



Federal Aviation Administration

Memorandum

Date: April 19, 2012

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

From: Manager, Transport Airplane Directorate, ANM-100

Prepared by: Douglas Bryant, Aerospace Engineer, ANM-112

Subject: INFORMATION: Equivalent Level of Safety (ELOS) Finding for Airbus' Project on the Model A340-200/-300 Airplanes, FAA Project # TD00905IB-T

ELOS Memo#: TD00905IB-T-P-1

Regulatory 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 finding for the Airbus Model A340-200 and -300 airplanes.

Background

Title 14, Code of Federal Regulations (14 CFR) part 25 section 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 Model A340-200/-300 airplanes will not demonstrate compliance with § 25.933(a)(1)(ii). However, Airbus states that the A340-200/-300 aircraft 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 for some thrust reverser pivoting doors, during certain flight conditions, the airplane directly complies with § 25.933 and for the remaining doors the risk of inadvertent opening 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 flight crew actions. Therefore, any design intended to provide an equivalent level of safety 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 Advisory Circular 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/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

§§ 25.933(a)(1)(ii)

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

In May of 2000, the Transport Aircraft and Engine Issues Group 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 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 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 a combination of "controllability" and "reliability" in accordance with the means of compliance detailed in AMC 25.933(a)(1). They will demonstrate direct compliance with

“controllability” for some cases and for the remaining cases they will demonstrate “reliability” as an equivalent level of safety.

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 demonstration of compliance to EASA CS 25.933(a)(1) using the combined “controllability” and “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

The FAA has approved the aforementioned equivalent level of safety finding in project issue paper P-1, 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 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 of type certificates and amended type certificates or in the Limitations and Conditions Section of the supplemental type 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 25.933(a)(1)(ii), Reversing Systems (documented in TAD ELOS Memorandum TD00905IB-T-P-1)

Signed by Victor Wicklund

Manager, TSS, Propulsion/Mechanical Systems
ANM-112

April 30, 2012

Date

ELOS Originated by TSS:	Project Engineer Douglas Bryant	Routing Symbol ANM-112
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