[4910-13] DRAFT

DEPARTMENT OF TRANSPORTATION 10/26/95

Federal Aviation Administration

14 CFR Part 25

[Docket No. ; Notice No.]

RIN 2120-

Braked Roll Conditions

AGENCY: Federal Aviation Administration, DOT.

ACTION: Notice of proposed rulemaking (NPRM).

SUMMARY: This notice proposes to amend the requirements for landing gear braking on transport category airplanes to require that the airplane be designed to withstand main landing gear maximum braking forces during ground operations. This action would ensure that the landing gear and fuselage are capable of withstanding the dynamic loads associated with the maximum dynamic braking condition, and would also relieve a burden on industry by eliminating differences between the Federal Aviation Regulations (FAR) and European Joint Aviation Requirements (JAR).

DATES: Comments must be received on or before [insert date 90 days after date of publication in the Federal Register].

ADDRESSES: Comments on this proposal should be mailed in triplicate to: Federal Aviation Administration, Office of the Chief Counsel, Attention: Rules Docket (AGC-10), Docket No. , 800 Independence Avenue SW., Washington, DC 20591. Comments delivered must be marked Docket No. . Comments may be examined in Room 915G weekdays, except Federal holidays, between 8:30 a.m. and 5:00 p.m. In addition, the FAA is maintaining an information docket of comments in the Office of the Assistant Chief Counsel (ANM-7), FAA, Northwest Mountain Region, 1601 Lind Avenue SW., Renton, Washington 98055-4056. Comments in the information docket may be examined in the Office of the Assistant Chief Counsel weekdays, except Federal holidays, between 7:30 a.m. and 4:00 p.m.

FOR FURTHER INFORMATION CONTACT: Iven D. Connally, FAA, Airframe and Propulsion Branch (ANM-112), Transport Airplane Directorate, Aircraft Certification Service, 1601 Lind Avenue SW., Renton, Washington 98055-4056; telephone (206) 227-2120.

SUPPLEMENTARY INFORMATION:

Comments Invited

Interested persons are invited to participate in this proposed rulemaking by submitting such written data, views, or arguments as they may desire. Comments relating to the environmental, energy, or economic impact that might result from adopting the proposal contained in this notice are invited. Substantive comments should be accompanied by cost estimates. Commenters should identify the regulatory docket or notice number and submit comments in triplicate to the Rules Docket address specified above. All comments received on or before the closing date for comments will be considered by the Administrator before taking action on this rulemaking. The proposal contained in this notice may be changed in light of comments received. All comments will be available in the Rules Docket, both before and after the closing date for comments, for examination by interested persons. A report summarizing each substantive public contact with FAA personnel concerning this rulemaking will be filed in the docket. Commenters wishing the FAA to acknowledge receipt of their comments must submit with those comments a self-addressed, stamped postcard on which the following statement is made: "Comments to Docket No. ." The postcard will be date stamped and returned to the commenter.

Availability of the NPRM

Any person may obtain a copy of this NPRM by submitting a request to the Federal Aviation Administration, Office of Public Affairs, Attention: Public Inquiry Center, APA-230, 800 Independence Avenue SW., Washington, D.C. 20591, or by calling (202) 267-3484. Communications must identify the notice number of this NPRM. Persons interested in being placed on a mailing list for future rulemaking documents should also request a copy of Advisory

Circular No. 11-2A, Notice of Proposed Rulemaking Distribution System, which describes the application procedure.

Background

The current 14 CFR part 25 airworthiness standards, § 25.493, and its predecessor rule, Civil Air Regulations (CAR) 4b.235(b), prescribe conditions that the airplane structure and landing gear must be designed to withstand during airplane taxiing with a constant (steady) application of brakes ("braked roll" condition). Both rules treat the braked roll condition as a static equilibrium condition that accounts for the airplane weight and the added nose down force caused by steady braking. Neither rule accounts for the additional dynamic loads on the nose gear and fuselage caused by the initial pitching motion of the airplane due to sudden application of main landing gear brakes. Adequate strength has been achieved on existing airplanes by application of other part 25 design requirements and by the manufacturers' need to comply with the more stringent British Civil Airworthiness Requirements (BCAR).

