DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Part 25

[Docket No. 27902; Amdt. No. 25–86]

RIN 2120–AF27

Revised Discrete Gust Load Design Requirements

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Final rule.

SUMMARY: This amendment revises the gust load design requirements for transport category airplanes. This amendment replaces the current discrete gust requirement with a new requirement for a discrete tuned gust; modifies the method of establishing the design airspeed for maximum gust intensity; and provides for an operational rough air speed. These changes are made in order to provide a more rational basis of accounting for the aerodynamic and structural dynamic characteristics of the airplane. These changes also provide for harmonization of the discrete gust requirements with the Joint Aviation Requirements (JAR) of Europe as recently amended.

EFFECTIVE DATE: March 11, 1996.

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SUPPLEMENTARY INFORMATION:

Background

The National Advisory Committee for Aeronautics (NACA), the predecessor of the National Aeronautics and Space Administration (NASA), began an inflight gust measurement program in 1933 to assist in the refinement of gust load design criteria. Using unsophisticated analog equipment, that program resulted in the development of the improved design requirements for gust loads that were issued in part 04 of the Civil Aeronautics Regulations (CAR) in the 1940's. The corresponding Civil Aeronautics Manual (CAM) 04 provided a simplified formula from which to derive the design gust loads from the specified design gust velocities. These criteria were based on an analytical encounter of the airplane with a discrete ramp-shaped gust with a gradient distance (the distance necessary for the gust to build to a peak) of 10 times the mean chord length of the airplane wing. An alleviation factor, calculated from wing loading, was provided in order to account for the relieving effects of rigid body motion of the airplane as it penetrated the gust. With the development of the VGH (velocity, load factor, height) recorder in 1946, NASA began collecting a large quantity of gust load data on many types of aircraft in airline service. Although that program was terminated for transport airline operations in 1971, the data provided additional insight into the nature of gusts in the atmosphere, and resulted in significant changes to the gust load design requirements. The evolution of the discrete gust design criteria from part 04 through part 4b of the CAR to current part 25 of Title 14 of the Code of Federal Regulations (CFR) (which contains the design requirements for transport category airplanes) resulted in the establishment of a prescribed gust shape with a specific gust gradient distance and increased peak gust design velocities. The prescribed shape was a "one-minus-cosine" gust shape with a specified gust gradient distance of 12.5 times the mean chord length of the airplane wing. The gust gradient distance, for that particular shape, was equal to one-half the total gust length. A simplified analytical method similar to the methodology of CAM 04 was provided along with an improved alleviation factor that accounted for unsteady aerodynamic forces, gust shape, and the airplane rigid body vertical response.

The increasing speed, size, and structural flexibility of transport airplanes resulted in the need to consider not only the rigid body response of the airplane, but also structural dynamic response and the effects of structural deformation on the aerodynamic parameters. Early attempts to account for structural flexibility led to a "tuned" gust approach in which the analysis assumed a flexible airplane encountering gusts with various gradient distances in order to find the most critical gust gradient distance for use in design for each major component. A tuned discrete gust approach became a requirement for compliance with the British Civil Airworthiness Requirements.

Another method of accounting for the structural dynamic effects of the airplane involved the power spectral density (PSD) analysis technique which accounted for the statistical distribution of gusts in continuous turbulence in conjunction with the aeroelastic and structural dynamic characteristics of the airplane. In the 1960's, the Federal Aviation Administration (FAA) awarded study contracts to Boeing and Lockheed for the purpose of assisting the FAA in developing the PSD gust methodology into continuous gust design criteria with analytical procedures. The final PSD continuous turbulence criteria were based on those studies and were codified in Appendix G to part 25 in 1980.

Recognizing that the nature of gusts was not completely defined, and that individual discrete gusts might exist outside the normal statistical distribution of gusts in continuous turbulence, the FAA retained the existing criteria for discrete gusts in addition to the new requirement for continuous turbulence. The current discrete gust criteria in Subpart C of part 25 require the loads to be analytically developed assuming the airplane encounters a gust with a fixed gradient distance of 12.5 mean chord lengths. For application of the current criteria, it is generally assumed that the airplane is rigid in determining the dynamic response to the gust while the effects of wing elastic deflection on wing static lift parameters are normally taken into account. The minimum value of the airplane design speed for maximum gust intensity, V_B, is also established from the discrete gust criteria.

