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DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Part 25

[Docket No. FAA–2013–0907; Special Conditions No. 25–541–SC]

Special Conditions: Airbus Model A350–900 Series Airplane; Tire Failure—Debris Penetration or Rupture of Fuel-Tank Structure

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Final special conditions.

SUMMARY: These special conditions are issued for Airbus Model A350–900 series airplanes. These airplanes will have a novel or unusual design feature associated with fuel tanks constructed of carbon-fiber reinforced plastic (CFRP) materials located within the tire-impact zone, including the wing fuel tanks.

The ability of aluminum wing skins, as has been conventionally used, to resist penetration or rupture when impacted by tire debris, is understood from extensive experience. The ability of carbon-fiber composite material to resist these hazards has not been established. No current airworthiness standards specifically address this hazard for all exposed wing surfaces. 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:* September 8, 2014.

FOR FURTHER INFORMATION CONTACT: Doug Bryant, Propulsion/Mechanical Systems, ANM–112, Transport Airplane Directorate, Aircraft Certification Service, 1601 Lind Avenue SW., Renton, Washington, 98057–3356; telephone (425) 227–2384; facsimile (425) 227–1320.

SUPPLEMENTARY INFORMATION:

Background

On August 25, 2008, Airbus applied for a type certificate for their new Model A350–900 series airplane. Later, Airbus requested and the FAA approved an extension to the application for FAA type certification to November 15, 2009. The Model A350–900 series airplane has a conventional layout with twin wing-mounted Rolls-Royce Trent XWB engines. It features a twin aisle, 9-abreast, economy-class layout, and accommodates side-by-side placement of LD–3 containers in the cargo compartment. The basic Model A350–900 series airplane configuration accommodates 315 passengers in a standard two-class arrangement. The design cruise speed is Mach 0.85 with a maximum take-off weight of 602,000 lbs.

Accidents have resulted from uncontrolled fires caused by fuel leaks following penetration or rupture of the lower wing by fragments of tires, or from uncontained engine failure. In a November 1984 accident, a Boeing Model 747 airplane tire burst during an aborted takeoff from Honolulu, Hawaii. That tire debris penetrated a fuel-tank access cover, causing substantial fuel leakage. Passengers were evacuated down the emergency slides into pools of fuel that fortunately had not ignited.

After an August 1985 Boeing Model 737 airplane accident in Manchester, England, in which a fuel-tank access cover was penetrated by engine debris creating a fire, the FAA amended Title 14, Code of Federal Regulations (14 CFR) 25.963 to require fuel-tank access covers that are resistant to both tire and engine debris (engine debris is addressed outside of these special conditions). Modifications to the access covers were required of the existing fleet by an amendment to 14 CFR part 121. This regulation, § 25.963(e), only addressed the fuel-tank access covers because service experience at the time showed that the lower-wing skin of a conventional, subsonic airplane provided adequate inherent capability to resist tire and engine debris threats. More specifically, this regulation requires showing, by analysis or tests, that the access covers ''. . . minimize penetration and deformation by tire fragments, low energy engine debris, or other likely debris.'' Advisory Circular (AC) 25.963–1 defines the region of the wing that is vulnerable to impact damage from these sources and provides a method to substantiate that the rule has been met for tire fragments. No specific requirements were established for the contiguous wing areas into which the access covers are installed. AC 25.963–1 specifically notes, ''The access covers, however, need not be more impact resistant than the contiguous tank structure,'' highlighting the assumption that the wing was adequately addressed.

The Concorde accident in July 2000 is the most notable example. That accident demonstrated an unanticipated failure mode in an airplane with an unusual transport-airplane configuration. Impact to the thin aluminum wing surface by tire debris induced pressure waves within the fuel tank that resulted in fuel leakage and fire. The skin on the Concorde delta-wing supersonic airplane is made of aluminum, having a thickness that is much less than that of a conventional subsonic airplane.

Several previous accidents from burst tires damaged the fuel tank and wings on the Concorde. In 1979, a burst main-gear tire put a hole through the wing, causing both fuel and hydraulic leaks. In 1980, a burst tire damaged the engine and airframe. In July 1993, a main-gear tire burst, damaging the wing and causing hydraulic problems. In October 1993, a main-gear tire burst, broke the water deflector, and created holes in the fuel tank. Fortunately, the fuel did not catch fire during any of these events before the July 2000 accident involving the Concorde airplane.

