



Federal Aviation Administration

Memorandum

Date: August 18, 2015

To: Manager, International Branch, ANM-116

From: Manager, Transport Airplane Directorate, ANM-100

Prepared by: Sekhar Vaidyanath, ANM-117

Subject: INFORMATION: Equivalent Safety Finding for Flight Control System Failure Criteria on Embraer Model EMB-550 and EMB-545 airplanes Program, FAA Project # TC0717IB-T and AT10256IB-T

ELOS Memo #: TC0717IB-T-S-3

Regulatory Ref: §§ 21.21(b), 25.671(c)(2), 25.1309

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

The Embraer Model EMB-550 and EMB-545 airplanes must be shown capable of continued safe flight and landing, without requiring exceptional piloting skill or strength, for single failures and certain combinations of failures not shown to be extremely improbable. The requirements for the consideration of failure conditions in the flight control systems are covered specifically by Title 14, Code of Federal Regulations (14 CFR) 25.671 and in general by § 25.1309. Embraer has proposed an ELOS for § 25.671(c)(2) based on the proposal from the Flight Controls Harmonization Working Group (FCHWG) Aviation Rulemaking Advisory Committee (ARAC) and the draft harmonized Advisory Circular (AC)/AMJ 25.1309 (“ARSENAL” version) from the System Design and Analysis Harmonization Working Group (SDAHWG).

Applicable regulation(s)

§ 21.21(b), 25.671(c)(2), 25.1309

Regulation(s) requiring an ELOS finding

§ 25.671(c)(2)

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)

Section 25.671(c)(2), as proposed by the FCHWG ARAC recommendation, provides a definition of acceptable risk level for subsequent failures. It states:

- The airplane must be shown to be capable of continued safe flight and landing after “any combination of failures not shown to be extremely improbable. Furthermore, in the presence of any single failure in the flight control system, any additional failure states that could prevent continued safe flight and landing shall have a combined probability of less than 1 in 1000.”

The FAA proposes the following additional criterion:

- Failure conditions that are classified as catastrophic and that occur as a result of two failures, either of which is latent, must be highlighted in the system safety assessment, subject to review by the FAA. This review will ensure that any such failure conditions are, in fact, extremely improbable by assessing the failure rates and service history of each component, the inspection type and interval for any component whose failure would be latent, and any possible common cause or cascading failure modes.

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

The FCHWG recommendations pertaining to § 25.671 are considered to be an improvement of the existing § 25.671 requirements. For § 25.671(c)(2), by adopting a clear definition of acceptable risk level for subsequent failures, the proposed approach has the advantage of addressing latency and eliminating possible dubious judgments in the determination of probable failures.

The FAA considers that the use of § 25.671(c)(2) proposed by the FCHWG ARAC report (along with the use of the associated proposed AC guidance), plus the additional criterion documented above, will provide an ELOS to the existing requirements of § 25.671.

FAA approval and documentation of the ELOS finding

The FAA has approved the aforementioned ELOS finding in project issue paper S-3, Flight Control System Failure Criteria. 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 provided below.

Equivalent Level of Safety Findings have been made for the following regulation(s):
§ 25.627(c)(2) Flight Control System Failure Criteria (documented in TAD ELOS Memo TC0717IB-T-S-3)

Original Signed by

Tom Groves

Transport Airplane Directorate,
Aircraft Certification Service

August 18, 2015

Date

ELOS Originated by: Safety Management Branch	Project Engineer: Sekhar Vaidyanath	Routing Symbol: ANM-117
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