Recent flight measurement efforts by FAA and NASA have been aimed at utilizing measurements from the digital flight data recorders (DFDR) to derive gust load design information for airline transport airplanes. The Civil Aviation Authority (CAA) of the United Kingdom has also been conducting a comprehensive DFDR gust measurement program for transport airplanes in airline service. The program, called CAADRP (Civil Aircraft Airworthiness Data Recording Program), uses data sampling rates that allow the measurement of a wide range of gust gradient distances. The CAADRP program is still continuing and has resulted in an extensive collection of reliable gust data.

In 1988, the FAA, in cooperation with the JAA and organizations representing the American and European aerospace industries, began a process to harmonize the airworthiness requirements of the United States and the airworthiness requirements of Europe in regard to gust requirements. The objective was to achieve common requirements for the certification of transport airplanes without a substantive change in the level of safety provided by the regulations. Other airworthiness authorities such as Transport Canada have also participated in this process.

In 1992, the harmonization effort was undertaken by the Aviation Regulatory Advisory Committee (ARAC). A working group of industry and government structural loads specialists of Europe, the United States, and Canada was chartered by notice in the Federal Register (58 FR 13819, March 15, 1993) to harmonize certain specific sections of part 25, including the requirements related to discrete gusts. The harmonization task concerning discrete gusts was completed by the working group and recommendations were submitted to FAA by letter dated October 15, 1993. The FAA concurred with the recommendations and proposed them in Notice of Proposed Rulemaking (NPRM) No. 94–29 which was published in the Federal Register on September 16, 1994, (59 FR 47756).

Discussion of Comments

Comments were received from domestic and foreign aviation manufacturers and foreign airworthiness authorities. The majority of the commenters agreed with the proposal and recommended its adoption. However, some commenters disagreed substantially with the proposal while providing alternative proposals that appeared to merit further consideration by the Aviation Rulemaking Advisory Committee. Therefore the FAA tasked the ARAC Loads and Dynamics Working Group by notice in the Federal Register (60 FR 18874, April 13, 1995) to consider the comments and provide recommendations for the disposition of the comments along with any recommendations for changes to the proposal. The disposition of comments that follows is based on the recommendation submitted to the FAA by ARAC on July 14, 1995.

One commenter suggests that the new method for calculating the minimum V_B results in lower values at altitude than the current method provided in the Joint Aviation Requirements (JAR) and could provide unrealistic margins above the stalling speed. The FAA disagrees. The commenter provides no data or other information that shows the new V_B calculations to be unrealistic. The new method for calculating the minimum V_B is approximately the same as in the current FAR and JAR; the main difference being that revised gust speeds are used in the calculation. These gust speeds are based on actual measurements in aircraft operation and are considered to result in a realistic and conservative V_B speed, even if it is somewhat lower than the current requirements at some altitudes. In addition, a new operational rough air speed, V_{RA}, is provided in order to ensure adequate stall margins while operating in rough air. As part of the effort to harmonize the airworthiness requirements, the JAA is also considering adopting this method of calculating the minimum V_B speeds. This commenter, along with several other, also points out an error in the formula for the design speed for maximum gust intensity, V_B, in § 25.335(d) and this error has been corrected.

One commenter suggests that the proposed tuned gust criteria do not fully account for the dynamic response of the airplane and therefore could produce unconservative results and seriously underpredict the gust design loads. The commenter suggests that the proposal be replaced by an entirely new method of accounting for discrete gusts. This method is known in the industry as the statistical discrete gust method (SDG). In response to the task defined in the Federal Register, the ARAC Loads and Dynamics Working Group considered the commenters comments and the alternate proposal in considerable detail. It is recognized by the working group that the current proposed tuned gust criteria have some limitations and that the suggested SDG method may have some promising applications for predicting gust loads. However, the SDG method is in a developmental stage, and there is currently no established industry process for using this method in predicting gust design loads. The FAA will retain the commenters proposal for possible consideration in future rulemaking actions. In response to the commenters specific concerns, neither ARAC nor the FAA agree that the tuned gust method will result in unconservative design loads. In addition, for the extreme gust gradient distances where the commenter questions the adequacy of the tuned gust method to fully account for dynamic response, the FAA considers that the additional continuous gust criteria of § 25.341(b) will compensate for any possible deficiencies. The commenter provides some comparisons of loads produced by the SDG method with the results of the proposed tuned gust method. These results show no significant differences in overall load levels when all factors are considered, and in some cases the SDG method actually provided lower design loads. Therefore, except for an editorial correction to the mathematical equation noted above, the amendment is adopted as proposed.

