—

* * * * *

(c) When determining the total load on the horizontal surfaces for the conditions specified in paragraph (a) of this section, the initial balancing loads for steady unaccelerated flight at the pertinent design speeds V_F, V_C, and V_D must first be determined. The incremental load resulting from the gusts must be added to the initial balancing load to obtain the total load.

(d) In the absence of a more rational analysis, the incremental load due to the gust must be computed as follows only on airplane configurations with aft-mounted, horizontal surfaces, unless its use elsewhere is shown to be conservative:

* * * * *

§ 23.427 [Amended]

17. Section 23.427 is amended by removing the word "tail" in paragraph (a) and inserting the phrase "other than main wing" after the words "horizontal surfaces"; by removing the phrase "tail surfaces," in paragraph (b) and inserting the phrase "horizontal surfaces other than main wing," in its place; and by removing the word "tail" in paragraph (c) and inserting the phrase "other than main wing" after the phrase "horizontal surfaces".

Subpart C—[Amended]

18. Subpart C is amended by revising the heading preceding § 23.441 to read as follows:

Vertical Surfaces

§ 23.441 [Amended]

19. Section 23.441 is amended by removing the word "tail" in two places in paragraph (a); and by removing the text of paragraph (b) and designating paragraph (b) as "Reserved."

§ 23.443 [Amended]

20. Section 23.443 is amended by removing the word "tail" from paragraph (a); by removing in three places the word "tail" in the definitions in paragraph (c) and adding in its place the word "surface"; and by removing paragraph (d).

21. Section 23.445 is amended by revising the section heading; by revising paragraph (a); by adding the words "or winglets" after the words "outboard fins" in paragraphs (b) and (c); and by adding a new paragraph (d) to read as follows:

§ 23.445 Outboard fins or winglets.

(a) If outboard fins or winglets are included on the horizontal surfaces or wings, the horizontal surfaces or wings must be designed for their maximum load in combination with loads induced by the fins or winglets and moments or forces exerted on the horizontal surfaces or wings by the fins or winglets.

* * * * *

(d) When rational methods are used for computing loads, the maneuvering loads of § 23.441 on the vertical surfaces and the one-g horizontal surface load, including induced loads on the horizontal surface and moments or forces exerted on the horizontal surfaces by the vertical surfaces, must be applied simultaneously for the structural loading condition.

§ 23.455 [Amended]

22. Section 23.455 is amended by removing the text of paragraph (b) and marking it "[Reserved]".

23. Section 23.677 is amended by revising paragraph (d) to read as follows:

§ 23.677 Trim Systems.

* * * * *

(d) It must be demonstrated that the airplane is safely controllable and that the pilot can perform all maneuvers and operations necessary to effect a safe landing following any probable powered trim system runaway that reasonably might be expected in service, allowing for appropriate time delay after pilot recognition of the trim system runaway. The demonstration must be conducted at critical airplane weights and center of gravity positions.

24. Section 23.701 is amended by revising paragraph (a); by redesignating paragraph (b) as (c); and by adding a new paragraph (b) to read as follows:

§ 23.701 Flap interconnection.

(a) The main wing flaps and related movable surfaces as a system must—

(1) Be synchronized by mechanical connection; or

(2) Maintain synchronization so that the occurrence of an unsafe condition has been shown to be extremely improbable; or

(b) The airplane must be shown to have safe flight characteristics with any combination of extreme positions of individual movable surfaces (mechanically interconnected surfaces are to be considered as a single surface).

* * * * *

25. Section 23.735 is amended by adding a new paragraph (c) to read as follows:

§ 23.735 Brakes.

* * * * *

(c) If antiskid devices are installed, the devices and associated systems must be designed so that no single probable malfunction or failure will result in a hazardous loss of braking ability or directional control of the airplane.

§ 23.831 [Amended]

26. Section 23.831 is amended by removing the words, "In addition, for pressurized commuter category airplanes," in paragraph (b) and adding in their place the words, "For pressurized airplanes,".

27. Section 23.939 is amended by adding paragraph (b) and revising paragraph (c) to read as follows:

§ 23.939 Powerplant operating characteristics.

