[4910-13]

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Part 25

[Docket No. FAA-2012-1241; Special Conditions No. 25-480-SC]

Special Conditions: Embraer S.A., Model EMB-550 Airplane; Design Roll Maneuver for Electronic Flight Controls

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Final special conditions.

SUMMARY: These special conditions are issued for the Embraer S.A. Model EMB-550 airplane. This airplane will have a novel or unusual design feature(s) associated with the design roll maneuver for electronic flight controls, specifically an electronic flight control system that provides control of the aircraft through pilot inputs to the flight computer. The applicable airworthiness regulations do not contain adequate or appropriate safety standards for this design feature. These special conditions contain the additional safety standards that the Administrator considers necessary to establish a level of safety equivalent to that established by the existing airworthiness standards.

EFFECTIVE DATE: [Insert date 30 days after date of publication in the *Federal Register*].

FOR FURTHER INFORMATION CONTACT: Todd Martin, FAA, Airframe and Cabin Safety Branch, ANM-115, Transport Airplane Directorate, Aircraft Certification Service, 1601 Lind Avenue SW., Renton, Washington, 98057-3356; telephone 425-227-1178; facsimile 425-227-1149.

SUPPLEMENTARY INFORMATION:

Background

On May 14, 2009, Embraer S.A. applied for a type certificate for their new Model EMB-550 airplane. The Model EMB-550 airplane is the first of a new family of jet airplanes designed for corporate flight, fractional, charter, and private owner operations. The aircraft has a conventional configuration with low wing and T-tail empennage. The primary structure is metal with composite empennage and control surfaces. The Model EMB-550 airplane is designed for 8 passengers, with a maximum of 12 passengers. It is equipped with two Honeywell HTF7500-E medium bypass ratio turbofan engines mounted on aft fuselage pylons. Each engine produces approximately 6,540 pounds of thrust for normal takeoff. The primary flight controls consist of hydraulically powered fly-by-wire elevators, ailerons, and rudder, controlled by the pilot or copilot sidestick.

The flight control system for the Model EMB-550 airplane does not have a direct mechanical link or a linear gain between the airplane flight control surface and the pilot's cockpit control device, which is not accounted for in Title 14, Code of Federal Regulations (14 CFR) 25.349(a). Instead, a flight control computer commands the airplane flight control surfaces, based on input received from the cockpit control device. The pilot input is modified by the flight control computer before the command is given to the flight control surface.

Type Certification Basis

Under the provisions of 14 CFR 21.17, Embraer S.A. must show that the Model EMB-550 airplane meets the applicable provisions of part 25, as amended by Amendments 25-1 through 25-127 thereto.

If the Administrator finds that the applicable airworthiness regulations (i.e., 14 CFR part 25) do not contain adequate or appropriate safety standards for the Model EMB-500 airplane because of a novel or unusual design feature, special conditions are prescribed under the provisions of § 21.16.

Special conditions are initially applicable to the model for which they are issued. Should the type certificate for that model be amended later to include any other model that incorporates the same or similar novel or unusual design feature, the special conditions would also apply to the other model under § 21.101.

In addition to the applicable airworthiness regulations and special conditions, the Model EMB-550 airplane must comply with the fuel vent and exhaust emission requirements of 14 CFR part 34 and the noise certification requirements of 14 CFR part 36 and the FAA must issue a finding of regulatory adequacy under section 611 of Public Law 92-574, the "Noise Control Act of 1972."

The FAA issues special conditions, as defined in 14 CFR 11.19, in accordance with § 11.38, and they become part of the type-certification basis under § 21.17(a)(2).

Novel or Unusual Design Features

The Embraer S.A. Model EMB-550 airplane will incorporate the following novel or unusual design features: The Model EMB-550 airplane is equipped with an electronic flight control system that provides control of the aircraft through pilot inputs to the flight computer. Current part 25 airworthiness regulations account for "control laws" where aileron deflection is proportional to control stick deflection. They do not address any nonlinearities, i.e., situations

where output does not change in the same proportion as input, or other effects on aileron actuation that may be caused by electronic flight controls.

Discussion

These special conditions differ from current regulatory requirements in that they require that the roll maneuver result from defined movements of the cockpit roll control as opposed to defined aileron deflections. Also, these special conditions require an additional load condition at design maneuvering speed (V_A), in which the cockpit roll control is returned to neutral following the initial roll input.

These special conditions differ from similar special conditions previously issued on this topic. These special conditions are limited to the roll axis only, whereas other special conditions also included pitch and yaw axes. Special conditions are no longer needed for the yaw axis because 14 CFR 25.351 was revised at Amendment 25-91 to take into account effects of an electronic flight control system. No special conditions are needed for the pitch axis because the method that Embraer S.A. proposed for the pitch maneuver takes into account effects of an electronic flight control system. These special conditions contain the additional safety standards that the Administrator considers necessary to establish a level of safety equivalent to that established by the existing airworthiness standards.

Discussion of Comments

Notice of proposed special conditions No. 25-12-15-SC for the Embraer S.A. EMB-550 airplanes was published in the *Federal Register* on November 26, 2012 (77 FR 70384). No comments were received, and the special conditions are adopted as proposed.

Applicability

As discussed above, these special conditions are applicable to the Model EMB-550 airplane. Should Embraer S.A. apply at a later date for a change to the type certificate to include another model incorporating the same novel or unusual design feature, the special conditions would apply to that model as well.

Conclusion

This action affects only certain novel or unusual design features on one model EMB-550 of airplanes. It is not a rule of general applicability.

List of Subjects in 14 CFR Part 25

Aircraft, Aviation safety, Reporting and recordkeeping requirements.

The authority citation for these special conditions is as follows:

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

The Special Conditions

Accordingly, pursuant to the authority delegated to me by the Administrator, the following special conditions are issued as part of the type certification basis for Embraer S.A. Model EMB-550 airplanes.

1. Design Roll Maneuver for Electronic Flight Controls.

In lieu of compliance to 14 CFR 25.349(a), the Embraer S.A. Model EMB-550 airplane must comply with the following.

The following conditions, speeds, and cockpit roll control motions (except as the motions may be limited by pilot effort) must be considered in combination with an airplane load factor of zero and of two-thirds of the positive maneuvering factor used in design. In determining the

resulting control surface deflections, the torsional flexibility of the wing must be considered in accordance with 14 CFR 25.301(b).

(a) Conditions corresponding to steady rolling velocities must be investigated. In addition, conditions corresponding to maximum angular acceleration must be investigated for airplanes with engines or other weight concentrations outboard of the fuselage. For the angular acceleration conditions, zero rolling velocity may be assumed in the absence of a rational time history investigation of the maneuver.

(b) At V_A, sudden movement of the cockpit roll control up to the limit is assumed. The position of the cockpit roll control must be maintained until a steady roll rate is achieved and then must be returned suddenly to the neutral position.

(c) At V_C, the cockpit roll control must be moved suddenly and maintained so as to achieve a roll rate not less than that obtained in paragraph (b).

(d) At V_D, the cockpit roll control must be moved suddenly and maintained so as to achieve a roll rate not less than one third of that obtained in paragraph (b).

Issued in Renton, Washington, on February 12, 2013.

Ali Bahrami
Manager, Transport Airplane Directorate
Aircraft Certification Service

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