Regulatory Evaluation Summary

Regulatory Evaluation, Regulatory Flexibility Determination, and Trade Impact Assessment

Changes to federal regulations must undergo several economic analyses. First, Executive Order 12866 directs Federal agencies to promulgate new regulations or modify existing regulations only if the potential benefits to society justify its costs. Second, the Regulatory Flexibility Act of 1980 requires agencies to analyze the economic impact of regulatory changes on small entities. Finally, the Office of Management and Budget directs agencies to assess the effects of regulatory changes on international trade. In conducting these assessments, the FAA has determined that this rule: (1) will generate benefits exceeding its costs and is not ‘‘significant’’ as defined in Executive Order 12866; (2) is not ‘‘significant’’ as defined in DOT's Policies and Procedures; (3) will not have a significant impact on a substantial number of small entities; and (4) will not constitute a barrier to international trade. These analyses, available in the docket, are summarized below.

Costs and Benefits

The changes will have economic consequences. The costs will be the incremental costs of meeting the tuned discrete gust requirements rather than the current static discrete gust requirements. The benefits will be the cost savings from not meeting two different sets of discrete gust requirements, i.e., the requirements in the current FAR and the requirements in the JAR. In order to sell their transport category airplanes in a global marketplace, manufacturers usually certify their products under both sets of regulations.

Industry sources provided information on the additional costs and cost savings that would result from the rule. Based on this information, a range of representative certification costs and savings are shown below. The costs and savings per certification are those related to meeting discrete gust load requirements, including related provisions of the final rule.

PER CERTIFICATION COSTS AND SAVINGS ASSOCIATED WITH REVISED DISCRETE GUST LOAD REQUIREMENTS

[in thousands of dollars]

Current FAA certification requirement costs	$29–$115
Current JAA certification requirement costs	$70–$145
Current joint certification requirement costs	$100–$150
Revised FAA certification requirement costs	$70–$145

PER CERTIFICATION COSTS AND SAVINGS ASSOCIATED WITH REVISED DISCRETE GUST LOAD REQUIREMENTS—Continued

[in thousands of dollars]

Revised joint certification requirement costs	$70–$145
Savings (current joint certification costs minus revised joint certification costs)	$5–$30

The costs and cost savings of specific certifications may vary from these estimates. In all cases where a manufacturer seeks both FAA and JAA certification, however, the cost savings realized through harmonized requirements will outweigh the expected incremental costs of the rule. The FAA did not receive comments concerning this quantification of costs during the comment period; therefore, the FAA holds that these are representative costs and savings.

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 Federal regulations. The RFA requires agencies to review rules which may have ''a significant economic impact on a substantial number of small entities.'' FAA Order 2100.14A outlines FAA's procedures and criteria for implementing the RFA.

An aircraft manufacturer must employ 75 or fewer employees to be designated as a ''small'' entity. A substantial number of small entities is defined as a number that is 11 or more and which is more than one-third of the small entities subject to a proposed or final rule. None of the manufacturers of transport category airplanes qualify as small entities under this definition. Therefore, the final rule will not have a significant economic impact on a substantial number of small entities.

International Trade Impact Assessment

The rule will not constitute a barrier to international trade, including the export of American goods and services to foreign countries and the import of foreign goods and services into the United States. The discrete gust load requirements in this rule will harmonize with those of the JAA and will, in fact, lessen the restraints on trade.

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 level of government. Thus, in accordance with Executive Order 12612, it is determined that this proposal does not have sufficient federalism implications to warrant the preparation of a Federalism Assessment.

Conclusion

Because the proposed changes to the gust design criteria are not expected to result in a substantial economic cost, the FAA has determined that this proposed regulation would not be significant under Executive Order 12866. Because this is an issue that has not promoted a great deal of public concern, the FAA has determined that this action is not significant under DOT Regulatory Policies and Procedures (44 FR 11034; February 25, 1979). In addition, since there are no small entities affected by this rulemaking, the FAA certifies that the rule would not have a significant economic impact, positive or negative, on a substantial number of small entities under the criteria of the Regulatory Flexibility Act, since none would be affected. A copy of the regulatory evaluation prepared for this project may be examined in the Rules Docket or obtained fro the person identified under the caption **FOR FURTHER INFORMATION CONTACT**.

List of Subjects in 14 CFR Part 25

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

The Amendments

In consideration of the foregoing, the Federal Aviation Administration (FAA) amends 14 CFR Part 25 of the Federal Aviation Regulations (FAR) as follows:

PART 25—AIRWORTHINESS STANDARDS: TRANSPORT CATEGORY AIRPLANES

1. The authority citation for part 25 is revised to read as follows:

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

§ 25.305 [Amended]

2. By amending § 25.305 by removing and reserving paragraph (d).

3. By amending § 25.321 by adding new paragraphs (c) and (d) to read as follows:

§ 25.321 General.

