[4910-13]

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Part 25

[Docket No. FAA-2016-9282; Special Conditions No. 25-640-SC]

Special Conditions: **Embraer S.A., Model ERJ 190-300 Series Airplanes; Electrical/Electronic Equipment Bay Fire Detection and Smoke Penetration**

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Final special conditions; request for comments.

SUMMARY: These special conditions are issued for the Embraer S.A. Model ERJ 190-300 series airplanes. These airplanes will have novel or unusual design features when compared to the state of technology envisioned in the airworthiness standards for transport category airplanes. These design features are electrical/electronic equipment bays distributed throughout the airplane, with three of them in the pressurized area. The time it takes to determine the source of smoke in an airplane with three or more equipment bays could allow fire to spread, generating a significant quantity of smoke and damage. The applicable airworthiness regulations do not contain adequate or appropriate safety standards 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.

DATES: This action is effective on Embraer S.A. on **[INSERT DATE OF PUBLICATION IN THE FEDERAL REGISTER].** We must receive your comments by **[INSERT DATE 45 DAYS AFTER PUBLICATION IN THE FEDERAL REGISTER].**

ADDRESSES: Send comments identified by docket number FAA-2016-9282 using any of the following methods:

- *Federal eRegulations Portal:* Go to http://www.regulations.gov/ and follow the online instructions for sending your comments electronically.
- *Mail:* Send comments to Docket Operations, M-30, U.S. Department of Transportation (DOT), 1200 New Jersey Avenue, SE., Room W12-140, West Building Ground Floor, Washington, DC, 20590-0001.
- *Hand Delivery or Courier:* Take comments to Docket Operations in Room W12-140 of the West Building Ground Floor at 1200 New Jersey Avenue, SE., Washington, DC, between 9 a.m. and 5 p.m., Monday through Friday, except Federal holidays.
- *Fax:* Fax comments to Docket Operations at 202-493-2251.

Privacy: The FAA will post all comments it receives, without change, to http://www.regulations.gov/, including any personal information the commenter provides. Using the search function of the docket Web site, anyone can find and read the electronic form of all comments received into any FAA docket, including the name of the individual sending the comment (or signing the comment for an association, business, labor union, etc.). DOT's complete Privacy Act Statement can be found in the Federal Register published on April 11, 2000 (65 FR 19477-19478), as well as at http://DocketsInfo.dot.gov/.

Docket: Background documents or comments received may be read at http://www.regulations.gov/ at any time. Follow the online instructions for accessing the docket or go to Docket Operations in Room W12-140 of the West Building Ground Floor at 1200 New Jersey Avenue, SE., Washington, DC, between 9 a.m. and 5 p.m., Monday through Friday, except Federal holidays.

FOR FURTHER INFORMATION CONTACT: Stephen Happenny, FAA, Propulsion and Mechanical Systems Branch, ANM-112, Transport Airplane Directorate, Aircraft Certification Service, 1601 Lind Avenue SW., Renton, Washington, 98057-3356; telephone 425-227-2147; facsimile 425-227-1149.

SUPPLEMENTARY INFORMATION:

The FAA has determined that notice of, and opportunity for prior public comment on, these special conditions is impracticable because these procedures would significantly delay issuance of the design approval and thus delivery of the affected airplane.

In addition, the substance of these special conditions has been subject to the public comment process in several prior instances with no substantive comments received. The FAA therefore finds that good cause exists for making these special conditions effective upon publication in the Federal Register.

Comments Invited

The FAA is requesting comments to allow interested persons to submit views that may not have been submitted in response to the prior opportunities for comment described above. We invite interested people to take part in this rulemaking by sending written comments, data, or views. The most helpful comments reference a specific portion of the special conditions, explain the reason for any recommended change, and include supporting data.

We will consider all comments we receive by the closing date for comments. We may change these special conditions based on the comments we receive.

Background

On September 13, 2013, Embraer S.A. applied for an amendment to Type Certificate (TC) No. A57NM to include the new Model ERJ 190-300 series airplanes. The ERJ 190-300,

which is a derivative of the ERJ 190-100 STD currently approved under TC No. A57NM, is a 97 to 114-passenger transport category airplane with two Pratt & Whitney Model PW1900G engines, a new wing design with a high aspect ratio and raked wingtip, and a new electrical distribution system.

