capability below the level required by 14 CFR part 25 or significantly reduce the reliability of the remaining system. As far as reasonably practicable, the flightcrew must be made aware of these failures before flight. Certain elements of the control system, such as mechanical and hydraulic components, may use special periodic inspections, and electronic components may use daily checks, in lieu of detection and indication systems to achieve the objective of this requirement. These certification maintenance requirements must be limited to components that are not readily detectable by normal detection and indication systems and where service history shows that inspections will provide an adequate level of safety.

(2) The existence of any failure condition, not extremely improbable, during flight that could significantly affect the structural capability of the airplane and for which the associated reduction in airworthiness can be minimized by suitable flight limitations, must be signaled to the flightcrew. For example, failure conditions that result in a factor of safety between the airplane strength and the loads of Subpart C below 1.25, or flutter margins below V″, must be signaled to the flightcrew during flight.

(d) Dispatch with known failure conditions. If the airplane is to be dispatched in a known system failure condition that affects structural performance, or affects the reliability of the remaining system to maintain structural performance, then the provisions of these special conditions must be met, including the provisions of paragraph 2(a) for the dispatched condition, and paragraph 2(b) for subsequent failures. Expected operational limitations may be taken into account in establishing P_j as the probability of failure occurrence for determining the safety margin in Figure 1 of these special conditions. Flight limitations and expected operational limitations may be taken into account in establishing Q_j as the combined probability of being in the dispatched failure condition and the subsequent failure condition for the safety margins in Figures 2 and 3 of these special conditions. These limitations must be such that the probability of being in this combined failure state and then subsequently encountering limit load conditions is extremely improbable. No reduction in these safety margins is allowed if the subsequent system failure rate is greater than 10^{-3} per hour.

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

Ali Bahrami,

Manager, Transport Airplane Directorate, Aircraft Certification Service.

[FR Doc. 2013–03678 Filed 2–15–13; 8:45 am]

BILLING CODE 4910–13–P

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Part 25

[Docket No. FAA–2012–1218; Special Conditions No. 25–483–SC]

Special Conditions: Embraer S.A., Model EMB–550 Airplane; Electronic Flight Control System: Lateral-Directional and Longitudinal Stability and Low Energy Awareness

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 an electronic flight control system with respect to lateral-directional and longitudinal stability and low energy awareness. 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.

DATES: *Effective date:* March 21, 2013.

FOR FURTHER INFORMATION CONTACT: Joe Jacobsen, FAA, Airplane and Flight Crew Interface Branch, ANM–111 Transport Airplane Directorate, Aircraft Certification Service, 1601 Lind Avenue SW., Renton, Washington 98057–3356; telephone 425–227–2011; 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, aileron and rudder, controlled by the pilot or copilot sidestick.

The Embraer S.A. Model EMB–550 airplane has a flight control design feature within the normal operational envelope in which sidestick deflection in the roll axis commands roll rate. As a result, the stick force in the roll axis will be zero (neutral stability) during the straight, steady sideslip flight maneuver required by Title 14, Code of Federal Regulations (14 CFR) 25.177(c) and will not be ''substantially proportional to the angle of sideslip'' as required by the rule.

The longitudinal flight control laws for the Model EMB–550 airplane provide neutral static stability within the normal operational envelope; therefore, the airplane design does not comply with the static longitudinal stability requirements of §§ 25.171, 25.173, and 25.175.

Static longitudinal stability provides awareness to the flightcrew of a low energy state (i.e., low speed and thrust at low altitude). Recovery from a low energy state may become hazardous when associated with a low altitude and performance-limiting conditions. These low energy situations must therefore be avoided, and pilots must be given adequate cues when approaching such situations.

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–550 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 part 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 Model EMB–550 airplane will incorporate the following novel or unusual design features:

(1) *Lateral-Directional Static Stability:* The electronic flight control system on the Model EMB–550 airplane contains fly-by-wire control laws that can result in neutral lateral-directional static stability; therefore, the conventional requirements in §§ 25.171, 25.173, 25.175, and 25.177 are not met.

Positive static directional stability is the tendency to recover from a skid with the rudder free. Positive static lateral stability is the tendency to raise the low wing in a sideslip with the aileron controls free. These control criteria are intended to accomplish all of the following:

- Provide additional cues of inadvertent sideslips and skids through control force changes,
- Ensure that short periods of unattended operation do not result in any significant changes in yaw or bank angle,
- Provide predictable roll and yaw response, and
- Provide an acceptable level of pilot attention and workload to attain and maintain a coordinated turn.