* * * * *

(b) Turbocharged reciprocating engine operating characteristics must be investigated in flight to assure that no adverse characteristics, as a result of an inadvertent overboost, surge, flooding, or vapor lock, are present during normal or emergency operation of the engine(s) throughout the range of operating limitations of both airplane and engine.

(c) For turbine engines, the air inlet system must not, as a result of airflow distortion during normal operation, cause vibration harmful to the engine.

§ 23.1047 [Amended]

27–1. Section 23.1047 is amended in paragraph (d) introductory text by removing the phrase "§ 23.67(a) or"; in paragraph (d)(1) by removing the phrase "or § 23.67(b)(1)"; in paragraph (d)(5) by removing the phrase "§ 23.67(a) or"; and in paragraph (e) by removing the phrase "§ 23.67(a) or".

28. Part 23 is amended by adding a new § 23.1109 after § 23.1105 to read as follows:

§ 23.1109 Turbocharger bleed air system.

The following applies to turbocharged bleed air systems used for cabin pressurization:

(a) The cabin air system may not be subject to hazardous contamination following any probable failure of the turbocharger or its lubrication system.

(b) The turbocharger supply air must be taken from a source where it cannot be contaminated by harmful or hazardous gases or vapors following any probable failure or malfunction of the engine exhaust, hydraulic, fuel, or oil system.

29. Section 23.1163 is amended by revising paragraphs (a)(1), (a)(2), and (a)(3); by removing the phrase "In addition, for commuter category airplanes, if" in paragraph (d) and inserting in its place the word "If"; and by adding a new paragraph (e) to read as follows:

§ 23.1163 Powerplant accessories.

(a) * * *

(1) Be approved for mounting on the engine involved and use the provisions on the engines for mounting; or

(2) Have torque limiting means on all accessory drives in order to prevent the torque limits established for those drives from being exceeded; and

(3) In addition to paragraphs (a)(1) or (a)(2) of this section, be sealed to prevent contamination of the engine oil system and the accessory system.

* * * * *

(e) Each accessory driven by a gearbox that is not approved as part of the powerplant driving the gearbox must—

(1) Have torque limiting means to prevent the torque limits established for the affected drive from being exceeded;

(2) Use the provisions on the gearbox for mounting; and

(3) Be sealed to prevent contamination of the gearbox oil system and the accessory system.

30. Section 23.1323 is amended by adding a new paragraph (e) to read as follows:

§ 23.1323 Airspeed indicating system.

* * * * *

(e) If certification for instrument flight rules or flight in icing conditions is requested, each airspeed system must have a heated pitot tube or an equivalent means of preventing malfunction due to icing.

31. Section 23.1325 is amended by adding a new paragraph (g) to read as follows:

§ 23.1325 Static pressure system.

* * * * *

(g) For airplanes prohibited from flight in instrument meteorological conditions, in accordance with § 23.1559(b) of this part, paragraph (b)(3) of this section does not apply.

Appendix B [Removed and Reserved]

32. Part 23 is amended by removing Appendix B and inserting the words "Appendix B [Reserved]" in its place.

Issued in Washington, DC, on December 21 1990.

James B. Busey,

Administrator.

[FR Doc. 91–23 Filed 1–2–91; 8:45 am]

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Corrections

Federal Register
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DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Parts 1 and 23

[Docket No. 25811; Amdt. Nos. 1-37 and 23-42]

1RIN 2120-AC15

Small Airplane Airworthiness Review Program Amendment No. 2

Correction

In the issue of Monday, February 11, 1991, on page 5455, beginning in the second column, in the correction to rule document 91-23, the docket number was inaccurately printed and should have appeared as shown above.

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DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Parts 1 and 23

[Docket No. 25811; Amdt. Nos. 1-37 and 23-42]

RIN 2120-AC15

Small Airplane Airworthiness Review Program Amendment No. 2

Correction

In rule document 91-23 beginning on page 344, in the issue of Thursday, January 3, 1991 make the following corrections:

1. On page 346, in the second column, in the second complete paragraph, in the eighth line, "claim" should read "climb".

2. On page 349, in the second column, in the second line, "§ 23.969(b)" should read "§ 23.939(b)".

3. On the same page, in the same column, under *Proposal 29.*, in the eighth line, "23-24." should read "23-34.".

§ 23.221 [Corrected]

4. On page 352, in § 23.221(a)(1)(i), in the first line, "the" should read "and".

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