* * * * *

(c) Enough points on and within the boundaries of the design envelope must be investigated to ensure that the maximum load for each part of the airplane structure is obtained.

(d) The significant forces acting on the airplane must be placed in equilibrium in a rational or conservative manner. The linear inertia forces must be considered in equilibrium with the thrust and all aerodynamic loads, while the angular (pitching) inertia forces must be considered in equilibrium with thrust and all aerodynamic moments, including moments due to loads on components such as tail surfaces and nacelles. Critical thrust values in the range from zero to maximum continuous thrust must be considered.

4. By amending § 25.331 by revising the title and paragraph (a) introductory text, by removing paragraphs (a) (1) and (2) and redesignating paragraphs (a) (3) and (4) as (a) (1) and (2) respectively and revising them to read as set forth below, and by removing paragraph (d).

§ 25.331 Symmetric maneuvering conditions.

(a) *Procedure.* For the analysis of the maneuvering flight conditions specified in paragraphs (b) and (c) of this section, the following provisions apply:

(1) Where sudden displacement of a control is specified, the assumed rate of control surface displacement may not be less than the rate that could be applied by the pilot through the control system.

(2) In determining elevator angles and chordwise load distribution in the maneuvering conditions of paragraphs (b) and (c) of this section, the effect of corresponding pitching velocities must be taken into account. The in-trim and out-of-trim flight conditions specified in § 25.255 must be considered.

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5. By amending § 25.333 by revising the title and paragraph (a) to read as follows, and by removing paragraph (c).

§ 25.333 Flight maneuvering envelope.

(a) *General.* The strength requirements must be met at each combination of airspeed and load factor on and within the boundaries of the representative maneuvering envelope (*V-n* diagram) of paragraph (b) of this section. This envelope must also be used in determining the airplane structural operating limitations as specified in § 25.1501.

* * * * *

6. By amending § 25.335 by revising paragraph (d) to read as follows:

§ 25.335 Design airspeeds.

* * * * *

(d) *Design speed for maximum gust intensity,* V_B.

(1) V_B may not be less than

$$V_{S1}\left[1+\frac{K_g U_{ref} V_c a}{498w}\right]^{1/2}$$

where—

V_{S1}=the 1-g stalling speed based on C_{NAmax} with the flaps retracted at the particular weight under consideration;

V_c=design cruise speed (knots equivalent airspeed);

U_{ref}=the reference gust velocity (feet per second equivalent airspeed) from § 25.341(a)(5)(i);

w=average wing loading (pounds per square foot) at the particular weight under consideration.

$$K_g = \frac{.88\mu}{5.3+\mu}$$

$$\mu = \frac{2w}{\rho cag}$$

ρ=density of air (slugs/ft³);

c=mean geometric chord of the wing (feet);

g=acceleration due to gravity (ft/sec²);

a=slope of the airplane normal force coefficient curve, C_{NA} per radian;

(2) At altitudes where V_C is limited by Mach number—

(i) V_B may be chosen to provide an optimum margin between low and high speed buffet boundaries; and,

(ii) V_B need not be greater than V_C.

* * * * *

7. By revising § 25.341 to read as follows:

§ 25.341 Gust and turbulence loads.

(a) *Discrete Gust Design Criteria.* The airplane is assumed to be subjected to symmetrical vertical and lateral gusts in level flight. Limit gust loads must be determined in accordance with the provisions:

(1) Loads on each part of the structure must be determined by dynamic analysis. The analysis must take into account unsteady aerodynamic characteristics and all significant structural degrees of freedom including rigid body motions.

(2) The shape of the gust must be:

$$U = \frac{U_{ds}}{2}\left[1-\cos\left(\frac{\pi s}{H}\right)\right]$$

for $0 \le s \le 2H$

where—

s=distance penetrated into the gust (feet);

U_{ds}=the design gust velocity in equivalent airspeed specified in paragraph (a)(4) of this section; and

H=the gust gradient which is the distance (feet) parallel to the airplane's flight path for the gust to reach its peak velocity.

(3) A sufficient number of gust gradient distances in the range 30 feet to 350 feet must be investigated to find the critical response for each load quantity.