The Flight Test Harmonization Working Group recommended a rule and advisory material change for § 25.177, Static lateral-directional stability, which was adopted at Amendment 25–135 (76 FR 74654, December 1, 2011), effective January 30, 2012. (This amendment is not in the Model EMB–550 certification basis.) That harmonized text formed the basis for these special conditions.

(2) *Longitudinal Static Stability:* Static longitudinal stability on airplanes with mechanical links to the pitch control surface means that a pull force on the controller will result in a reduction in speed relative to the trim speed, and a push force will result in higher than trim speed. Longitudinal stability is required by the regulations for the following reasons:

- Speed change cues are provided to the pilot through increased and decreased forces on the controller.
- Short periods of unattended control of the airplane do not result in significant changes in attitude, airspeed or load factor.
- A predictable pitch response is provided to the pilot.
- An acceptable level of pilot attention (workload) to attain and maintain trim speed and altitude is provided to the pilot.
- Longitudinal stability provides gust stability.

The pitch control movement of the sidestick on the Model EMB–550 airplane is designed to be a normal load factor or *g* command that results in an initial movement of the elevator surface to attain the commanded load factor that's then followed by integrated movement of the stabilizer and elevator to automatically trim the airplane to a neutral, 1*g,* stick-free stability. The flight path commanded by the initial sidestick input will remain, stick-free, until the pilot gives another command. This control function is applied during ''normal'' control law within the speed range from initiation of the angle of attack protection limit, to V_{MO}/M_{MO}. Once outside this speed range, the control laws introduce the conventional longitudinal static stability as described above.

As a result of neutral static stability, the Model EMB–550 airplane does not meet the 14 CFR part 25 requirements for static longitudinal stability.

(3) *Low Energy Awareness:* Past experience on airplanes fitted with a flight control system providing neutral longitudinal stability shows there is insufficient feedback cues to the pilot of excursion below normal operational speeds. The maximum angle of attack protection system limits the airplane angle of attack and prevents stall during normal operating speeds, but this system is not sufficient to prevent stall at low speed excursions below normal operational speeds. Until intervention, there are no stability cues since the airplane remains trimmed. Additionally, feedback from the pitching moment due to thrust variation is reduced by the flight control laws. Recovery from a low speed excursion may become hazardous when the low speed situation is associated with a low altitude and with the engines at low thrust or with performance-limiting conditions.

Discussion

In the absence of positive lateral stability, the curve of lateral control surface deflections against sideslip angle should be in a conventional sense, and reasonably in harmony with rudder deflection during steady heading sideslip maneuvers.

Since conventional relationships between stick forces and control surface displacements do not apply to the ''load factor command'' flight control system on the Model EMB–550 airplane, longitudinal stability characteristics should be evaluated by assessing the airplane handling qualities during simulator and flight test maneuvers appropriate to operation of the airplane. This may be accomplished by using the Handling Qualities Rating Method presented in Appendix 7 of Advisory Circular (AC) 25–7B, *Flight Test Guide,* dated March 29, 2011, or an acceptable alternative method proposed by Embraer S.A. Important considerations are as follows:

- Adequate speed control without creating excessive pilot workload,
- Acceptable high and low speed protection, and
- Providing adequate cues to the pilot of significant speed excursions beyond V_{MO}/M_{MO}, and low speed awareness flight conditions.

The airplane should provide adequate awareness cues to the pilot of a low energy (i.e., a low speed, low thrust, or low height) state to ensure that the airplane retains sufficient energy to recover when flight control laws provide neutral longitudinal stability significantly below the normal operating speeds. This may be accomplished as follows:

- Adequate low speed/low thrust cues at low altitude may be provided by a strong positive static stability force gradient (1 pound per 6 knots applied through the sidestick), or
- The low energy awareness may be provided by an appropriate warning with the following characteristics:
  - It should be unique, unambiguous, and unmistakable.
  - It should be active at appropriate altitudes and in appropriate configurations (e.g., at low altitude, in the approach and landing configurations).
  - It should be sufficiently timely to allow recovery to a stabilized flight condition inside the normal flight envelope while maintaining the desired flight path and without entering the flight controls angle-of-attack protection mode.
  - It should not be triggered during normal operation, including operation in moderate turbulence for recommended maneuvers at recommended speeds.

