



Federal Aviation Administration

Memorandum

Date: November 26, 2014

To: Manager, Wichita Aircraft Certification Office, ACE-115W

From: Earl Lawrence, Manager, Small Airplane Directorate, ACE-100

Prepared by: James Galstad, Wichita Aircraft Certification Office, ACE-116W

Subject: INFORMATION: Equivalent Level of Safety (ELOS) Finding for Textron-Beechcraft, King Air Models B200GT and B200CGT

ELOS Memo#: ACE-15-02

Regulatory Ref: 14 CFR 23.1305(d), amendment 23-34
14 CFR 23.1311(a)(6) and (7), amendment 23-49
14 CFR 23.1549(a), (b), (c), and (d), amendment 23-45

This memorandum informs the certificate management aircraft certification office of an evaluation made by the Accountable Directorate on the establishment of an equivalent level of safety (ELOS) finding for the Textron-Beechcraft, King Air Models B200GT and B200CGT airplanes.

Background:

This ELOS finding pertains to the usage of a digital only display, the ProLine Fusion® Powerplant Engine Instrument Display, manufactured by Rockwell Collins, Inc., in certain Textron-Beechcraft King Air Model B200GT and B200CGT airplanes. A digital only display of engine high-pressure rotor speed (N1) rpm is included instead of full time analog display of N1 rpm. The digital display utilizes sensory cues that are alternative and in addition to those required by regulation. The restricted rpm marking is an alternative marking to the regulatory required marking. Regulatory and guidance material for the applicable areas relevant to this ELOS finding are identified below.

Digital Only Display:

Advisory Circular (AC) 23.1311-1C, paragraph 9.4c provides the basis for establishing an equivalent level of safety for a digital only display of engine high-pressure rotor speed (N1) rpm.

Sensory Cues:

AC 23.1311-1C, paragraph 9.5 specifies that "Alternate markings that do not comply with the requirements of § 23.1549 require an ELOS."

Restricted Propeller RPM:

Section 23.1549(d) requires restricted propeller rpm ranges to be marked with a red arc or red line. The electronic display utilizes additional colors and a conditional timer for the red arc marking.

Applicable regulations:Digital Only Display:

- 14 CFR 23.1305(d)
- 14 CFR 23.1549(a),(b), and (c)

Sensory Cues:

- 14 CFR 23.1311(a)(6)
- 14 CFR 23.1549(a), (b), and (c)

Restricted Propeller RPM:

- 14 CFR 23.1311(a)(7)
- 14 CFR 23.1549(d)

Regulations requiring an ELOS finding:Digital Only Display:

- Section 23.1305(d), amendment 23-34, states the following:

“For turbojet/turbofan engine-powered airplanes. In addition to the powerplant instruments required by paragraphs (a) and (c) of this section, the following powerplant instruments are required:

 - (1) For each engine, an indicator to indicate thrust or to indicate a parameter that can be related to thrust, including a free air temperature indicator if needed for this purpose.
 - (2) For each engine, a position indicating means to indicate to the flight crew when the thrust reverser, if installed, is in the reverse thrust position.”
- Section 23.1549(a), (b), and (c), amendment 23-45, states the following:

“(a) Each maximum and, if applicable, minimum safe operating limit must be marked with a red radial or a red line;”

“(b) Each normal operating range must be marked with a green arc or green line, not extending beyond the maximum and minimum safe limits;”

“(c) Each takeoff and precautionary range must be marked with a yellow arc or a yellow line; and . . .”

Sensory Cues:

- Section 23.1311(a)(6), amendment 23-49, states the following:

“Incorporate sensory cues that provide a quick glance sense of rate and, where appropriate, trend information to the parameter being displayed to the pilot.”
- Section 23.1549(a), (b), and (c), amendment 23-45, states the following:

“(a) Each maximum and, if applicable, minimum safe operating limit must be marked with a red radial or a red line;”

“(b) Each normal operating range must be marked with a green arc or green line, not extending beyond the maximum and minimum safe limits;”

“(c) Each takeoff and precautionary range must be marked with a yellow arc or a yellow line; and . . .”

Restricted Propeller RPM:

- Section 23.1311(a)(7), amendment 23-49, states the following:

“Incorporate equivalent visual displays of the instrument markings required by §§ 23.1541 through 23.1553, or visual displays that alert the pilot to abnormal operational values or approaches to established limitation values, for each parameter required to be displayed by this part.”
- Section 23.1549(d), amendment 23-45, states the following:

“Each engine, auxiliary power unit, or propeller range that is restricted because of excessive vibration stresses must be marked with red arcs or red lines.”

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

Digital Only Display:

The compensating features provided for the digital only display of the engine’s high pressure rotor rpm (N1) are those identified in AC 23.1311-1C, paragraph 9.4c.

Sensory Cues:

Sensory cues that are alternative to the regulatory required sensory cues include aural annunciations, left to right comparators, flashing display features, and a propeller synchronization indicator.

Restricted Propeller RPM:

The propeller restricted marking includes additional colors and a conditionally timed display of the red arc for the restricted rpm.

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

Digital Only Display:

AC 23.1311-1C, paragraph 9.4c, provides compensating features for the digital only display of the engine's high-pressure rotor rpm (N1). The show compliance data establishes how the ProLine Fusion® display features combine to meet each of the requirements for equivalency identified in AC 23.1311-1C, paragraph 9.4c.

Sensory Cues:

Sensory cues that are alternative to the regulatory required sensory cues include aural annunciators, left to right comparators, flashing display features, and a propeller synchronization indicator. These sensory cues are evaluated using the FAA's criteria set forth in Small Airplane Airworthiness Review Program Notice No. 5, Notice of Proposed Rulemaking, Notice No. 89-6 (Docket No. 25812) describes electronic display features that may be beneficial to safety when they are "... less prone to misreading ..." based on the "... tasks they perform for the pilot."

Restricted Propeller RPM:

The propeller restricted marking includes additional colors and a conditionally timed display for the restricted rpm red arc. The restricted rpm marking combines additional colors and a conditionally timed display of the red arc. These sensory cues are evaluated using the FAA's criteria set forth in Small Airplane Airworthiness Review Program Notice No. 5, Notice of Proposed Rulemaking, Notice No. 89-6 (Docket No. 25812) describes electronic display features that may be beneficial to safety when they are "... less prone to misreading ..." based on the "... tasks they perform for the pilot."

FAA approval and documentation of the ELOS finding:

The FAA has approved the aforementioned equivalent level of safety finding in project issue paper P-1, Stage 4, Powerplant Instrument Display of Equivalent Level of Safety, date November 24, 2014. This memorandum provides standardized documentation of the ELOS finding that is non-proprietary and can be made available to the public. The Accountable Directorate has assigned a unique ELOS Memorandum number (see front page) to facilitate archiving and retrieval of this ELOS. This ELOS Memorandum number must be listed in the Type Certificate Data Sheet under the Certification Basis section (TCs & ATCs) or in the Limitations and Conditions section of the STC. An example of an appropriate statement is provided below.

Equivalent Level of Safety Findings have been made for the following regulations:

14 CFR 23.1305(d), amendment 23-34
 14 CFR 23.1311(a)(6) and (7), amendment 23-49
 14 CFR 23.1549(a), (b), (c), and (d), amendment 23-45
 (documented in ELOS Memo ACE-14-YY)

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 Aircraft Certification Service

11-26-14

Date

ELOS Originated by: Wichita Aircraft Certification Office	Manager, Project Support Branch: Charles Riddle	Routing Symbol: ACE-115W
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