Federal Aviation Administration

Memorandum

Date:	March 30, 2011
To:	Manager, Transport Airplane Directorate International Branch, ANM-116
From:	Manager, Transport Standards Staff, Propulsion/Mechanical Systems, ANM-112
Prepared by:	Douglas N. Bryant, Aerospace Engineer, ANM-112
Subject:	INFORMATION: Equivalent Level of Safety (ELOS) Finding for Airbus project on Models A330-201/-202/-203/-223/-223F/-243/-243F A340-211/-212/-213/-311/-312/-313 and A340-541/-642, FAA Project # TD0609IB-T
ELOS Memo#:	TD0764IB-T-P-1
Regulatory Ref:	SFAR 88, §§ 25.901, 25.951, 25.952, 25.955, 25.961, 25.981(a) and (b), Amd. 25-102, 25.1301, 25.1309, 25.1351, 25.1353, 25.1357, 25.1363, 25.1581, 25.1529, 25.1585, Special Conditions No. 25-ANM-77 and No. 25-ANM-69

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 Models A330-201/-202/-203/-223/-223F/-243/-243F, A340-211/-212/-213/-311/-312/-313 and A340-541/-642.

Background

Paragraph 2.(a) of Special Federal Aviation Regulation No. 88 (SFAR 88) requires the affected design approval holders (DAHs) "Conduct a safety review of the airplane fuel tank system to determine that the design meets the requirements of Title 14 Code of Federal Regulations (14 CFR) paragraphs 25.901 and 25.981(a) and (b). If the current design does not meet these requirements, develop all design changes to the fuel tank system that are necessary to meet these requirements." Paragraph 2.(c), including paragraph 2.(c)(1), requires the DAH [2.(c)] "Submit a report for approval to the FAA Aircraft Certification Office (ACO), or office of the Transport Airplane Directorate, having cognizance over the type certificate for the affected airplane, that: [2.(c)(1)] "Provides substantiation that the airplane fuel tank system design, including all necessary design changes, meets the requirements of §§ 25.901 and 25.981(a) and (b) of this chapter."

FAA policy memorandum number 2003-112-15, "SFAR 88 – Mandatory Action Decision Criteria," dated February 25, 2003, provides standardized policy for determining the need for mandatory action relative to the findings from the fuel system safety review required by SFAR 88. It provides

a 4-element unsafe condition evaluation criteria for determining if design changes are necessary under SFAR 88. Failures of the pump and its associated wiring that results in arcing within the fuel tank ullage were identified as one of the higher priority issues from the SFAR 88 unsafe condition finding reviews. The FAA determined that Element 1 of the 4-element unsafe condition criteria covers this failure mode. Element 1 states that any "foreseeable" single failure condition, regardless of probability and service experience, must be addressed for both high and low flammability tanks. Airbus developed ground fault interrupter (GFI) devices to protect the power circuits of electrical motor driven fuel pumps as corrective action for unsafe conditions identified under SFAR 88.

Applicable regulation(s)

§§ SFAR 88, §§ 25.901, 25.951, 25.952, 25.955, 25.961, 25.981(a) and (b), Amd. 25-102, 25.1301, 25.1309, 25.1351, 25.1353, 25.1357, 25.1363,25.1581, 25.1529, 25.1585, Special Conditions No. 25-ANM-77 and No. 25-ANM-69

Regulation(s) requiring an ELOS finding

§ 25.981(a)(3), amendment 25-102

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 GFI is intended for installation in all three-phase alternating current (AC) circuits of certain fuel pumps of Airbus Model A330 and A340 series airplanes. The GFI is designed to remove three phase electrical power from the fuel pump when a fault occurs with the fuel pump wiring. Section 25.981(a)(3) requires demonstrating that an ignition source could not result from each single failure, from each single failure in combination with each latent failure condition not shown to be extremely remote, and from all combinations of failures not shown to be extremely improbable. The probability of the GFI having a latent failure condition, which would prevent it from detecting a fault current and removing power from the fuel pump, is not shown to be extremely remote. The available compensating factors are:

- Limited exposure to potential GFI failures to perform their function
- Low likelihood of arcing failures (short circuit to ground) for which the GFI would be the mitigation means

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

There are compensating features that together provide an equivalent level of safety to that which would be provided if the aircraft was directly compliant to § 25.981(a)(3), amendment 25-102. These features are:

1. The extensive service history on the Airbus Model A300/A310/A318/A319/A320/A321/A330/A340 airplanes includes 403,000,000 hours of electric motor fuel pump operation that show limited exposure to pump failure modes that

could result in an ignition source. Failure rates associated with potential ignition source problems of fuel pump phase-to-phase and phase-to-ground shorts are relatively low.

2. Service experience has resulted in design improvements to prevent certain failures so there are limited numbers of foreseeable failures for which the GFI would be needed to provide additional protection.

3. Periodic inspections will be performed to check functionality of the GFI. However, due to the potential latent failures of the GFI functions, a maximum 4,000 flight-hour maintenance interval for checking the functionality of the GFI is required. A GFI that fails a functional check must be replaced prior to further flight or the associated fuel pump deactivated per the Master Minimum Equipment List (MMEL). The proposed maintenance check will be included as a Fuel Airworthiness Limitation in Airworthiness Limitations Section (ALS) part 5.

FAA approval and documentation of the ELOS finding

The FAA has approved the aforementioned equivalent level of safety finding in project issue paper P-1 "Installation of Fuel Pump Ground Fault Interrupter (GFI) Devices". This memorandum provides standardized documentation of the ELOS finding that is non-proprietary and can be made available to the public. The Transport Airplane 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 in accordance with the statement below:

Equivalent Level of Safety Findings have been made for the following regulation(s): 14 CFR part 25.981(a)(3), amendment 25-102, Fuel tank ignition prevention (documented in TAD ELOS Memo TD0764IB-T-P-1).

APRIL 19, 2011

Manager, Transport Airplane Directorate,
Aircraft Certification Service

Date

ELOS Originated by TAD:	Project Engineer Douglas N. Bryant	Routing Symbol ANM-112