



Federal Aviation Administration

Memorandum

Date: September 22, 2014

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

From: Manager, Transport Airplane Directorate, ANM-100

Prepared by: Jeff Meyers, ANM-111

Subject: INFORMATION: Equivalent Level of Safety (ELOS) Finding for the Airbus Model A350-900 Airplane (FAA Project Number TC0544IB-T) Pitot Heat Indication System

ELOS Memo #: TC0544IB-T-SA-23

Reg. Ref: § 25.1326

This memorandum informs the certificate management aircraft certification office of an evaluation made by the Transport Airplane Directorate (TAD) on the establishment of an equivalent level of safety (ELOS) finding for the Airbus Model A350-900 airplane.

Background

Title 14, Code of Federal Regulations (14 CFR) section 25.1326 states:

If a flight instrument pitot heating system is installed, an indication system must be provided to indicate to the flight crew when that pitot heating system is not operating. The indication system must comply with the following requirements:

- (a) The indication provided must incorporate an amber light that is in clear view of a flight-crew member.
- (b) The indication provided must be designed to alert the flight crew if either of the following conditions exist:
 - (1) The pitot heating system is switched 'off'.
 - (2) The pitot heating system is switched 'on' and any pitot tube heating element is inoperative.

Section 25.1326 was established to require effective pitot heat warning indicators for the type certification of transport category airplanes equipped with pitot heating systems. This rule was in response to accidents and incidents in which pilots of transport category airplanes equipped with pitot heating systems encountered difficulties because of faulty indications from flight data instrumentation systems, while the airplanes were operating in freezing precipitation. The FAA believed that these incidents occurred because of a lack of pitot heat and that transport category

airplanes having pitot heating systems should be equipped with pitot heat warning indicators that provide an effective indication of a lack of pitot heat.

The A350 design does not provide an indication to alert the flight crew following the failure of any pitot heating system and therefore does not meet the requirements of § 25.1326(b)(2).

The A350-900 aircraft incorporates a new and novel air data and inertial data function to improve the detection of misleading air and inertial data and simplify flight crew related tasks. The air data and inertial data function is referred to as the ‘New Air and Inertial Automatic Data Switching’ function (NAIADS). The system provides a flight crew alert following the failure of more than one pitot heating system failure but not for a single pitot heating system failure.

Applicable regulation(s)

§ 25.1326

Regulation(s) requiring an ELOS finding

§ 25.1326

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

The A350 NAIADS function ensures that no erroneous air data is displayed to the flight crew in case Air Data and Inertial Reference System (ADIRS) loss and/or failure including when pitot heating systems are detected as inoperative. A single failure of a pitot heating system will cause air data from that air data inertial reference unit (ADIRU) to be rejected and not displayed to the flight crew. Instead the system will automatically display data from a ‘good’ ADIRU (–e.g., if ADIRU 1 pitot heating system failed, the Captain’s Primary Flight Display (PFD) would automatically switch from displaying ADIRU 1 air data to displaying air data from ADIRU 3). No alert would be provided to the flight crew following this single failure since there is enough redundancy to ensure that the systems will work properly. Additional redundancy is provided through back-up airspeed and altitude data, computed from engine air data and angle of attack (AOA) data. The A350 design ensures a consistent approach when managing single pitot heating system failure. As the actions are automated, there is little benefit in advising the flight crew of this single failure (as no flight crew action is required).

The A350 design will provide alerts for multiple pitot heating system failures.

Explanation of how design features or alternative standards provide an ELOS to that intended by the regulation

For the A350 Type Certificate, the design of the pitot heating system alerting function following a single failure, as described below, demonstrates an ELOS compared to compliance with § 25.1326(b)(2).

The A350 design provides:

1. Automatic reconfiguration of the air data and inertial data source in case ADIRS loss and/or failure including when the pitot heating system (for the related data source) is detected as inoperative (flight control primary computers (PRIM) monitoring).
2. Additional redundancy through back-up airspeed and altitude data, computed from engine air data and AOA data. This is used for PRIM monitoring and automatic reconfiguration of the displayed air data and inertial information. The back-up airspeed and altitude data can also be manually selected by the flight crew in case of unreliable airspeed or altitude.
3. In case multiple pitot heating systems are detected as inoperative, the flight crew is informed when a flight crew action is required and/or when aircraft capabilities are lost as per the requirements in §§ 25.1301(a), 25.1302(b), (c) and 25.1309(c).

FAA approval and documentation of the ELOS finding

The FAA has approved the aforementioned ELOS finding in the Model A350-900 issue paper SA-23, titled “Pitot Heat Indication Systems.” In addition, because the issue paper follows the corresponding European Aviation Safety Agency (EASA) certification review item (CRI) F-69, the FAA has accepted this CRI as the basis for a finding of an ELOS.

This memorandum provides standardized documentation of the ELOS finding that is non-proprietary and can be made available to the public. The TAD has assigned a unique ELOS Memorandum number (see front page) to facilitate archiving and retrieval of this ELOS finding. This ELOS Memorandum number should be listed in the Type Certificate Data Sheet under the Certification Basis section in accordance with the statement below.

ELOS Findings have been made for the following regulations:
 § 25.1326 Pitot Heat Indication Systems (documented in ELOS Memo TC0544IB-T-SA-23)

Original signed by

Robert Duffer

Transport Airplane Directorate,
 Aircraft Certification Service

9/22/14

Date

ELOS Originated by: Airplane and Flight Crew Interface Branch	Project Engineer: Jeff Meyers	Routing Symbol: ANM-111
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