



# Federal Aviation Administration

---

---

## Memorandum

Date: November 20, 2015

To: Manager, Seattle ACO, ANM-100S

From: Manager, Transport Airplane Directorate, ANM-100

Prepared by: David Webber, ANM-160

Subject: INFORMATION: Equivalent Level of Safety (ELOS) Finding for Speeds for En Route Flight Paths on a Model 787-9 airplane, FAA Project Nos. PS06-0496 and PS06-0497, Model 787-10 airplane, FAA Project Nos. PS13-0546 and PS14-1031

ELOS Memo #: PS06-0496-F-22

Regulatory Ref: § 25.123(a) and (b), Amendment 25-121

---

---

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 Model 787-9 airplane.

This memo is being revised to define this ELOS as being applicable to the Boeing 787-10.

### Background

Section 21.21(b)(1) states that a type certificate may be issued if it is found that any airworthiness provisions not complied with are compensated by factors that provide an ELOS. Amendment 25-121 to Title 14, Code of Federal Regulations (14 CFR) 25.123 added minimum speed requirements in non-icing and icing conditions to ensure the airplane has adequate maneuver capability during the en route phase of flight and to prevent applicants from showing compliance with § 25.123 by trading altitude for airspeed when transitioning from the final takeoff to the en route climb segment. After examining the minimum speed requirement, it is concluded that there is no safety concern associated with trading airspeed for altitude in transition from the final takeoff to the en route climb segment, provided the en route climb speed provides sufficient maneuver capability and margin to stall. With the advent of Amendment 25-121, the 787-9/-10 does not literally comply with the minimum speed requirements of § 25.123(a) and (b).

The objectives of the amended regulation are appropriate; however, there are two issues that prevent a direct showing of literal compliance for the 787-9/-10. These are:

- 1) At some weights, the 787-9/-10  $V_{FTO}$  is expected to be faster than the speed selected for en route climb. This is in conflict with the literal wording of the regulation, but as described in the next section this does not conflict with the intent of the regulation.
- 2) The regulation requires that the en route climb speed be compared to  $V_{SR}$  with ice and  $V_{FTO}$ , both of which are only defined for altitudes within a few thousand feet of maximum airport altitudes, while en route climb speeds must be determined up to higher altitudes.

For these two reasons, an equivalent level of safety finding is necessary to establish a clear path for demonstration of compliance.

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

§ 25.123(a) and (b), Amendment 25-121

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

§ 25.123(a) and (b), Amendment 25-121

### **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 compensating factor(s) raise the level of safety to that required by § 25.123(a) and (b) at Amendment 25-121 by ensuring that the en route climb speed provides the margin to stall speed in non-icing and icing conditions, and the maneuver capability to stick shaker or initial buffet, required to achieve the level of safety consistent with the intent of § 25.123(a) and (b) at Amendment 25-121. New criteria § 25.123(a)(i), (ii) and (iii) ensure that the en route climb speed will provide at least the minimum stall speed margin and maneuver capability required for  $V_{FTO}$  in non-icing conditions, for altitudes up to and exceeding those for which  $V_{FTO}$  is defined, thus meeting the intent of the minimum speed requirement of § 25.123(a) for non-icing conditions.  $ALT_{maxEO}$  is used as an upper altitude limit for these criteria because that is the maximum altitude the airplane will be scheduled to fly in a steady-state engine-out condition for a sustained period of time. Criteria § 25.123(a)(i), and (ii) are limited to a maximum altitude of 20,000 feet because stall speeds and the related stall warning requirements are not defined at arbitrarily high altitudes. Stall speeds are not required to be defined more than 1,500 feet above the airport altitude (takeoff) or 1,500 feet above the runway threshold (landing). The 20,000 feet value is a conservatively high altitude to ensure stall speeds are defined several thousand feet above the highest airports in the world.

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

If the en route climb speed for icing conditions must be directly addressed due to ice effects exceeding one of the thresholds specified in paragraphs § 25.123 (b)(2)(i) and (b)(2)(ii), the effects of en route ice must be included when showing compliance to criteria § 25.123(a)(i), and (ii) (i.e. stall speed margin and maneuver capability to stick shaker at altitudes up to the lower of

20,000 feet pressure altitude or ALTmaxEO) . The effects of en route ice are not applicable to criteria § 25.123(a)(iii) (i.e. maneuver capability to initial buffet) because, as stipulated in § 25.21(g) of Amendment 25-121, § 25.251(e) is specifically exempt from consideration in icing conditions.

The FAA accepts the compensating factors in the form of the proposed criteria for en route climb speeds provide an ELOS with that intended by § 25.123(a) and (b).

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

The FAA has approved the aforementioned ELOS finding in project Issue Paper F-22, “Speeds for En Route Flight Paths” 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 Level of Safety Findings have been made for the following regulation(s): § 25.123En route flight paths (documented in TAD ELOS Memorandum PS06-0496-F-22)]

  
\_\_\_\_\_  
Transport Airplane Directorate,  
Aircraft Certification Service

*11/24/15*  
\_\_\_\_\_  
Date

ELOS Originated by ACO: BASOO	ACO Manager: A. Xidias	Routing Symbol: ANM-100B
----------------------------------	------------------------	-----------------------------