



# Federal Aviation Administration

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## Memorandum

Date: May 29, 2015

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

From: Manager, Transport Airplane Directorate, ANM-100

Prepared by: Sherry Vevea, ANM-140S

Subject: INFORMATION: Equivalent Level of Safety (ELOS) Finding for Display of Powerplant Instruments on the Boeing Model 737-7, -8, and -9 Airplanes, FAA Project Numbers PS12-0037, PS12-0038, PS12-0039

ELOS Memo#: PS12-0038-P-16

Reg. Ref.: § 25.1549(b)

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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 Boeing Model 737-7, 737-8 and 737-9 (737 MAX) airplanes.

### Background

Title 14, Code of Federal Regulations (14 CFR) 25.1549(b), "Powerplant and auxiliary power unit instruments" requires each powerplant and auxiliary power unit instrument, as appropriate to the type of instrument, to have the normal operating range marked with a green arc or green line, not extending beyond the maximum and minimum safe limits.

The 737 MAX design for the display of powerplant instruments does not have a green arc or green line marking for the normal operating range. Therefore, the Model 737 MAX airplanes do not comply with § 25.1549(b).

### Applicable regulation(s)

§§ 21.21(b)(1) and 25.1549(b)

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

§ 25.1549(b)

### **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 range markings are intended to indicate to a flight crewmember, at a glance, that system operation is being accomplished in a safe or unsafe condition. With the advent of full authority digital engine controls (FADEC), the primary means of assuring operation within some engine safe operating limits has been taken over by automated protection features within these engine controls. Hence, such controls provide compensating features to be considered when establishing whether or not providing a green arc or a green line to indicate a safe condition for continuous operation provides an equivalent level of safety. If a FADEC is designed to assure a given engine operating limit is not exceeded, then the crew is no longer the primary means of preventing an exceedance of that limit, and their need for limit value awareness, such as that required by the § 25.1549 redline markings, is greatly diminished.

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

Although noncompliant with § 25.1549(b), the lack of normal operating range “arc” type markings may be effectively compensated for by display digits/ background that change color based on the range in which the parameter is currently operating. If the engine control fails to keep engine operation within normal operating limits, then the flight crew is made aware of that via appropriate crew alerting features (e.g. background or digit color changes, flashing display, aural, associated messaging, procedures, etc.). Such modern alerting clearly is superior to just providing the colored “arc” or background type markings required by § 25.1549.

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

The FAA has approved the aforementioned ELOS finding in the 737 MAX airplanes project issue paper P-16, titled “Display of Powerplant Instruments.” 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 sheet under the Certification Basis section in accordance with the statement below:

Equivalent Level of Safety Finding has been made for the following regulation:

§ 25.1549(b) Powerplant and Auxiliary Power Unit Instruments

(Documented in TAD ELOS Memorandum PS12-0038-P-16)

Original Signed by

*Victor Wicklund*

Transport Airplane Directorate,  
Aircraft Certification Service

July 9, 2015

Date

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| ELOS Originated by<br>Boeing Aviation<br>Safety Oversight<br>Office | BASOO Manager:<br>Angelos Xidias | Routing Symbol:<br>ANM-100B |
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