



# Federal Aviation Administration

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## Memorandum

Date: November 30, 2012

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 Thrust Reverser Testing for the Airbus Model A350 airplane (FAA Project Number TC0544IB-T)

ELOS Memo #: TC0544IB-T-P-33

Reg. Ref.: §§ 25.934 and 33.97

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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 airplane.

### **Background**

Title 14, Code of Federal Regulations (14 CFR) 25.934 requires that thrust reversers installed on turbojet engines meet the requirements of § 33.97, which requires that a production thrust reverser be installed on the engine during engine endurance calibration, operation, vibration, and reverser cycling testing. Airbus has proposed to use a slave C-duct for the forward thrust testing and evaluate the impact of the engine functioning on the stowed thrust reverser based on use of other engine service readiness endurance testing.

### **Applicable regulation(s)**

§§ 25.934 and 33.97

### **Regulation requiring an ELOS finding**

§ 25.934

**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)**

Alternative standards for thrust reverser testing:

1) Testing with the thrust reverser in the forward thrust configuration:

a.) Slave C-ducts.

The engine endurance certification test required by § 33.87 will use slave C-ducts to simulate the production thrust reverser in the stowed position. The aerodynamic, thermodynamic, mechanical stiffness and any other characteristics required to be effectively identical to the production thrust reverser will be simulated by the slave C-ducts. This allows for flexibility to adapt the nozzle size to reach the engine redlines during the test.

b.) Production representative thrust reverser.

The other engine testing conducted for part 33 certification, such as the calibration, operation, and vibration tests, will use a production representative thrust reverser. There will be at least 150 hours of test time demonstrating simulated flight cycles that will be equivalent to the operating time at idle, maximum thrust, and the number of accelerations to and decelerations from extreme levels of thrust experienced during the § 33.87 engine endurance certification test.

2) Testing with the thrust reverser in the reverse thrust configuration:

a.) The same production representative thrust reverser unit used to perform the forward thrust configuration testing of 1(b) will be used to perform the 200 reverse cycle testing required by § 33.97(b).

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

The use of slave C-ducts during testing demonstrate an equivalent production thrust reverser operation exposure to the engine as would be experienced if a production thrust reverser were used during the engine endurance certification test. Additionally, the use of a production thrust reverser during the other engine testing demonstrates an equivalent engine operation exposure to the thrust reverser as would be experienced if a production thrust reverser were used during the engine certification tests. The use of the same production thrust reverser to also perform the reverse cycle testing meets the requirements of § 33.97(b). The combination of these tests effectively meet the intent of § 25.934. Therefore, although noncompliant with the regulation, the alternative standards are considered to provide an ELOS as that established by demonstrating direct compliance to § 25.934.

**FAA approval and documentation of the ELOS finding**

The FAA has approved the aforementioned ELOS finding in the Model A350 project Issue Paper P-33, titled "Thrust Reverser Testing." 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:

An Equivalent Level of Safety Finding has been made for the following regulation:  
 14 CFR 25.934, Turbojet engine thrust reverser system tests (documented in TAD ELOS Memo TC0544IB-T-P-33)

Original signed by

*Victor Wicklund*

November 30, 2012

Transport Airplane Directorate,  
 Aircraft Certification Service

Date

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| ELOS Originated by Transport Standards Staff: Propulsion and Mechanical Systems Branch | Project Engineer<br>Douglas Bryant | Routing Symbol<br>ANM-112 |
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