

**DEPARTMENT OF TRANSPORTATION****Federal Aviation Administration****14 CFR Part 25**

[Docket No. FAA-2012-0978; Special Conditions No. 25-478-SC]

**Special Conditions: Embraer S.A., Model EMB-550 Airplane; Electronic Flight Control System: Control Surface Awareness and Mode Annunciation**

**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 control surface awareness and mode annunciation of the electronic flight control system. 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.

**Type Certification Basis**

Under the provisions of Title 14, Code of Federal Regulations (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.

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 § 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 Model EMB-550 airplane will incorporate the following novel or unusual design features: The Embraer S.A. Model EMB-550 airplane will have a fly-by-wire electronic flight control system and no direct coupling from the flightdeck controller to the control surface. As a result, the pilot is not aware of the actual control surface position as envisioned when part 25 was written.

**Discussion**

These special conditions propose that the flightcrew receive a suitable flight control position annunciation when a flight condition exists in which nearly full surface authority (not crew-commanded) is being used. Suitability of such a display must take into account that some pilot-demanded maneuvers (e.g., rapid roll) are necessarily associated with intended full performance, which may saturate the surface. Therefore, simple alerting

systems function in both intended and unexpected control-limiting situations. As a result, they must be properly balanced between providing necessary crew awareness and being a potential nuisance to the flightcrew. A monitoring system that compares airplane motion and surface deflection with the demand of the pilot sidestick controller could help reduce nuisance alerting.

These special conditions also address flight control system mode annunciation. It proposes suitable mode annunciation be provided to the flightcrew for events that significantly change the operating mode of the system but do not merit the classic "failure warning."

These special conditions establish a level of safety equivalent to that provided by a conventional flight control system and that contemplated in existing regulations.

**Discussion of Comments**

Notice of proposed special conditions No. SC-12-25 for the Embraer S.A. EMB-550 airplanes was published in the **Federal Register** on September 27, 2012 (77 FR 57039). 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: Control Surface Awareness and Mode Annunciation. In addition to the requirements of §§ 25.143, 25.671, and

25.672, the following requirements apply:

a. The system design must ensure that the flightcrew is made suitably aware whenever the primary control means nears the limit of control authority.

**Note:** The term “suitably aware” indicates annunciations provided to the flightcrew are appropriately balanced between nuisance and that necessary for crew awareness.

b. If the design of the flight control system has multiple modes of operation, a means must be provided to indicate to the flightcrew any mode that significantly changes or degrades the normal handling or operational characteristics of the airplane.

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-2012-1216; Special Conditions No. 25-479-SC]

#### Special Conditions: Embraer S.A., Model EMB-550 Airplane, Limit Pilot Forces for Sidestick Control

**AGENCY:** Federal Aviation Administration (FAA), DOT.

**ACTION:** Final special conditions.

**SUMMARY:** These special conditions for the Embraer S.A. Model EMB-550 airplane. This airplane will have a novel or unusual design feature, specifically sidestick controllers designed to be operated with only one hand. 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:** 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.

Current regulations reference pilot effort loads for the cockpit pitch and roll controls that are based on a two-handed effort. The cockpit roll and pitch controls for the Model EMB-550 airplane are designed for one-handed operation.

#### Type Certification Basis

Under the provisions of Title 14, Code of Federal Regulations (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 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 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 a sidestick controller instead of a conventional wheel or control stick. This kind of controller is designed to be operated using only one hand. The requirement of 14 CFR 25.397(c), which defines limit pilot forces and torques for conventional wheel or stick controls, is not appropriate for a sidestick controller. Therefore, a special condition is necessary to specify the appropriate loading conditions for this kind of controller.

#### Discussion

The Embraer S.A. Model EMB-550 airplane is equipped with a sidestick controller instead of a conventional wheel or control stick. This kind of controller is designed to be operated using only one hand. The requirement of 14 CFR 25.397(c), which defines limit pilot forces and torques for conventional wheel or stick controls, is not appropriate for a sidestick controller, because pilot forces are applied to sidestick controllers with only the wrist, not arms. 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. 25-12-13-SC for the Embraer S.A. Model EMB-550 airplanes was published in the **Federal Register** on November 20, 2012, (77 FR 69571). 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