



[4910-13]

**DEPARTMENT OF TRANSPORTATION**

**Federal Aviation Administration**

**14 CFR part 25**

[Docket No. FAA-2013-0908; Notice No. 25-13-24-SC]

**Special Conditions: Airbus, Model A350-900 series airplane; Airplane Level of Safety**

**Provided by Composite Fuel Tank Structure: Post-Crash Fire Survivability.**

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

**ACTION:** Notice of proposed special conditions.

**SUMMARY:** This action proposes special conditions for Airbus Model A350-900 series airplanes. These airplanes will have a novel or unusual design feature(s) associated with the post-crash fire survivability of composite fuel tanks. The applicable airworthiness regulations do not contain adequate or appropriate safety standards for this design feature. These proposed 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:** Send your comments on or before [insert a date 45 days after date of publication in the Federal Register].

**ADDRESSES:** Send comments identified by docket number FAA-2013-0908 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, D.C., 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, D.C., between 8 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 the Docket Operations in Room W12-140 of the West Building Ground Floor at 1200 New Jersey Avenue, SE, Washington, D.C., between 9 a.m. and 5 p.m., Monday through Friday, except federal holidays.

**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:**

### **Comments Invited**

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 on or before the closing date for comments. We may change these proposed special conditions based on the comments we receive.

### **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 June 28, 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 will accommodate 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. Airbus proposes the Model A350-900 series airplane to be certified for extended operations (ETOPS) beyond 180 minutes at entry into service for up to a 420-minute maximum diversion time.

The Model A350-900 series airplane will be the second large transport category airplane certificated with composite wing and fuel tank structure that may be exposed to the direct effects of post-crash ground or under-wing fuel-fed fires. Although the FAA has previously approved fuel tanks made of composite materials located in the horizontal stabilizer of some airplanes, the

composite wing structure of the Model A350-900 series airplane will incorporate a new fuel tank construction into service.

Advisory Circular (AC) 20-107A, Composite Aircraft Structure, under the topic of flammability, states: “The existing requirements for flammability and fire protection of aircraft structure attempt to minimize the hazard to the occupants in the event ignition of flammable fluids or vapors occurs. The use of composite structure should not decrease this existing level of safety.” Pertinent to the wing structure, post-crash fire passenger survivability is dependent on the time available for passenger evacuation prior to fuel tank breach or structural failure. Structural failure can be a result of degradation in load-carrying capability in the upper or lower wing surface caused by a fuel-fed ground fire. Structural failure can also be a result of over-pressurization caused by ignition of fuel vapors internal to the fuel tank.

The inherent capability of aluminum to resist fire has been considered by the FAA in development of the current regulations. Title 14 Code of Federal Regulations (14 CFR) part 25 Chapter 1, Section 1.1, General Definitions, defines fire resistant as follows: “With respect to sheet or structural members means the capacity to withstand the heat associated with fire at least as well as aluminum alloy in dimensions appropriate for the purpose for which they are used.” It is noteworthy that aluminum alloy is identified as the performance standard for fire resistance, though no thickness or heat intensities are defined. Based on the performance of aluminum alloy, the definition of fire resistance was later defined for testing of other materials in AC 20-135 as the capability to withstand a 2000° F flame for five minutes.

The FAA has historically promulgated rules with the assumption that the material of construction for wing and fuselage would be aluminum. As a representative case, § 25.963 was promulgated as a result of a large fuel-fed fire following the failures of fuel tank access doors

caused by uncontained engine failures. During the subsequent Aviation Rulemaking Advisory Committee (ARAC) harmonization process, the structures group attempted to harmonize § 25.963 regarding the impact and fire resistance of the fuel tank access panels. Discussions between the FAA and the European Aviation Safety Agency (EASA), formerly the European Joint Aviation Authorities (JAA), ensued regarding the need for fire resistance of the fuel tank access panels. The EASA position was that the FAA requirement for the access panels to be fire resistant when the surrounding wing structure was not required to be fire resistant was inconsistent and that the access panels only needed to be as fire resistant as the surrounding tank structure. The FAA position stated that the fuel tank access panel fire resistance requirement should be retained, and that long term there should be a minimum requirement created for the wing skin itself. Both authorities recognized that existing aluminum wing structure provided an acceptable level of safety. Further rulemaking has not yet been pursued.

As with previous Airbus airplane designs with under-wing mounted engines, the wing tanks and center tanks are located in proximity to the passengers and near the engines. Past experience indicates post-crash survivability is greatly influenced by the size and intensity of any fire that occurs. The ability of aluminum wing surfaces wetted by fuel on their interior surface to withstand post-crash fire conditions has been demonstrated by tests conducted at the FAA

William J. Hughes Technical Center.<sup>1</sup>

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<sup>1</sup> Hill, R., and Johnson, G.R., "Investigation of Aircraft Fuel Tank Explosions and Nitrogen Inerting Requirements During Ground Fires," FAA Report DOT/FAA/RD-75-119, October 1975. Available via the FAA Technical Center Website for Fire Safety at <http://www.fire.tc.faa.gov/>.

Results of these tests have verified adequate dissipation of heat across wetted aluminum fuel tank surfaces so that localized hot spots do not occur, thus minimizing the threat of explosion. This inherent capability of aluminum to dissipate heat also allows the wing lower surface to retain its load carrying characteristics during a fuel-fed ground fire and significantly delay wing collapse or burn-through for a time interval that usually exceeds evacuation times. In addition, as an aluminum fuel tank is heated with significant quantities of fuel inside, fuel vapor accumulates in the ullage space, exceeding the upper flammability limit relatively quickly and thus reducing the threat of a fuel tank explosion prior to fuel tank burn-through. Service history of conventional aluminum airplanes has shown that fuel tank explosions caused by ground fires have been rare on airplanes configured with flame arrestors in the fuel tank vent lines. Fuel tanks constructed with composite materials may or may not have equivalent capability.