◦ The pilot should only be able to cancel it by achieving a higher energy state.

◦ An adequate hierarchy should exist among the warnings so that the pilot is not confused and led to take inappropriate recovery action if multiple warnings occur.

Simulators and flight test should evaluate global energy awareness and ensure that low energy cues are not a nuisance in all take-off and landing altitude ranges for which certification is requested. These evaluations should include all relevant combinations of weight, center of gravity position, configuration, airbrakes position, and available thrust, including reduced and derated take-off thrust operations and engine failure cases. A sufficient number of tests should be conducted to assess the level of energy awareness and the effects of energy management errors. 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. 25–12–11–SC for the Embraer S.A. Model EMB–550 airplanes was published in the **Federal Register** on November 20, 2012 (77 FR 69573). 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 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 Model EMB–550 airplanes.

1. *Electronic Flight Control System:* Lateral-Directional and Longitudinal Stability and Low Energy Awareness. In lieu of the requirements of §§ 25.171, 25.173, 25.175, and 25.177, the following special conditions apply:

a. The airplane must be shown to have suitable static lateral, directional, and longitudinal stability in any condition normally encountered in service, including the effects of atmospheric disturbance. The showing of suitable static lateral, directional, and longitudinal stability must be based on the airplane handling qualities, including pilot workload and pilot compensation, for specific test procedures during the flight test evaluations.

b. The airplane must provide adequate awareness to the pilot of a low energy (e.g., low speed, low thrust, or low height) state when fitted with flight control laws presenting neutral longitudinal stability significantly below the normal operating speeds. ‘‘Adequate awareness’’ means warning information must be provided to alert the crew of unsafe operating conditions and to enable them to take appropriate corrective action.

c. The static directional stability (as shown by the tendency to recover from a skid with the rudder free) must be positive for any landing gear and flap position and symmetrical power condition, at speeds from 1.13 V_{SR1}, up to V_{FE}, V_{LE}, or V_{FC}/M_{FC} (as appropriate).

d. The static lateral stability (as shown by the tendency to raise the low wing in a sideslip with the aileron controls free) for any landing gear and wing-flap position and symmetric power condition, may not be negative at any airspeed (except that speeds higher than V_{FE} need not be considered for wing-flaps extended configurations nor speeds higher than V_{LE} for landing gear extended configurations) in the following airspeed ranges:

i. From 1.13 V_{SR1} to V_{MO}/M_{MO}.

ii. From V_{MO}/M_{MO} to V_{FC}/M_{FC}, unless the divergence is –

1. Gradual;
2. Easily recognizable by the pilot; and
3. Easily controllable by the pilot.

e. In straight, steady sideslips over the range of sideslip angles appropriate to the operation of the airplane, but not less than those obtained with one-half of the available rudder control movement (but not exceeding a rudder control force of 180 pounds), rudder control movements and forces must be substantially proportional to the angle of sideslip in a stable sense; and the factor of proportionality must lie between limits found necessary for safe operation. This requirement must be met for the configurations and speeds specified in paragraph (c) of this section.

f. For sideslip angles greater than those prescribed by paragraph (e) of this section, up to the angle at which full rudder control is used or a rudder control force of 180 pounds is obtained, the rudder control forces may not reverse, and increased rudder deflection must be needed for increased angles of sideslip. Compliance with this requirement must be shown using straight, steady sideslips, unless full lateral control input is achieved before reaching either full rudder control input or a rudder control force of 180 pounds; a straight, steady sideslip need not be maintained after achieving full lateral control input. This requirement must be met at all approved landing gear and wing-flap positions for the range of operating speeds and power conditions appropriate to each landing gear and wing-flap position with all engines operating.

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

Ali Bahrami,
Manager, Transport Airplane Directorate, Aircraft Certification Service.

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DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Part 25

[Docket No. FAA–2012–1215; Special Conditions No. 25–12–482–SC]

Special Conditions: Embraer S.A., Model EMB–550 Airplanes; Flight Envelope Protection: High Speed Limiting

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, specifically an electronic flight control system which contains fly-by-wire control laws, including envelope protections, for the overspeed protection and roll limiting function. The applicable airworthiness regulations do not contain adequate or appropriate safety standards for this design feature. These special conditions contain the