



# Federal Aviation Administration

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## Memorandum

Date: January 28, 2016

To: Manager, Boeing Aviation Safety Oversight Office, ANM-100B

From: Manager, Transport Airplane Directorate, ANM-100

Prepared by: Mark Freisthler, ANM-120S

Subject: INFORMATION: Equivalent Level of Safety (ELOS) for Symmetric Maneuvering Conditions on Boeing Model 787-8/-9/-10 (Project Nos. TC6918SE-T, PS06-0496, PS06-0497, PS13-0546 and PS14-1031)

Memo No.: TC6918SE-T-A-12

Reg. Ref.: § 25.331

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The purpose of this memorandum is to inform 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 Model 787-8 airplane.

This memo was subsequently revised to extend this ELOS to the Boeing Model 787-9 and 787-10 airplanes.

### Background

Boeing has proposed the use of certain pitch maneuver criteria, recently developed within the Aviation Rulemaking Advisory Committee (ARAC) forum, for showing compliance to the pitch maneuver requirement of Title 14, Code of Federal Regulations (14 CFR) 25.331(c).

The ARAC Loads and Dynamics Harmonization Working Group (LDHWG), comprised of regulatory authorities and industry, proposed revisions to the pitch maneuver requirements of § 25.331(c)(2). These recommendations have been incorporated by European Aviation Safety Agency (EASA) in Certification Specification (CS) 25, and were incorporated into 14 CFR part 25 at Amendment 25-141 which harmonizes the FAA and EASA rules for § 25.331(c)(2). The certification bases of Boeing Models 787-8, 787-9, and 787-10 were established prior to the FAA's issuance of Amendment 25-141. Therefore, this equivalent safety finding is necessary for § 25.331(c)(2) at Amendment 25-91, the amendment level of this rule included in the certification bases of Boeing Models 787-8, 787-9, and 787-10.

## **Applicable regulation(s)**

§ 25.331(c)

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

§ 25.331(c) Amendment 25-91

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

Section 25.331(c)(2) at Amendment 25-91 prescribes a checked pitching maneuver in which the cockpit pitch control is first displaced in a nose up direction, then the control is displaced in the opposite direction sufficient to "check" the pitching motion. The control displacements must develop specified nose up and nose down pitching accelerations. The magnitude of these control inputs must be such that the positive limit maneuvering load factor prescribed in § 25.337 is achieved on the airplane, but not exceeded.

Section 25.331(c)(2) at Amendment 25-91 specifies pitching accelerations without regard to the size, configuration or characteristics of the airplane. In fact, the same pitching accelerations are applied to the smallest personal airplanes as to the largest jet transports. The ARAC proposed condition, on the other hand, relates the frequency of the control motion to the frequency of the short-period rigid body mode of the airplane, thereby accounting for the characteristics of the particular airplane. The ARAC condition also provides adequate criteria to account for the characteristics of advanced electronic flight control systems in which the achievable maneuvering load factors are governed by special computer control laws.

## **Explanation of how design features or alternative standards provide an equivalent level of safety to the level of safety intended by the regulation**

Within the ARAC forum, regulatory authorities and industry have proposed revisions to the current pitch maneuver requirements in § 25.331(c). The technical aspects of this recommendation have been agreed upon and have been accepted by the ARAC Loads and Dynamics Harmonization Working Group. The ARAC recommendation has been incorporated by European Aviation Safety Agency (EASA) Certification Specification (CS) 25, and adopted into 14 CFR part 25 at Amendment 25-141.

In accordance with Federal Aviation Administration (FAA) policy, an applicant may request the use of a mature ARAC proposal, in lieu of the current requirement(s), as providing an equivalent level of safety. This issue paper documents the Boeing request and FAA finding.

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

The FAA has approved the aforementioned ELOS finding in project Issue Paper A-12 or Administrative Collector Issue Paper G-6. This memorandum provides standardized documentation of the ELOS 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. This ELOS Memorandum number should be listed in the type

certificate data sheet under the Certification Basis section. An example of an appropriate statement is provided below.

Equivalent Safety Findings have been made for the following regulation(s):

§ 25.331(c), “Structure – Symmetric Maneuvering Conditions” (documented in TAD ELOS Memo TC6918SE-T-A-12).

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Transport Airplane Directorate,  
Aircraft Certification Service

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Date

ELOS Originated by ACO:	Mark Freisthler	ANM-120S
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