The ERJ 190-300 will have electrical/electronic equipment bays distributed throughout the airplane, with three of them in the pressurized area. The applicable airworthiness requirements of Title 14, Code of Federal Aviation (14 CFR) 25.831 and 25.869 do not contain adequate or appropriate safety standards regarding smoke or fire detection and protection against the penetration of hazardous quantities of smoke into occupied areas of the airplane for this type of airplane configuration.

Type Certification Basis

Under the provisions of 14 CFR 21.101, Embraer S.A. must show that the ERJ 190-300 meets the applicable provisions of the regulations listed in TC No. A57NM or the applicable regulations in effect on the date of application for the change, except for earlier amendments as agreed upon by the FAA. Embraer S.A. must show that the ERJ 190-300 meets the applicable provisions of 14 CFR part 25, as amended by Amendments 25-1 through 25-137.

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 ERJ 190-300 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 novel or unusual design features, or should any other model already included on the

same type certificate be modified to incorporate the same novel or unusual design features, these special conditions would also apply to the other model under § 21.101.

In addition to the applicable airworthiness regulations and special conditions, the ERJ 190-300 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.

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 § 21.101.

Novel or Unusual Design Features

The ERJ 190-300 will incorporate the following novel or unusual design features: Electrical/electronic equipment bays that are distributed throughout the airplane. There are three electrical bays in the pressurized area—forward, center, and aft. The forward bay is located below the flight deck; the center bay is in the center fuselage below the cabin floor; and the aft bay is located near the aft pressure bulkhead.

Discussion

Traditionally, airplanes certified under part 25 have had one or two electrical equipment bays located in the lower lobe adjacent to pressure regulator and outflow valves or vents. If a fire occurs in an electrical/electronic equipment bay, any smoke is drawn toward the outflow valves or vents and discharged from the airplane without entering occupied areas. On these airplanes, the procedure for flight crew determination of whether the source of the smoke is in the electrical/electronic equipment bay has relied on trial and error. However, many factors, including the airflow pattern, potential leak paths, and location of outflow and regulator valves, can make it difficult to identify the smoke source, especially during system and flight transients, such as climbing, descending, or other changes that would affect the internal flow path. Also, if

smoke penetrates occupied areas, the flight crew would have less information with which to determine whether the source of the smoke is in an electrical/electronic equipment bay.

The FAA has accepted this trial and error approach for airplanes with no more than two electrical/electronic equipment bays, both located in the lower lobe. However, for airplanes with three or more equipment bays, the additional time it could take the flightcrew to determine the source of smoke would also allow the fire additional time to spread and generate significant amounts of smoke and damage.

Section 25.857 requires that cargo compartments have means to prevent hazardous quantities of smoke or fire extinguishing agent from penetrating into occupied areas of the airplane. However, the regulatory requirements do not address the following:

- Preventing hazardous quantities of smoke or extinguishing agent originating from the electrical/electronic equipment bays from penetrating into occupied areas of the airplane; or
- Installing smoke or fire detectors in electrical/electronic equipment bays.

The FAA determined that airplanes with electrical/electronic equipment bay configurations like that of the ERJ 190-300 need a means to detect smoke or fire in each electrical/electronic equipment bay located in the pressurized cabin to ensure that the flightcrew can make an informed decision as to the source of smoke and shut down the specific electrical/electronic equipment where smoke or fire is present. If the electrical/electronic equipment cannot be completely shut down due to conflict with other safety requirements, Embraer must conduct an analysis to:

- Show the criteria for shutting down the specific electrical/electronic equipment in the electrical/electronic equipment bay that can be shut down; and

- For the remaining electrical/electronic equipment, demonstrate that there are safety precautions incorporated against fire propagation, such as thermal protection, fire containment, or other means, as addressed in advisory circular AC 25-16, "Electrical Fault and Fire Prevention and Protection," dated April 5, 1991.

The purpose of the smoke/fire detection systems is to accomplish one or more of the following: automatically shut off power to the affected equipment; reconfigure the environmental control systems, if necessary, to control any smoke resulting from a fire or overheat condition; or alert the crew to the existence of the fire.

