Federal Aviation Administration

# Memorandum

Date: July 28, 2011

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 the Airbus Model A350 airplane (FAA Project Number TC0544IB-T)

ELOS Memo#: TC0544IB-T-P-7

Reg. Ref.: § 25.779(b)(1)

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 Model A350 airplane.

**Background**

Title 14 Code of Federal Regulations (14 CFR) 25.779(b)(1) requires forward motion to increase forward thrust and rearward motion to increase rearward thrust. The design of the Airbus Model A350 airplanes incorporates features that during certain reduced thrust (flexible) takeoffs a rearward thrust lever motion will result in a forward thrust increase.

The design of a typical transport category airplane has several thrust settings. The maximum thrust setting is referred to as the takeoff setting. A normally used setting below that is the climb setting. Another typical design aspect of a transport category airplane is to incorporate reduced takeoff settings when the maximum thrust available isn't necessary to perform a normal takeoff. This is sometimes referred to as a flexible takeoff. This allows for an optimization of thrust use and a decrease in fuel consumption resulting in a cost savings and a positive environmental impact.

The Model A350 incorporates the reduced thrust (flexible) takeoff and when it is selected it can be less thrust than the climb thrust rating. In this case the climb setting is automatically adjusted (reduced) to the reduced thrust takeoff setting. This is the typical

approach for accommodating the § 25.779(b)(1) requirement since it results in no thrust increase (no thrust change) when thrust levers are moved to a position associated with the lower rating. However, when in flight and the thrust lever is reduced to the climb detent (rearward motion) the commanded thrust setting remains at the adjusted climb level for only a given time period (typically a few seconds) and then the commanded thrust setting progressively increases (over another given time period) to the normal (non-reduced) climb thrust level. This results in an increase in thrust following a rearward thrust lever motion. This hesitation logic incorporated by a timer function circumvents the intent of § 25.779(b)(1) by only initially prohibiting the increase in thrust to the normal climb setting.

**Applicable regulation(s)**

§ 25.779(b)(1)

**Regulation(s) requiring an ELOS finding**

§ 25.779(b)(1)

**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 Model A350 incorporates washout logic that delays the increase in thrust when the thrust lever is reduced to the climb detent following a reduced (flexible) takeoff where the reduced (flexible) thrust setting is lower than the normal climb rating. The washout logic delays any change in thrust initially by automatically reducing the climb rating to be equal to the reduced (flexible) takeoff thrust level. This delay will last for several seconds. The thrust increase from the reduced climb rating to the normal climb rating is gradual, occurring over a period of several seconds. The magnitude of the change in thrust from the reduced climb setting to the normal climb setting is considered small. Additionally, the dynamic effects of the thrust increase do not impact the controllability of the airplane. The duration of the washout and the magnitude of the change has been evaluated through flight test and found to be imperceptible by the flight crew. However, a description of this feature will be included in flight crew training to provide awareness of this situation.

**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 transparent nature of the washout to the flight crew is considered to provide adequate compensation for not providing a forward thrust motion associated with the increase in forward thrust. Relevant compensating factors include: (1) the washout logic that gradually introduces the thrust change, (2) the low magnitude of the thrust change and, (3) awareness of the washout logic provided in flight crew training.

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

The FAA has approved the aforementioned equivalent level of safety finding in the Model A350 project issue paper P-7, titled "Reduced (Flexible) Takeoff Thrust Operations and Throttle Motion." 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. An example of an appropriate statement is provided below:

Equivalent Level of Safety Findings have been made for the following regulation(s): 14 CFR 25.779(b)(1), Motion and effect of cockpit controls, Powerplant
(documented in TAD ELOS Memo TC0544IB-T-P-7)

*Victor Wicklund*

Manager, Transport Airplane Directorate,
Aircraft Certification Service

August 8, 2011

Date

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