

for these design features. 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. Additional special conditions will be issued for other novel or unusual design features of Embraer Model 170 series airplanes.

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SUPPLEMENTARY INFORMATION:

Background

On May 20, 1999, Embraer applied for a type certificate for its new Model ERJ-170 airplane. Two basic versions of the Model ERJ-170 are included in the application. The ERJ-170-100 airplane is a 69-78 passenger, twin-engine regional jet with a maximum takeoff weight of 81,240 pounds. The ERJ-170-200 is a derivative with a lengthened fuselage. Passenger capacity for the ERJ-170-200 is increased to 86, and maximum takeoff weight is increased to 85,960 pounds.

Type Certification Basis

Under the provisions of 14 CFR 21.17, Embraer must show that the Model ERJ-170 series airplanes meet the applicable provisions of 14 CFR part 25, as amended by Amendments 25-1 through 25-98.

If the Administrator finds that the applicable airworthiness regulations (*i.e.*, part 25, as amended) do not contain adequate or appropriate safety standards for Embraer Model ERJ-170 series airplanes because of novel or unusual design features, special conditions are prescribed under the provisions of § 21.16.

In addition to the applicable airworthiness regulations and special conditions, Embraer Model ERJ-170 series airplanes 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 pursuant to § 611 of Public Law 93-574, the "Noise Control Act of 1972."

Special conditions, as defined in 14 CFR 11.19, are issued in accordance with § 11.38 and become part of the type certification basis in accordance with

§ 21.17(a)(2), Amendment 21-69, effective September 16, 1991.

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 incorporate the same novel or unusual design feature, or should any other model already included on the same type certificate be modified to incorporate the same novel or unusual design features, the special conditions would also apply to the other model under the provisions of § 21.101(a)(1), Amendment 21-69, effective September 16, 1991.

Novel or Unusual Design Features

The Embraer Model ERJ-170 series airplanes will incorporate the following novel or unusual design features:

I. Electronic Flight Control System

In airplanes with electronic flight control systems, there may not always be a direct correlation between pilot control position and the associated airplane control surface position. Under certain circumstances, a commanded maneuver that does not require a large control input may require a large control surface movement, possibly encroaching on a control surface or actuation system limit without the flightcrew's knowledge. This situation can arise in either manually piloted or autopilot flight and may be further exacerbated on airplanes where the pilot controls are not back-driven during autopilot system operation. Unless the flightcrew is made aware of excessive deflection or impending control surface limiting, control of the airplane by the pilot or autoflight system may be inadvertently continued so as to cause loss of control of the airplane or other unsafe characteristics of stability or performance.

Given these possibilities, a special condition for Embraer Model ERJ-170 series airplanes addresses control surface position awareness. This special condition requires that suitable display or annunciation of flight control position be provided to the flightcrew when near full surface authority (not crew-commanded) is being used, unless other existing indications are found adequate or sufficient to prompt any required crew actions. Suitability of such a display or annunciation must take into account that some piloted maneuvers may demand the airplane's maximum performance capability, possibly associated with a full control surface deflection. Therefore, simple display systems—that would function in both intended and unexpected control-

limiting situations—must be properly balanced to provide needed crew awareness and minimize nuisance alerts. A monitoring system that compares airplane motion, surface deflection, and pilot demand could be useful in eliminating nuisance alerting.

II. Automatic Takeoff Thrust Control System (ATTCS)

The Embraer Model ERJ-170 series airplane will incorporate an Automatic Takeoff Thrust Control System (ATTCS) in the engine's Full Authority Digital Electronic Control (FADEC) system architecture. The manufacturer requested that the FAA issue special conditions to allow performance credit to be taken for use of this function during go-around to show compliance with the requirement of § 25.121(d) regarding the approach climb gradient.

Section 25.904 and Appendix I refer to operation of ATTCS only during takeoff. Model ERJ-170 series airplanes have this feature for go-around also. The ATTCS will automatically increase thrust to the maximum go-around thrust available under the ambient conditions in the following circumstances:

- If an engine failure occurs during an all-engines-operating go-around, or
- If an engine has failed or been shut down earlier in the flight.

This maximum go-around thrust is the same as that used to show compliance with the approach-climb-gradient requirement of § 25.121(d). If the ATTCS is not operating, selection of go-around thrust will result in a lower thrust level.

The part 25 standards for ATTCS, contained in § 25.904 [Automatic takeoff thrust control system (ATTCS) and Appendix I], specifically restrict performance credit for ATTCS to takeoff. Expanding the scope of the standards to include other phases of flight, such as go-around, was considered when the standards were issued but was not accepted because of the effect on the flightcrew's workload. As stated in the preamble to amendment 25-62:

In regard to ATTCS credit for approach climb and go-around maneuvers, current regulations preclude a higher thrust for the approach climb [§ 25.121(d)] than for the landing climb [§ 25.119]. The workload required for the flightcrew to monitor and select from multiple in-flight thrust settings in the event of an engine failure during a critical point in the approach, landing, or go-around operations is excessive. Therefore, the FAA does not agree that the scope of the amendment should be changed to include the use of ATTCS for anything except the takeoff phase." (Refer to 52 FR 43153, November 9, 1987.)