



Federal Aviation Administration

Memorandum

Date: August 19, 2015

To: Manager, International Branch, ANM-116

From: Manager, Transport Airplane Directorate, ANM-100

Prepared by: Todd Martin, ANM-115

Subject: INFORMATION: Equivalent Level of Safety (ELOS) Finding for Gust and Turbulence Design Loads on Embraer Model EMB-550 and EMB-545 airplanes, FAA Project # TC0717IB-T and AT10256IB-T

ELOS Memo#: TC0717IB-T-A-13

Regulatory Ref: §§ 25.341, 25.343, 25.345, 25.371, 25.373, 25.391, 25.1517

Revision Description: The FAA revised the memo to add the Embraer Model EMB-545.

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 Embraer Model EMB-550 and EMB-545 airplanes.

Background

Embraer has requested an equivalent safety finding to the requirements of Title 14, Code of Federal Regulations (14 CFR) 25.341, 25.343, 25.345, 25.371, 25.373, 25.391, and 25.1517 for the Model EMB-550 and EMB-545 airplanes. Embraer proposes using Aviation Rulemaking Advisory Committee (ARAC) proposed rules for gust and continuous turbulence design loads, incorporated by the European Aviation Safety Agency (EASA) Notice of Proposed Amendment (NPA) 11/2004, for showing compliance to §§ 25.341, 25.343, 25.345, 25.371, 25.373, 25.391, and 25.1517. These criteria have since been adopted, with some changes, by EASA in Certification Specifications (CS) 25.

Applicable regulation(s)

§§ 25.341, 25.343, 25.345, 25.371, 25.373, 25.391, 25.1517

Regulation(s) requiring an ELOS finding

§§ 25.341, 25.343, 25.345, 25.371, 25.373, 25.391, 25.1517

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)

The regulatory authorities and the aviation industries of the U.S., Canada, and Europe convened under the ARAC with the aim of finding a single gust design methodology that would account for both discrete gust and continuous turbulence. After considering several methodologies, the ARAC has recommended that a continuous turbulence criterion be utilized as this method accounts for aircraft response to realistic atmospheric conditions.

The ARAC proposal includes a revision to the gust intensity model used in the design envelope method for continuous turbulence, elimination of the mission analysis method, provisions for treating non-linearities, and reorganization and clarification of the requirement.

The design envelope criterion is retained with a revised gust intensity distribution with altitude. The proposed gust intensities are based on analysis of gust measurements from the Civil Aircraft Airworthiness Data Recording Program (CAADRP). The CAADRP data is the most recent gust information available and it represents measurements of gust and turbulence on transport airplanes in actual operation.

In addition, § 25.1517 will be replaced with the following EASA CS 25.1517 and will apply:

Rough air speed,

- (a) A rough air speed V_{RA} for use as the recommended turbulence penetration air speed, and a rough air Mach number M_{RA} , for use as the recommended turbulence penetration Mach number, must be established to ensure that likely speed variation during rough air encounters will not cause the overspeed warning to operate too frequently.
- (b) At altitudes where V_{MO} is not limited by Mach number, in the absence of a rational investigation substantiating the use of other values, V_{RA} must be less than $V_{MO} - 35$ KTAS.
- (c) At altitudes where V_{MO} is limited by mach number, M_{RA} may be chosen to provide an optimum margin between low and high speed buffet boundaries.

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

The current rule § 25.341 requires consideration of non-linearities only in relation to stability augmentation systems; however, with modern transport airplanes it is possible that the primary flight control system and the airplane itself could exhibit significant non-

linearities. The ARAC proposal would require that any significant non-linearity could be considered in a realistic or conservative manner, and it would provide additional criteria that can be used with other rational approaches that can account for non-linearities (e.g., time domain solutions).

The FAA is in the process of harmonizing § 25.1517 with the current EASA CS 25.1517. The final harmonized paragraph has been published in EASA CS 25, but has not yet been published by the FAA. The FAA issued Policy Statement PS-ANM100-00-113-1034, dated January 4, 2001, that provides a procedure for an applicant to request an equivalent safety finding to use an ARAC recommended rule that has not yet been adopted by the FAA.

FAA approval and documentation of the ELOS finding

The FAA has approved the aforementioned ELOS finding in project issue paper A-13. 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:

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

- § 25.341, Gust and Turbulence Design Loads
 - § 25.343, Design fuel and oil loads
 - § 25.345, High lift devices
 - § 25.371, Gyroscopic loads
 - § 25.373, Speed Control devices
 - § 25.391, Control Surface loads: General
 - § 25.1517, Rough Air Speed, V_{RA}
- (documented in TAD ELOS Memo TC0717IB-T-A-13)

Original Signed by

Suzanne Masterson

Transport Airplane Directorate,
Aircraft Certification Service

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Date

ELOS Originated by: Airframe & Cabin Safety Branch	Project Engineer: Todd Martin	Routing Symbol: ANM-115
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