Federal Aviation Administration

Memorandum

Date: August 21, 2014

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

From: Manager, Transport Airplane Directorate, ANM-100

Prepared by: Thomas Thorson, ANM-100B

Subject: INFORMATION: Equivalent Level of Safety Finding for the Engine and Auxiliary Power Unit (APU) Fire Switch Handle Design on Boeing Model 747, 757, 767, 777, and 787 Airplanes, FAA Project Numbers PS06-0496 and PS09-0863

ELOS Memo # PS06-0496-F-18

Regulatory Ref: 14 CFR 21.21(b)(1) and 25.1555(d)(1)

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 following Boeing airplane models:

- 747-400, -400D, -400F, -8, -8F
- 757-200, -200PF, -200CB, -300
- 767-200, -300, -300F, -400ER, -2C
- 777-200, -200LR, -300, -300ER, 777F
- 787-8, -9

Background

Title 14, Code of Federal Regulations (14 CFR) 25.1555(d)(1) requires cockpit emergency controls to be colored red. The engine and APU fire switches are considered emergency controls and the fire switch handles are black in color rather than the prescriptive red as required by the regulation. Although the controls are black during normal operations, they illuminate red during detected fire conditions.

Applicable regulation(s)

14 CFR 25.1555(d)(1)

Regulation(s) requiring an ELOS finding

14 CFR 25.1555(d)(1)

Description of compensating design features or alternative Methods of Compliance (MoC) which allow the granting of the ELOS (including design changes, limitations or equipment need for equivalency)

The engine and APU fire switch handles indicate red during detected fire conditions. The conditionally red control indications serve to decrease cockpit visual noise within the flight deck during normal operations while providing control distinction when required. Illumination of an engine or APU fire switch handle gives clear and prompt indication that a fire has been detected in the respective engine or APU compartment. The fire switch handles will display red only under detected fire conditions. This coincides with the quiet, dark flight deck design philosophy and is an improvement to fire indication. The red color coding allows users to quickly identify these controls.

The fire switches have a mechanical lock to prevent inadvertent operation. The locking feature is automatically unlocked in response to engine and APU fire indications, or requires a separate and distinct crew action to unlock when the fire switch is required for use in procedures other than in response to annunciated fire warnings. The mechanical lock will prevent inadvertent crew action.

Additionally, crew checklists contain requirements to "confirm" which fire switch should be pulled for any emergency for which there is a necessity to ensure that the correct fire switch is pulled. Flight crews are trained to identify and operate the fire switches during initial and recurrent type rating for the Boeing models listed above. Also, the fire switches are distinctive and unique flight deck controls with respect to their shape, method of operation, and location.

Explanation of how design features or alternative Methods of Compliance (MoC) provide an equivalent level of safety to the level of safety intended by the regulation

Under an annunciated fire condition in an engine or APU compartment, the fire switch handles are brightly illuminated in a red color. The illumination is sufficient for crew identification and crew alerting in all lighting conditions. The illumination of the fire switch handles is not required by 14 CFR part 25 regulations and is considered a compensating design feature to support a finding that the fire switch design provides an ELOS to that intended by § 25.1555(d)(1) under annunciated fire conditions. Illumination of the fire switch handles following a detected engine or APU fire provides prompt and accurate annunciation to the flight crew, and thus provides an ELOS to fire switch handles that are colored red as required by the regulation.

The fire switches have a mechanical lock to prevent inadvertent operation. Because one of the considerations in requiring emergency controls to be red under § 25.1555(d)(1) is to assist in preventing accidental selection or improper operation by flight crews, the FAA considers this locking feature to be a compensating feature in support of the ELOS. The locking feature is automatically unlocked in response to engine and APU fire indications, or requires a separate and distinct crew action to unlock when the fire switch is required for use in procedures other than in response to annunciated fire warnings. The mechanical lock will prevent inadvertent crew action and thus the design feature provides an ELOS in this regard.

FAA approval and documentation of the ELOS finding

The FAA has approved the aforementioned ELOS finding in Model 787 project issue paper F-18 and Models 747, 757, 767, and 777 project issue paper F-4. 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. This ELOS Memorandum number should be listed in the Type Certificate Data Sheets under the Certification Basis sections. An example of an appropriate statement is provided below.

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

14 CFR 25.1555(d)(1) Control markings

(documented in TAD ELOS Memorandum PS06-0496-F-18)

Original signed by
Rob Duffer — 8/21/14

Transport Airplane Directorate,
Aircraft Certification Service — Date

ELOS Originated by Boeing Aviation Safety Oversight Office	Thomas Thorson	ANM-100B