For many years the BCAR have included a dynamic braking condition that requires that consideration be given to the maximum likely combination of dynamic vertical reaction and sudden increase in drag load that could occur on the nose gear as a result of sudden main gear braking while encountering obstacles. The BCAR addresses obstacles such as overruns onto semi-prepared surfaces during rejected takeoffs, running off the edge then back on to the runway during avoidance maneuvers, running over displaced or lowered edges of runway paving, and inadvertent use of runways under repair. In application of the BCAR requirement, it was found that U.S. designed airplanes generally have had adequate strength to meet this condition without requiring any modifications. However, this may not always be the case, especially if new airplane designs are significantly different from past conventional configurations in vertical and longitudinal mass distributions of fuel, payload, engine location, etc. As the takeoff weight increases with respect to landing weight, the dynamic braked roll condition can become more

critical for the nose gear and fuselage. Without a specific dynamic braked roll condition, the current braked roll requirements do not guarantee that such strength will always be present.

In 1988, the FAA, in cooperation with the JAA and other 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. 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 also participated in this process.

In 1992, the harmonization effort was undertaken by the Aviation Rulemaking Advisory Committee (ARAC) to harmonize the loads requirements. A working group of industry and government structural loads specialists from Europe, the United States, and Canada was chartered by notice in the Federal Register (58 FR 13819, March 15, 1993). On June 10, 1994 (58 FR 30081), the Loads & Dynamics Harmonization Working Group was assigned the additional task of reviewing and harmonizing the braked roll condition. That harmonization effort has now progressed to the point where a specific proposal has been developed by the working group and recommended to the FAA by letter dated [insert date of submittal of recommendation to the FAA].

Discussion

The European Joint Aviation Authorities (JAA) consider the BCAR braked roll condition too severe a condition to be considered for an airplane design requirement. For instance, it is unlikely that maximum braking will occur at the same instant the gear runs off the runway or during an avoidance maneuver. Nevertheless, the JAA has recognized that sudden application of main gear maximum braking during ground operations is a likely event that the airplane should be able to withstand; and since October 1988, the European Joint Aviation Requirements (JAR-25) have included a dynamic braked roll condition, which now supersedes the previously cited BCAR requirement.

The FAA agrees with the JAA that the sudden application of main gear maximum braking force during ground operations is a likely operational event that the airplane must be able to withstand, and that the BCAR requirement that combines high vertical loads with extreme drag load is an unrealistic condition for the nose gear. However, the current braked roll condition of § 25.493 of the FAR does not ensure that the nose landing gear and fuselage structure are capable of withstanding the loads developed from sudden application of main gear maximum braking force.

The FAA considers the JAA proposed dynamic braked roll condition to be a realistic method to account for dynamic loads that could exceed the static load requirements of § 25.493(b) on future designs. The proposed rule would amend the current FAR braked roll conditions, which address only the loads produced by airplane weight and steady braking forces, to add a requirement to include the effects of dynamic braking. This would account for the effects of airplane pitch inertia on the nose gear and fuselage. The proposed new § 25.493(e) provides a mathematical expression, in terms of airplane weight, geometry, coefficient of friction, and dynamic response factor, that may be used in lieu of a more rational analysis to account for the total nose gear loading, including the effects of dynamic braking. Regardless of the FAR requirements, the existing JAR requirement will be imposed on U.S. manufactured airplanes seeking approval to the JAR. It is therefore proposed to harmonize the FAR with the JAR by incorporating the dynamic braked roll condition in the FAR.

Since there is no evidence to suggest that the current fleet of transport category airplanes does not have adequate strength to withstand the proposed dynamic braked roll condition, the FAA does not consider it necessary to apply this requirement retroactively.

Regulatory Evaluation Summary

Preliminary Regulatory Evaluation, Initial Regulatory Flexibility Determination, and Trade Impact Assessment

Proposed changes to Federal regulations must undergo several economic analyses. First, Executive Order 12866 directs that each Federal agency shall propose or adopt a regulation only upon a reasoned determination that the benefits of the intended regulation justify its costs. Second, the Regulatory Flexibility Act of 1980 requires agencies to analyze the economic effects of regulatory changes on small entities. Third, the Office of Management and Budget directs agencies to assess the effects of regulatory changes on international trade. In conducting these analyses, the FAA has determined that this proposal: (1) would generate benefits that justify its costs; (2) is not a "significant regulatory action" as defined in the Executive Order and is not "significant" as defined in DOT's Regulatory Policies and Procedures; (3) would not have a significant economic impact on a substantial number of small entities; and (4) would not constitute a barrier to international trade. These analyses, available in the docket, are summarized below.

Regulatory Evaluation Summary

The proposed amendment would codify current industry practice and would not impose additional costs on manufacturers of transport category airplanes. By conforming § 25.493 of the FAR with § 25.493 of the JAR, the proposed amendment would increase harmonization between American and European airworthiness standards and reduce duplicate certification costs.

