



Federal Aviation Administration

Memorandum

Date: January 11, 2011

To: Manager, Transport Standards Staff, International Branch, ANM-116

From: Manager, Transport Airplane Directorate, ANM-100

Prepared by: Douglas Bryant, ANM-112

Subject: INFORMATION: Equivalent Level of Safety (ELOS) Finding for the Airbus Model A350 airplane (FAA Project Number TC0544IB-T)

ELOS Memo#: TC0544IB-T-P-9

Reg. Ref.: §§ 25.997(d) and 25.1305(c)(6)

This memorandum informs the certificate management aircraft certification office of an evaluation made by the Transport Airplane Directorate on the establishment of an equivalent level of safety finding for the Airbus Model A350 airplane.

Background

Title 14 Code of Federal Regulations 25.1305(c)(6) requires “An indicator for the fuel strainer or filter required by § 25.997, to indicate the occurrence of contamination of the strainer or filter before it reaches the capacity established in accordance with §25.997(d).” Section 25.997 requires a fuel strainer or filter between the fuel tank outlet and the inlet of either the fuel metering device or an engine driven positive displacement pump, whichever is nearer the fuel tank outlet.

The engine fuel filtration system of the Rolls-Royce Trent XWB equipped Airbus Model A350-900 airplane incorporates a two filter system. A small-micron main filter, the low pressure (LP) filter, with a bypass, is located between the fuel tank outlet and the inlet of the engine high pressure (HP) pump. Impending bypass of the LP filter is indicated on the airplane flight deck display system by an amber caution message and an audible chime. A large micron secondary filter (HP fuel filter), located between the fuel flowmeter and the combustor, has no bypass means, and no indication to the flight crew of excessive pressure drop across the filter stage.

The proposed two fuel filter system was not envisioned at the time the referenced regulatory provisions were promulgated. Therefore the proposed fuel filtration system does not directly comply with § 25.1305(c)(6) because the HP fuel filter does not have an indication to the flight crew of impending bypass.

On turbine engine powered transport airplanes, a warning of a contaminated fuel filter or strainer is required so that the pilot will receive warning of an impending fuel flow and pressure loss condition. The contaminated filter warning is intended to be an advance warning of possible engine failure, which allows the pilot to take appropriate action - such as diverting on a twin engine airplane before the engine must be shut down due to low fuel pressure.

Applicable regulation(s)

§§ 21.21(b)(1), 25.997(d), 25.1305(c)(6)

Regulation(s) requiring an ELOS finding

§ 25.1305(c)(6)

Description of compensating design features or alternative standards which allow the granting of the ELOS (including design changes, limitations or equipment need for equivalency)

The LP fuel filter fully complies with § 25.1305(c)(6) requirements. It is the primary source of protection from debris residing in the fuel supply/wing fuel system.

The HP fuel filter is introduced to improve safety levels by protecting the engine combustor nozzles (fuel burners) from debris, which may be generated downstream of the LP filter (as a result of pump mechanical failure or degradation) within a given engine. The filter is sized to arrest particles that may block the fuel burners and are of much greater size than those considered for the LP filter. Blocking of the fuel burners could lead to an inadequate distribution of the fuel flow into the combustor and possibly result in an engine case burn-through event.

The impending bypass of the main LP fuel filter is indicated by a warning, which puts the aircraft in a no go situation at next landing. The filter must be changed before dispatch. The maintenance procedure associated with a blocked LP filter includes checking of the HP filter.

Tests performed for engine type certification show that even in case of LP filter bypass operation, the HP filter is not susceptible to blockage. In-service experience of the Rolls-Royce RB211 engines (which include the Trent family and exceed 100 million engine operating hours) confirm that the HP filter is not susceptible to blockage under normal engine operation.

Explanation of how design features or alternative standards provide an equivalent level of safety to the level of safety intended by the regulation

Although noncompliant with the regulation, the addition of the secondary filter and the engine fuel filtration system features are considered to provide adequate compensation for the lack of the required indication. Relevant compensating features include: (1) the impending bypass of the LP filter is indicated by a warning message which puts the aircraft in a no dispatch situation after landing until the LP filter is checked/changed and the procedure includes checking the HP filter, (2) the large capacity of the secondary HP filter stage should ensure that a flight will be completed (and the filter replaced) prior to the secondary filter becoming completely plugged and, (3) in-service experience, as well as engine type certification testing, with a similar LP/HP filtration system shows the ability of the fuel system to maintain acceptable levels of fuel system flow with the LP filter bypassed. In addition, despite the absence of bypass indication of the HP fuel filter, it is considered that the installation of this fuel filter system may improve the level of safety required by direct compliance to § 25.1305(c)(6).

FAA approval and documentation of the ELOS finding

The FAA has approved the aforementioned equivalent level of safety finding in the Model A350 project issue paper P-9, titled "Warning Means for Rolls Royce Engine Fuel Filter Contamination." This memorandum provides standardized documentation of the ELOS finding that is non-proprietary and can be made available to the public. The Transport Directorate has assigned a unique ELOS Memorandum number (see front page) to facilitate archiving and retrieval of this ELOS. This ELOS Memorandum number should be listed in the Type Certificate Data Sheet under the Certification Basis section (TC's & ATC's) or in the Limitations and Conditions Section of the STC Certificate. An example of an appropriate statement is provided below:

Equivalent Level of Safety Findings have been made for the following regulation(s):
14 CFR 25.1305(c)(6), Powerplant Instruments
(documented in TAD ELOS Memo TC0544IB-T-P-9)



Manager, Transport Airplane Directorate,
Aircraft Certification Service

FEBRUARY 11, 2011

Date

ELOS Originated by Transport Standards Staff:	Project Engineer Douglas Bryant	Routing Symbol ANM-112
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