Federal Aviation Administration

Memorandum

Date:	November 20, 2015
To:	Manager, Boeing Aviation Safety Oversight Office, ANM-100B
From:	Manager, Transport Airplane Directorate, ANM-100
Prepared by:	Jim Voytilla, ANM-100B
Subject:	INFORMATION: Equivalent Level of Safety Finding on the Wing Flap Control Lever for The Boeing Company Model 787-8/-9/-10 (Project Nos. TC6918SE-T, PS06-0496, PS06-0497, PS13-0546 and PS14-1031)
ELOS Memo#:	TC6918SE-T-SF-5
Regulatory Ref:	§ 25.777(e)

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

The Boeing Model 787-8/-9/-10 airplane flight deck design for the wing flap control lever does not comply with the cockpit controls requirements of Title 14 Code of Federal Regulations (CFR) 25.777(e). The location of the flap control lever is to the right of the thrust control (i.e., throttle) levers on the right side of the control stand pedestal and shares the axis of rotation with the thrust control levers.

Title 14 CFR 25.777 establishes the design criteria for aircraft cockpit controls. Sub-paragraph (e) states:

"Wing flap controls and other auxiliary lift device controls must be located on top of the pedestal, aft of the throttles, centrally or to the right of the pedestal centerline, and not less than 10 inches aft of the landing gear control."

This requirement has remained virtually unchanged since it was listed in Civil Aviation Regulations (CAR) Part 4b as § 4b.353 Controls, sub-paragraph (e)(1). Currently, there is no advisory material concerning the location of the flap control levers or any other parts of § 25.777. However, it is apparent that the regulation provides standardization of airplane cockpit controls in order to ensure convenient operation and prevent confusion and inadvertent operation of the controls.

At present, the relative positions of the 787 flap control lever and throttle levers are the same or similar to the flap control lever and throttle levers on the 707, 727, 737, 747, 757, 767, and 777 airplane models.

Regulation(s) requiring an ELOS

§ 25.777(e)

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 intent of § 25.777(e) is to require a flight deck arrangement in which flight crews will not inadvertently use the wrong control. The relative positions of the flap lever and throttle levers in the 787 control stand provide compensating design features as specified in § 21.21(b)(1) that provides an equivalent level of safety as that specified in the regulation, for the following reasons:

- The relative positions and travel ranges of the 787 flap lever and throttle levers are the same or similar to the flap lever and throttle levers on the 707, 727, 737, 747, 757, 767, and 777 airplane models. The in-service experience from these models demonstrates that the proposed 787 arrangement is safe. The 707, 727, 737, 747, 757, 767, and 777 airplane models have accumulated over 480 million hours and 260 million flight cycles, and no issues have been reported regarding the relative positions of the flap lever and throttle levers.

- Boeing's arrangement provides more left-right separation between the flap lever and throttle levers than the minimum required by § 25.777(e). The regulation allows the flap lever to be behind the throttle levers, so long as the flap lever is not directly behind the left side of the pedestal. Boeing's arrangement has the flap lever completely to the right of all throttle levers. The left-right separation provided in the 787 control stand provides an equivalent level of safety as the fore-aft separation that is specified in the regulation.

- The flap lever and throttle levers each require a different type of crew effort to initiate motion; this makes inadvertent use of the wrong control unlikely. The flap lever must be lifted up out of its detent prior to rotating the control. This flap lever operation contrasts to the purely-rotational nature of the throttle levers.

- The 787 airplane provides a level of flap/slat-system awareness that exceeds the minimum indication requirements of regulation § 25.699. The flap/slat position display on the engine indicating and crew alerting system (EICAS) is provided to meet § 25.699. Additional crew awareness to flap/slat motion is provided on the airspeed indicators,

which are part of the primary flight displays. The airspeed indicators display "bugs" that are based on flap/slat position. These bugs include flap placard speed, maneuver speed, and stall speed. It is Boeing's position that this extra level of crew awareness provides compensation for the unlikely possibility of the flight crew's inadvertent use of the wrong control.

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

The left-right separation of the flap lever and throttle levers on the 787 and the different motions required to actuate these controls (which includes the flap position detents) provides adequate protection against confusion and inadvertent operation. This is borne out by Boeing's service experience on their other models with similar control stand arrangements. Pilots already trained to fly other Boeing model airplanes are familiar with the Boeing flap lever/throttle levers arrangement such that confusion and inadvertent operation of the levers is not a concern.

FAA approval and documentation of the ELOS

The FAA has approved the aforementioned ELOS finding in project Issue Paper SF-5 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):
§ 25.777(e), "Wing Flap Control Lever" (documented in TAD ELOS Memo TC6918SE-T-SF-5).

12/4/15

Transport Airplane Directorate,
Aircraft Certification Service

Date

ELOS Originated by ACO:	Doug Tsuji	ANM-130S