Regulatory Flexibility Determination

The Regulatory Flexibility Act of 1980 (RFA) was enacted by Congress to ensure that small entities are not unnecessarily or disproportionately burdened by Government regulations. The RFA requires a Regulatory Flexibility Analysis, in which alternatives are considered and evaluated, if a rule is expected to have "a significant economic impact on a substantial number of small entities." FAA Order 2100.14A, Regulatory Flexibility Criteria and Guidance, prescribes standards for complying with RFA review requirements in FAA rulemaking actions. The Order

defines "small entities" in terms of size thresholds, "significant economic impact" in terms of annualized cost thresholds, and "substantial number" as a number which is not less than eleven and which is more than one-third of the small entities subject to the proposed or final rule.

The proposed amendment would affect manufacturers of transport category airplanes produced under new type certificates. For airplane manufacturers, Order 2100.14A specifies a size threshold for classification as a small entity as 75 or fewer employees. Since no part 25 airplane manufacturer has 75 or fewer employees, the proposed amendment would not have a significant economic impact on a substantial number of small airplane manufacturers.

International Trade Impact Assessment

The proposed amendment would not constitute a barrier to international trade, including the export of American airplanes to foreign countries and the import of foreign airplanes into the United States. Instead, by harmonizing standards of the FAR with those of the JAR, it would lessen restraints on trade.

Federalism Implications

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

Conclusion

Because the proposed changes to the braked roll condition are not expected to result in substantial economic cost, the FAA has determined that this proposed rule would not be significant under Executive Order 12866. Because this is an issue that has not prompted a great deal of public concern, the FAA has determined that this action is not significant as defined in Department of Transportation Regulatory Policy and Procedures (44 FR 11034, February 25, 1979). In addition, since there are no small entities affected by this proposed rulemaking, the

FAA certifies, under the criteria of the Regulatory Flexibility Act, that this proposed rule, if adopted, would not have a significant economic impact, positive or negative, on a substantial number of small entities. An initial regulatory evaluation of the proposed rule, including a Regulatory Flexibility Determination and Trade Impact Analysis, has been placed in the docket. A copy may be obtained by contacting the person identified under the caption, "FOR FURTHER INFORMATION CONTACT."

List of Subjects

14 CFR part 25

Aircraft, Aviation safety, Reporting and recordkeeping requirements.

The Proposed Amendment

Accordingly, the Federal Aviation Administration (FAA) proposes to amend 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 continues to read as follows:

Authority: 49 U.S.C. 1344, 1354(a), 1355, 1421, 1423, 1424, 1425, 1428, 1429, 1430; 49 U.S.C. 106(g); and 49 CFR 1.47(a).

2. By amending § 25.493 by revising paragraph (c), and by adding new paragraphs (d) and (e) to read as follows:

§ 25.493 Braked roll conditions.

* * * * *

(c) A drag reaction lower than that prescribed in this section may be used if it is substantiated that an effective drag force of 0.8 times the vertical reaction cannot be attained under any likely loading condition.

(d) An airplane equipped with a nose gear must be designed to withstand the loads arising from the dynamic pitching motion of the airplane due to sudden application of maximum braking force. The airplane is considered to be at design takeoff weight with the nose and main gears in

contact with the ground, and with a steady-state vertical load factor of 1.0. The steady-state nose gear reaction must be combined with the maximum incremental nose gear vertical reaction caused by the sudden application of maximum braking force as described in paragraphs (b) and (c) of this section.

(e) In the absence of a more rational analysis, the nose gear vertical reaction prescribed in paragraph (d) of this section must be calculated according to the following formula:

$$V_N = \frac{W_T}{A+B}\left[B + \frac{f\mu AE}{A+B+\mu E}\right]$$

Where: V_N= Nose gear vertical reaction.
W_T= Design takeoff weight.
A = Horizontal distance between the c.g. of the airplane and the nose wheel.
B = Horizontal distance between the c.g. of the airplane and the line joining the centers of the main wheels.
E = Vertical height of the c.g. of the airplane above the ground in the 1.0 g static condition.
μ = Coefficient of friction of 0.80.
f = Dynamic response factor; 2.0 is to be used unless a lower factor is substantiated.

In the absence of other information, the dynamic response factor f may be defined by the equation:

$$f = 1 + \exp\left(\frac{-\pi\xi}{\sqrt{1-\xi^2}}\right)$$

Where: ξ is the effective critical damping ratio of the rigid body pitching mode about the main landing gear effective ground contact point.

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1/23/95:ps:revised to accept ns/ic revisions approved by Doug this date.
3/14/95:ps:revised to correct error in amendatory language describing chg. to 25.571.
5/22/95:ps:revised to add reg eval summary
6/14/95:ps:ARAC discussion revised to include current task
10/26/95:ps:revised to add latest WG revisions from TAE mtg.