Following the accident in 2000, regulatory authorities required modifications to the Concorde aircraft to improve impact resistance of the lower wing, or means to retain fuel if the primary fuel retention means is damaged.

These accidents and incidents highlight the need to establish standards for fuel-tank designs and configurations that were not envisioned when the existing standards in 14 CFR part 25 were issued.

Type Certification Basis

Under 14 CFR 21.17, Airbus must show that the Model A350–900 series airplane meets the applicable provisions of part 25, as amended by Amendments 25–1 through 25–129.

If the Administrator finds that the applicable airworthiness regulations (i.e., 14 CFR part 25) do not contain adequate or appropriate safety standards for Model A350–900 series airplanes 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 A350–900 series airplane must be shown to 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 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 Airbus Model A350–900 series airplanes will incorporate the following novel or unusual design features: CFRP materials for most of the wing fuel-tank structure.

Discussion

To maintain the level of safety prescribed by § 25.963(e) for fuel-tank access covers, these special conditions establish a standard for resistance to potential tire-debris impacts to the contiguous wing surfaces, and require consideration of possible secondary effects of a tire impact, such as the induced pressure wave that was a factor in the Concorde accident. These special conditions take into account that new construction methods and materials may not necessarily provide the resistance to debris impact that has historically been shown as adequate. These special conditions are based on the defined tire-impact areas and tire-fragment characteristics described in AC 25.963–1.

In addition, despite practical-design considerations, some uncommon debris larger than that defined in paragraph (b) may cause a fuel leak within the defined area, so paragraph (c) of these special conditions also takes into consideration possible leakage paths. Fuel-tank surfaces of typical transport airplanes have thick aluminum construction in the tire-debris impact areas that is tolerant to tire debris larger than that defined in paragraph (b) of these special conditions. Consideration of leaks caused by larger tire fragments is needed to ensure that an adequate level of safety is provided.

Note: While § 25.963 includes consideration of uncontained engine debris, the effects of engine debris are not included in these special conditions because these related potential hazards are addressed on the Model A350–900 series airplane under the existing requirements of § 25.903(d). Section 25.903(d) requires minimizing the hazards from uncontained engine debris.

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. 25–13–19–SC for the Airbus Model A350–900 series airplanes was published in the **Federal Register** on January 14, 2014 (79 FR 2388). No comments were received, and the special conditions are adopted as proposed.

Applicability

As discussed above, these special conditions are applicable to Airbus Model A350–900 series airplanes. Should Airbus 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 Airbus Model A350–900 series 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 Airbus Model A350–900 series airplanes.

a. Impacts by tire debris to any fuel tank or fuel-system component located within 30 degrees to either side of wheel rotational planes may not result in penetration or otherwise induce fuel-tank deformation, rupture (for example, through propagation of pressure waves), or cracking sufficient to allow a hazardous fuel leak. A hazardous fuel leak results if debris impact to a fuel tank surface causes—

1. a running leak,

2. a dripping leak, or

3. a leak that, 15 minutes after wiping dry, results in a wetted airplane surface exceeding 6 inches in length or diameter.

The leak must be evaluated under maximum fuel-head pressure.

b. Compliance with paragraph (a) must be shown by analysis or tests assuming all of the following:

1. The tire-debris fragment size is equal to 1 percent of the tire mass.

2. The tire-debris fragment is propelled at a tangential speed that could be attained by a tire tread at the Airplane Flight Manual airplane rotational speed (VR at maximum gross weight).

3. The tire-debris fragment load is distributed over an area on the fuel-tank surface equal to 1.5 percent of the total tire-tread area.

c. Fuel leaks caused by impact from tire debris larger than that specified in paragraph (b), from any portion of a fuel tank or fuel-system component located within the tire-debris impact area defined in paragraph (a), may not result in hazardous quantities of fuel entering any of the following areas of the airplane:

1. Engine inlet,

2. APU inlet, or

3. Cabin-air inlet.

This must be shown by test or analysis, or a combination of both, for each approved engine forward-thrust condition, and each approved reverse-thrust condition.

Jeffrey E. Duven,

Manager, Transport Airplane Directorate, Aircraft Certification Service.

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