(4) The design gust velocity must be:

$$U_{ds} = U_{ref} F_g \left(\frac{H}{350}\right)^{1/6}$$

where—

U_{ref}=the reference gust velocity in equivalent airspeed defined in paragraph (a)(5) of this section.

F_g=the flight profile alleviation factor defined in paragraph (a)(6) of this section.

(5) The following reference gust velocities apply:

(i) At the airplane design speed V_C: Positive and negative gusts with reference gust velocities of 56.0 ft/sec EAS must be considered at sea level. The reference gust velocity may be reduced linearly from 56.0 ft/sec EAS at sea level to 44.0 ft/sec EAS at 15000 feet. The reference gust velocity may be further reduced linearly from 44.0 ft/sec EAS at 15000 feet to 26.0 ft/sec EAS at 50000 feet.

(ii) At the airplane design speed V_D: The reference gust velocity must be 0.5 times the value obtained under § 25.341(a)(5)(i).

(6) The flight profile alleviation factor, F_g, must be increased linearly from the sea level value to a value of 1.0 at the maximum operating altitude defined in § 25.1527. At sea level, the flight profile alleviation factor is determined by the following equation:

$$F_g = 0.5\left(F_{gz} + F_{gm}\right)$$

Where:

$$F_{gm} = 1 - \frac{Z_{mo}}{250000};$$

$$F_{gm} = \sqrt{R_2 \mathrm{Tan}\left(\pi R_1 / 4\right)};$$

$$R_1 = \frac{\text{Maximum Landing Weight}}{\text{Taximum Take-off Weight}};$$

$$R_2 = \frac{\text{Maximum Zero Fuel Weight}}{\text{Maximum Take-off Weight}};$$

Z_{mo}=Maximum operating altitude defined in § 25.1527.

(7) When a stability augmentation system is included in the analysis, the effect of any significant system nonlinearities should be accounted for when deriving limit loads from limit gust conditions.

(b) *Continuous Gust Design Criteria.* The dynamic response of the airplane to vertical and lateral continuous turbulence must be taken into account. The continuous gust design criteria of Appendix G of this part must be used to establish the dynamic response unless more rational criteria are shown.

8. By amending § 25.343 by revising paragraph (b)(1)(ii) to read as follows:

§ 25.343 Design fuel and oil loads.

(a) * * *

(b) * * *

(1) * * *

(ii) The gust conditions of § 25.341(a) but assuming 85% of the design velocities prescribed in § 25.341(a)(4).

* * * * *

9. By amending § 25.345 by revising paragraphs (a) and (c) to read as follows:

§ 25.345 High lift devices.

(a) If wing flaps are to be used during takeoff, approach, or landing, at the design flap speeds established for these stages of flight under § 25.335(e) and with the wing flaps in the corresponding positions, the airplane is assumed to be subjected to symmetrical maneuvers and gusts. The resulting limit loads must correspond to the conditions determined as follows:

(1) Maneuvering to a positive limit load factor of 2.0; and

(2) Positive and negative gusts of 25 ft/sec EAS acting normal to the flight path in level flight. Gust loads resulting on each part of the structure must be determined by rational analysis. The analysis must take into account the unsteady aerodynamic characteristics and rigid body motions of the aircraft. The shape of the gust must be as described in § 25.341(a)(2) except that—

U_{ds}=25 ft/sec EAS;

H=12.5 c; and

c=mean geometric chord of the wing (feet).

(b) * * *

(c) If flaps or other high lift devices are to be used in en route conditions, and with flaps in the appropriate position at speeds up to the flap design speed chosen for these conditions, the airplane is assumed to be subjected to symmetrical maneuvers and gusts within the range determined by—

(1) Maneuvering to a positive limit load factor as prescribed in § 25.337(b); and

(2) The discrete vertical gust criteria in § 25.341(a).

* * * * *

10. By amending § 25.349 by revising the introductory text and paragraph (b) to read as follows:

§ 25.349 Rolling conditions.

The airplane must be designed for loads resulting from the rolling conditions specified in paragraphs (a) and (b) of this section. Unbalanced aerodynamic moments about the center of gravity must be reacted in a rational or conservative manner, considering the principal masses furnishing the reaching inertia fores.

(a) * * *

(b) *Unsymmetrical gusts.* The airplane is assumed to be subjected to unsymmetrical vertical gusts in level flight. The resulting limit loads must be determined from either the wing maximum airload derived directly from § 25.341(a), or the wing maximum airload derived indirectly from the vertical load factor calculated from § 25.341(a). It must be assumed that 100 percent of the wing air load acts on one side of the airplane and 80 percent of the wing air load acts on the other side.