These alternate criteria that the FAA has developed to certify airplane designs that incorporate distributed electrical/electronic equipment bays are based on existing smoke/fire detection and smoke penetration guidance and acceptable past practices. Sections 25.831(b), (c), and (d), and 25.869 provide the general requirements that apply to electrical/electronic equipment smoke penetration and evacuation. Flight tests are conducted to demonstrate compliance; however, the amount of smoke generated and flight test conditions have been highly variable.

The special conditions below require a smoke or fire detection system in each electrical/electronic equipment bay located in the pressurized compartment. They also include requirements to prevent propagation of hazardous quantities of smoke or fire extinguishing agent throughout the passenger cabin.

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.

Applicability

As discussed above, these special conditions are applicable to the ERJ 190-300 series airplanes. 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, these special conditions would apply to that model as well.

Conclusion

This action affects only certain novel or unusual design features on one model series 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 the Embraer S.A. Model ERJ 190-300 series airplanes.

Design Requirements for Smoke Detection and Smoke Penetration in Distributed Electrical/Electronic Equipment Bays.

1. Requirements to prevent propagation of smoke from entering the passenger cabin and cockpit:

a. To prevent such propagation, means to prevent hazardous quantities of smoke originating from the electrical/electronic equipment bays from incapacitating passengers and crew must be demonstrated. Flight tests must be part of such demonstration and shall cover all dispatchable system configurations.

b. A small quantity of smoke may enter an occupied area only if the design meets all of the following conditions:

i. The smoke enters occupied areas during system transients[1] from below deck or main deck sources. No sustained smoke penetration beyond that from environmental control system transients is permitted.

ii. Penetration of the small quantity of smoke is a dynamic event, characterized by either dissipation or mobility. Dissipation is rapid dilution of the smoke by ventilation air, and mobility is rapid movement of the smoke into and out of the occupied area. In no case should there be formation of a light haze indicative of stagnant airflow, as this would indicate that the ventilation system is failing to meet the requirements of 14 CFR 25.831(b).

iii. The smoke from a smoke source below the main deck must not rise above armrest height on the main deck.

iv. The smoke from a source in the main deck must dissipate rapidly via dilution with fresh air and be evacuated from the airplane. A procedure must be included in the Airplane Flight Manual (AFM) to evacuate smoke from the occupied areas of the airplane. In order to demonstrate that the quantity of smoke is small, a flight test must be conducted that simulates the emergency procedures used in the event of a fire/smoke during flight, including the use of V_{MO}/M_{MO} descent profiles and a simulated landing, if such conditions are specified in the emergency procedure.

2. Requirement for smoke or fire detection in electrical/electronic equipment bays:

[1] Transient airflow conditions may cause air pressure differences between compartments, before the ventilation and pressurization system is reconfigured. Additional transients occur during changes to system configurations such as pack shut-down, fan shut-down, or changes in cabin altitude; transition in bleed source change, such as from intermediate stage to high stage bleed air; and cabin pressurization fly-through during descent may reduce air conditioning inflow. Similarly, in the event of a fire, a small quantity of smoke that penetrates into an occupied area before the ventilation system is reconfigured would be acceptable under certain conditions described within this special condition.

A smoke or fire detection system compliant with 14 CFR 25.858 and 25.855 must be provided for each electrical/electronic equipment bay in the pressurized cabin. Each system must provide a visual indication to the flight deck within one minute after the start of a fire. Airplane flight tests must be conducted to show compliance with these requirements, and the performance of the detectors must be shown in accordance with AC 25-9A, "Smoke Detection, Penetration, and Evacuation Tests and Related Flight Manual Emergency Procedures," or other means acceptable to the FAA.

3. Requirement for AFM procedures safety evaluation:

It shall be demonstrated by means of flight tests that, in the event of smoke/fire detection in the electrical/electronic equipment bays, the AFM procedures for shutting down any or all of the electrical/electronic equipment do not compromise the safe operation of the airplane.

In case a procedure requests only part of the equipment to be shut down, the remaining equipment shall be incorporated with safety features against fire propagation.

Issued in Renton, Washington, on October 4, 2016.

Michael Kaszycki
Assistant Manager, Transport Airplane Directorate
Aircraft Certification Service
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