Federal Aviation Administration

Memorandum

Date: January 16, 2013

To: Scott Horn, Acting Manager, Rotorcraft Certification Office, ASW-170

THRU: Larry Kelly, Manager, Standards Staff, ASW-110

From: Kim Smith, Manager, Rotorcraft Directorate, ASW-100

Prepared by: James Blyn, Aerospace Engineer, ASW-170

Subject: INFORMATION: Equivalent Level of Safety (ELOS) Finding for Bell Helicopter Textron, Inc.'s Supplemental Type Certificate for the Engine & Glass Cockpit Upgrade on Bell 412EP, ODA STC Project No. ST0025RC-RD

ELOS Memo No. ST0025RC-RD/P-1

Regulatory Ref: 14 CFR §§ 29.1305, 29.1321 and 29.1549

This memorandum informs the Rotorcraft Certification Office of an evaluation made by the Rotorcraft Directorate on the establishment of an equivalent level of safety finding for the Bell Helicopter Textron, Inc. (BHTI) Model 412EP Engine and Glass Cockpit Upgrade project.

Background

BHTI intends to modify the Bell Model 412EP Helicopter by Supplemental Type Certificate (STC) to include the PT6T-9 Engine, and a Glass Cockpit using the *Bell BasiX-Pro*® integrated avionics system first introduced in the Bell Model 429. The new modern glass cockpit uses four Display Units (DUs) to display the required engine instruments.

The Model 412EP Engine and Glass Cockpit Upgrade (412EPI) has a Power Situation Indicator (PSI), which provides a full-time digital display of the gas producer rotor speed (NG), gas temperature (MGT) and Torque in combination with a full-time analog (graphical) display representing the parameter (NG, MGT or Torque) which is closest to its limit. It displays both engine power turbines rotor speeds (NPT or NP) and main rotor speed (NR) in a triple tachometer bar format with digital readouts during normal flight and an arc format when NR is less than 90%, as during engine start, engine shutdown, or if a power-off autorotation condition is detected in flight. Additionally, the one engine inoperative (OEI) timers provided for operation in OEI rating alert the crew when the engine enters an OEI time limited zone, and when the timer is about to expire. Other helicopter designs, both Part 27 and 29, have introduced similar power indicators, also known as first limit indicators, though the implementations have differed in their approach.

While the flexibility of electronic displays are considered advantages over traditional mechanical indicators, the requirements of 14 CFR §§ 29.1305 and 29.1549 are prescriptive. If not met, compliance must be shown as documented through a finding of an Equivalent Level of Safety (ELOS).

Applicable regulation(s)

14 CFR §§ 29.1305(a)(11), (12), (13), (14), (15), and (16)
14 CFR §§ 29.1549(a), (b), (c), and (e)

Regulation(s) requiring an ELOS finding

14 CFR §§ 29.1305(a)(11), (12), (13), (14), (15), and (16)
14 CFR §§ 29.1549(a), (b), (c), and (e)

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 compensating factors which meet the intent of 14 CFR §§ 29.1305(a)(11), (12), (16) and 29.1549, are as follows:

- The PSI Arc provides an indication of Torque, MGT and NG such that the parameter nearest the engine operating limit is indicated by a single indicating needle per engine. The needle represents the smallest margin-to-limit for that engine allowing the pilot to determine the margin associated with the engine power available.
- The OEI timer and annunciations allow the pilot to quickly determine operating engine power available and time remaining in OEI condition.

The compensating factors to meet the intent of 14 CFR §§ 29.1305(a)(14), (15) and 29.1549, are as follows:

- The NR and both NPTs (NPs) are continuously displayed, during normal flight, in a triple tachometer bar format with digital readouts.
- When NR is less than 90%, as during engine start, engine shutdown, or if a power-off autorotation condition is detected in flight, the triple tachometer bar format indication is replaced by an arc format.

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

The information related to each engine is plainly visible to the crew and are presented on the displays in a way that allows the pilot to quickly determine the power available for each engine. When compared to a traditional system using three gauges with different scales (Torque, MGT and NG) for each engine, the single scale PSI arc display provides an enhanced engine health indication by allowing a straightforward comparison of the health between the two engines on the same arc display. The OEI timers provided for operation in OEI rating alert the crew when the engine enters an OEI time limited zone, and when the timer is about to expire. The triple tachometer bar format displays the NR and NPT (NP) continuously during normal flight, and converts to an expanded arc scale when NR is less than 90% to provide greater detail to the pilot.

The PSI Arc, Digital Readout, Triple Tachometer, OEI Timer and Annunciation features described above provide the required principal powerplant information to be used by the crew for ensuring safe operation of the rotorcraft and satisfy the intent of the requirements established in 14 CFR Part 29 and AC 20-88A.

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. This memorandum provides standardized documentation of the ELOS finding that is nonproprietary and can be made available to the public. The Rotorcraft Directorate has assigned a unique ELOS Memorandum number (ST0025RC-RD/P-1) to facilitate archiving and retrieval of this ELOS. This ELOS Memorandum number must be listed 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 §§ 29.1305(a)(11), (12), (13), (14), (15), and (16) Powerplant Instruments; and 29.1549(a), (b), (c), and (e) Powerplant Instruments (documented in ELOS Memo ST0025RC-RD/P-1)

Signed by - *Larry M. Kelly*
for _____ 1/16/2013
Manager, Accountable Directorate, Date
Aircraft Certification Service

ELOS Originated by ACO: Rotorcraft Certification Office	ACO Acting Manager: Scott A. Horn	Routing Symbol: ASW-170