11. By amending § 25.351 by revising the introductory text and by removing and reserving paragraph (b).

§ 25.351 Yawing conditions.

The airplane must be designed for loads resulting from the conditions specified in paragraph (a) of this section. Unbalanced aerodynamic moments about the center of gravity must be reacted in a rational or conservative manner considering the principal masses furnishing the reacting inertia forces:

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12. By revising § 25.371 to read as follows:

§ 25.371 Gyroscopic loads.

The structure supporting the engines and the auxiliary power units must be designed for the gyroscopic loads associated with the conditions specified in §§ 25.331, 25.341(a), 25.349 and 25.351 with the engine or auxiliary power units at maximum continuous rpm.

13. By amending § 25.373 by revising paragraph (a) to read as follows:

§ 25.373 Speed control devices.

* * * * *

(a) The airplane must be designed for the symmetrical maneuvers prescribed in § 25.333 and § 25.337, the yawing maneuvers prescribed in § 25.351, and the vertical and later gust conditions prescribed in § 25.341(a), at each setting and the maximum speed associated with that setting; and

* * * * *

14. By amending § 25.391 by revising the introductory text and paragraph (e) to read as follows:

§ 25.391 Control surface loads: general.

The control surfaces must be designed for the limit loads resulting from the flight conditions in §§ 25.331, 25.341(a), 25.349 and 25.351 and the ground gust conditions in § 25.415, considering the requirements for—

* * * * *

(e) Auxiliary aerodynamic surfaces, in § 25.445.

15. By revising § 25.427 to read as follows:

§ 25.427 Unsymmetrical loads.

(a) In designing the airplane for lateral gust, yaw maneuver and roll maneuver conditions, account must be taken of unsymmetrical loads on the empennage arising from effects such as slipstream and aerodynamic interference with the wing, vertical fin and other aerodynamic surfaces.

(b) The horizontal tail must be assumed to be subjected to unsymmetrical loading conditions determined as follows:

(1) 100 percent of the maximum loading from the symmetrical maneuver conditions of § 25.331 and the vertical gust conditions of § 25.341(a) acting separately on the surface on one side of the plane of symmetry; and

(2) 80 percent of these loadings acting on the other side.

(c) For empennage arrangements where the horizontal tail surfaces have dihedral angles greater than plus or minus 10 degrees, or are supported by the vertical tail surfaces, the surfaces and the supporting structure must be designed for gust velocities specified in § 25.341(a) acting in any orientation at right angles to the flight path.

(d) Unsymmetrical loading on the empennage arising from buffet conditions of § 25.305(e) must be taken into account.

16. By amending § 25.445 by revising the title and revising paragraph (a) to read as follows:

§ 25.445 Auxiliary aerodynamic surfaces.

(a) When significant, the aerodynamic influence between auxiliary aerodynamic surfaces, such as outboard fins and winglets, and their supporting aerodynamic surfaces, must be taken into account for all loading conditions including pitch, roll, and yaw maneuvers, and gusts as specified in § 25.341(a) acting at any orientation at right angles to the flight path.

* * * * *

17. By amending § 25.571 by revising paragraphs (b)(2) and (b)(3) to read as follows:

§ 25.571 Damage-tolerance and fatigue evaluation of structure.

* * * * *

(b) * * *

(2) The limit gust conditions specified in § 25.341 at the specified speeds up to V_C and in § 25.345.

(3) The limit rolling conditions specified in § 25.349 and the limit unsymmetrical conditions specified in §§ 25.367 and 25.427 (a) through (c), at speeds up to V_C.

* * * * *

18. By adding a new § 25.1517 to read as follows:

§ 25.1517 Rough air speed, V_{RA}.

A rough air speed, V_{RA}, for use as the recommended turbulence penetration airspeed in § 25.1585(a)(8), must be established, which—

(1) Is not greater than the design airspeed for maximum gust intensity, selected for V_B; and

(2) Is not less than the minimum value of V_B specified in § 25.335(d); and

(3) Is sufficiently less than V_{MO} to ensure that likely speed variation during rough air encounters will not cause the overspeed warning to operate too frequently. In the absence of a rational investigation substantiating the use of other values, V_{RA} must be less than V_{MO}—35 knots (TAS).

Issued in Washington, DC, on February 2, 1996.

David R. Hinson,

Administrator.

[FR Doc. 96–2633 Filed 2–8–96; 8:45 am]

BILLING CODE 4910–13–M