Federal Aviation Administration

Memorandum

Date: September 19, 2013

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 Flight Critical Thrust Reverser on the Airbus Single Aisle New Engine Option Model Airplanes (FAA Project Number AT00949IB-T)

ELOS Memo#: AT00949IB-T-P-17

Reg. Ref.: §§ 25.933(a)(1)(ii) and 25.1309(b)(1)

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 Single Aisle (SA) New Engine Option (NEO) Model airplanes.

Background

Title 14, Code of Federal Regulations (14 CFR) 25.933(a)(1)(ii) requires that "The airplane is capable of continued safe flight and landing under any possible position of the thrust reverser." Airbus declared that they will not demonstrate compliance with § 25.933(a)(1)(ii) for SA NEO model airplanes. However, Airbus states that the SA NEO model airplanes thrust reverser design protects against in-flight reverser deployment to an extent that provides a level of safety equivalent to that provided by direct compliance with the rule. Airbus has proposed to show that the risk of inadvertent in-flight reverser deployment is extremely improbable.

Compliance with § 25.933(a)(1)(ii) is intended to completely eliminate all risk of catastrophic in-flight reverser deployment from normal operation. Under § 25.933(a)(1)(ii), any residual risk of catastrophic in-flight reverser deployment would be limited to scenarios involving unusual aircraft configurations, abnormal flight conditions or inappropriate flightcrew actions. Therefore, any design intended to provide

an ELOS to the subject rule must limit the residual risk of catastrophic in-flight reverser deployment to a similar level.

In general, the catastrophic risks from other aircraft system hazards are identified and managed through compliance with § 25.1309(b)(1). Therefore, compliance with this standard by the means delineated in the related FAA Advisor Circular (AC) 25.1309-1A should be part of any equivalent safety finding utilizing probability that a catastrophic in-flight deployment will not occur. However, as documented in the docket justification for the subject § 25.933 rule, "A review of the past operating history of airplane engine thrust reversers indicates that fail-safe design features in the reverser systems do not always prevent unwanted deployment in flight. Many of these unwanted deployments are not caused by deficiencies in design but can be attributed to maintenance omissions, wear and other factors that cannot be completely accounted for in the original design and over which the manufacturer generally has no control even when comprehensive maintenance programs are established." This perspective has been re-enforced by an Aerospace Industries Association and FAA review of transport service history, which indicated that many of the reverser in-flight deployment incidents involved inadequate maintenance or improper operations. Other factors such as uncontained engine failure, unanticipated system failure modes and effects, and inadequate manufacturing quality have also played a role in in-service deployment incidents.

Therefore, in addition to the traditional reliability predictions provided in demonstrating compliance with § 25.1309, the equivalent safety finding to § 25.933 will require that the influences which could render that prediction invalid be identified and acceptable means for managing these influences be defined. To this end, compensating design assurance and continued airworthiness features must be provided.

Applicable regulation(s)

§§ 25.933(a)(1)(ii) and 25.1309(b)(1)

Regulation(s) requiring an ELOS finding

§ 25.933(a)(1)(ii)

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

In May of 2000, the Transport Aircraft and Engine Issues Group (TAEIG) submitted to the FAA an Aviation Rulemaking Advisory Committee (ARAC) formal recommendation to propose an amendment to § 25.933(a)(1) as a draft Notice of Proposed Rulemaking (NPRM) with a draft method of compliance in an advisory circular. This recommendation was harmonized with the regulations in 14 CFR part 25 and European Aviation Safety Agency (EASA) Certification Specification (CS) 25 (Joint Airworthiness Requirements (JAR) at the time). The FAA has not amended § 25.933(a)(1) at this time.

However, the FAA has stated that the ARAC recommendations for "controllability" are an acceptable means of demonstrating compliance and the recommendations for "reliability" can be used as a basis for an equivalent safety finding. Refer to FAA policy number PS-ANM100-00-113-1034, titled "INFORMATION: Use of ARAC (Aviation Rulemaking Advisory Committee) Recommended Rulemaking not yet formally adopted by the FAA, as a basis for equivalent level of safety or exemption to Part 25," dated January 2, 2001). Unlike the FAA, EASA has incorporated the ARAC recommendations into CS-25 Amendment 1 as CS 25.933(a)(1). A method of compliance to CS 25.933(a)(1) was also included as (AMC) 25.933(a)(1) that details how to comply by "controllability," "reliability," or a combination of the two. Airbus has proposed to use "reliability" in accordance with the means of compliance detailed in AMC 25.933(a)(1).

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

Although noncompliant with the regulation, the demonstration of compliance to EASA CS 25.933(a)(1) using the "reliability" means of compliance defined AMC 25.933(a)(1) at Amendment 11, which was harmonized during the ARAC, is considered to provide an equivalent level of safety to demonstrating that the airplane is capable of continued safe flight and landing under any possible position of the thrust reverser.

FAA approval and documentation of the ELOS finding

The FAA has approved the aforementioned ELOS finding in the SA NEO model airplanes project issue paper P-17, titled "Flight Critical Thrust Reverser." 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:

The FAA has made an ELOS Findings for the following regulation(s):

14 CFR 25.933(a)(1)(ii), Reversing Systems (documented in TAD ELOS Memo AT00949IB-T-P-17)

Original Signed by Victor Wicklund *September 19, 2013*

Transport Airplane Directorate, Aircraft Certification Service — Date

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