Due to the inherent properties provided by aluminum skin and structure, current regulations may not be adequate as they were developed and have evolved under the assumption that wing construction would be of aluminum materials. Inherent properties of aluminum with respect to fuel tanks and fuel fed fires are as follows:

- Aluminum is highly thermally conductive and readily transmits the heat of a fuel-fed external fire to fuel in the tank. This has the benefit of rapidly driving the fuel tank ullage to exceed the upper flammability limit prior to burn-through of the fuel tank skin or heating of the wing upper surface above the auto-ignition temperature, thus greatly reducing the threat of fuel tank explosion.
- Aluminum panels at thicknesses previously used in wing lower surfaces of large transport category airplanes have been fire resistant as defined in 14 CFR 14 part 1 and AC 20-135.

- Heat capacity of aluminum and fuel will prevent burn-through or wing collapse for a time interval that will generally exceed the passenger evacuation time.

### **Type Certification Basis**

Under Title 14, Code of Federal Regulations (14 CFR) 21.17, Airbus must show that the Model A350-900 series airplane meets the applicable provisions of 14 CFR 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 the Model A350-900 series airplane because of a novel or unusual design feature, special conditions are prescribed under § 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 proposed special conditions would also apply to the other model under § 21.101.

The FAA issues special conditions, as defined in 14 CFR 11.19, under § 11.38, and they become part of the type-certification basis under § 21.17(a)(2).

In addition to the applicable airworthiness regulations and special conditions, the Model A350-900 series 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."

### **Novel or Unusual Design Features**

The Airbus Model A350-900 series airplane will incorporate the following novel or

unusual design features: composite fuel tanks.

## **Discussion**

The extensive use of composite materials in the design of the A350 wing and fuel tank structure is considered a major change from conventional and traditional methods of construction, as this will be only the second large transport category airplane to be certificated with this level of composite material for these purposes. The applicable airworthiness regulations do not contain specific standards for post-crash fire safety performance of wing and fuel tank skin or structure.

In order to provide the same level of safety as exists with conventional airplane construction, Airbus must demonstrate that the Model A350-900 series airplane has sufficient post-crash survivability to enable occupants to safely evacuate in the event that the wings are exposed to a large fuel-fed fire. Factors in fuel tank survivability are the structural integrity of the wing and tank, flammability of the tank, burn-through resistance of the wing skin, and the presence of auto-ignition threats during exposure to a fire. The FAA assessed post-crash survival time during the adoption of Amendment 25-111 for fuselage burn-through protection. Studies conducted by and on behalf of the FAA indicated that, following a survivable accident, prevention of fuselage burn-through for approximately 5 minutes can significantly enhance survivability.<sup>2</sup>

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<sup>2</sup> Cherry, R. and Warren, K. "Fuselage Burnthrough Protection for Increased Postcrash Occupant Survivability: Safety Benefit Analysis Based on Past Accidents," FAA Report DOT/FAA/AR-99/57, September 1999 and R G W Cherry & Associates Limited, "A Benefit Analysis for Cabin Water Spray Systems and Enhanced Fuselage Burnthrough Protection," FAA Report DOT/FAA/AR-02/49, April 7, 2003.

There is little benefit in requiring the design to prevent wing skin burn-through beyond five minutes, due to the effects of the fuel fire itself on the rest of the airplane. That assessment was carried out based on accidents involving airplanes with conventional fuel tanks, and considering the ability of ground personnel to rescue occupants. In addition, AC 20-135 indicates that, when aluminum is used for fuel tanks, the tank should withstand the effects of fire for 5 minutes without failure. Therefore, to be consistent with existing capability and related requirements, the Model A350-900 series airplane fuel tanks must be capable of resisting a post-crash fire for at least 5 minutes. In demonstrating compliance, Airbus must address a range of fuel loads from minimum to maximum, as well as any other critical fuel load.

### **Applicability**

As discussed above, these proposed special conditions apply to Airbus Model A350-900 series airplanes. Should Airbus apply later for a change to the type certificate to include another model incorporating the same novel or unusual design feature, the proposed special conditions would apply to that model as well under the provisions of § 21.101.

### **Conclusion**

This action affects only certain novel or unusual design features on the 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 Proposed Special Conditions**

Accordingly, pursuant to the authority delegated to me by the Administrator, the following special conditions are proposed as part of the type certification basis for the Model A350-900 series airplane:

In addition to complying with 14 CFR part 25 regulations governing the fire-safety performance of the fuel tanks, wings, and nacelle, the Airbus Model A350-900 series airplane must demonstrate acceptable post-crash survivability in the event the wings are exposed to a large fuel-fed ground fire. Airbus must demonstrate that the wing and fuel tank design can endure an external fuel-fed pool fire for at least five minutes. This shall be demonstrated for minimum fuel loads (not less than reserve fuel levels) and maximum fuel loads (maximum range fuel quantities), and other identified critical fuel loads. Considerations shall include fuel tank flammability, burn-through resistance, wing structural strength retention properties, and auto-ignition threats during a ground fire event for the required time duration.

Issued in Renton, Washington, on October 22, 2013

Stephen P. Boyd  
Acting Manager, Transport Airplane Directorate  
Aircraft Certification Service

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