

SUBJECT : Equivalent safety finding for Powerplant Valve Indication

REQUIREMENTS incl. Amdt. : CS 25.1141 (f)(2) amdt. 15

ASSOCIATED IM/MoC : Yes / No

ADVISORY MATERIAL :

INTRODUCTORY NOTE:

The Equivalent Level of Safety (ELOS) finding Memo TXTAV-014180-P-05 has been issued by the FAA for the Textron Aviation project 700 (FAA TCDS T00015WI) for Amendment 25-115¹ of Title 14, Code of Federal Regulations (14 CFR) 25.1141(f)(2). The corresponding CS 25.1141(f)(2) has the same wording. The ELOS Memo is considered by EASA an acceptable Equivalent Safety Finding (ESF) to the corresponding CS 25.1141(f)(2). This ESF has been classified as important; as such it shall be subject to public consultation in accordance with EASA Management Board decision 12/2007 dated 11 September 2007, Article 3 (2.) which states:

"2. Deviations from the applicable airworthiness codes, environmental protection certification specifications and/or acceptable means of compliance with Part 21, as well as important special conditions and equivalent safety findings, shall be submitted to the panel of experts and be subject to a public consultation of at least 3 weeks, except if they have been previously agreed and published in the Official Publication of the Agency. The final decision shall be published in the Official Publication of the Agency."

Note: this consultation is for the EASA ESF and not for the FAA ELOS Memo. Comments and the corresponding resolution will affect the EASA ESF only.

IDENTIFICATION OF ISSUE:

See "background" in ELOS Memo "TXTAV-014180-P-05" attached.

Considering the above, the following Equivalent Safety Finding is proposed:

¹ The ELOS Memo "TXTAV-014180-P-05" refers to amdt.72 but it has been clarified by the FAA that this is a typo.

**Equivalent Safety Finding “ESF-E25.1141-01” to CS 25.1141 Amdt 15 for
Powerplant Valve Indication on Textron Aviation Inc. Model 700 Airplanes**

1. APPLICABILITY

Textron Aviation Inc. Model 700.

Affected CS

CS 25.1141(f)(2) amdt 15.

2. Intent of the CS, compensating Factors and/or alternative requirements

See section “Description of compensating design features or alternative standards which allow the granting of the ELOS finding (including design changes, limitations or equipment need for equivalency)” and “Explanation of how design features or alternative standards provide an ELOS to that intended by the regulation” in the ELOS Memo “TXTAV-014180-P-05” attached.

3. Attachments

FAA ELOS Memo "TXTAV-014180-P-05"



Federal Aviation Administration

Memorandum

Date: August 3, 2017
To: Manager, Wichita ACO, ACE-115W
From: Manager, Transport Airplane Directorate, ANM-100
Prepared by: Jeff Englert, ACE-116W
Subject: INFORMATION: Equivalent Level of Safety (ELOS) Finding for Powerplant Valve Indication on Textron Aviation Inc. Model 700 Airplanes, FAA Project No. TXTAV-014180

ELOS Memo #: TXTAV-014180-P-05

Regulatory Ref: 14 CFR 21.21(b)(1) and 25.1141(f)(2)

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 Textron Aviation Inc. Model 700 airplanes.

Background

Amendment 25-72 of Title 14, Code of Federal Regulations (14 CFR) 25.1141(f)(2) requires power assisted valve controls located in the cockpit to have a means to indicate to the flightcrew when a valve is:

- i. in the fully open or fully closed position, or
- ii. moving between the fully open and fully closed position.

The Model 700 aircraft utilizes throttle levers and Run/Stop switches located in the cockpit to control engine operation through power assisted valves, located within the Honeywell AS907-2-1S engine hydromechanical unit (HMU). The throttle levers and RUN/STOP switches do not provide HMU valve position indications in accordance with the requirements of § 25.1141(f)(2).

Applicable regulation(s)

14 CFR 21.21(b)(1) and 25.1141(f)(2)



ELOS Memo No. TXTAV-014180-P-05

Page 2

Regulation(s) requiring an ELOS finding

§ 25.1141(f)(2)

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

The compensating design features of the system are:

- The engine's Full-Authority Digital Electronic Control (FADEC) controls and monitors the HMU fuel valves that shutoff fuel to the engine.
- The HMU has two independent fuel valves (metering valve and pressurizing valve) that shutoff the fuel supplied to the fuel nozzles via the flow divider valve.
- Engine operating parameters are provided to the flightcrew to assist in determining proper engine operation.

AS907 engine power management sets and controls engine operation and power as a function of the aircraft power lever position and applicable aircraft input signals. The FADEC automatically sets thrust proportional to throttle lever angle (TLA) position. The RUN/STOP switch sends engine run or shutdown signals to the FADEC. The RUN/STOP switch position is indicated on the switch but feedback from the valve position is not included. Either signal source causes the FADEC to command the HMU to operate internal valves.

The engine has two independent methods of shutting off fuel flow to the engine. During normal operation, fuel flow to the flow divider valve, which distributes fuel to the nozzles, is physically shutoff by either the fuel metering valve or the pressurizing valve.

The FADEC continuously monitors the position of the metering valve during engine starting and operation. If the metering valve is not in the commanded position or not tracking properly then a FADEC fault will be posted. In a similar manner, if the other valves in the HMU fail to achieve commanded position during a start or when running, improper valve position is either indicated by FADEC fault messages or manifested to the crew by abnormal engine behavior. During normal engine operation and shutdowns on the ground, the FADEC checks the position of HMU metering valve. The FADEC posts faults when the valves do not respond as commanded or are detected in the incorrect position, which are annunciated to the crew as a no dispatch ENG CTRL FAULT CAS message.

If normal engine shutdown fails to shut down the engine, the ENG FIRE switch can be used. The switch cuts off the aircraft fuel supply to the HMU by closing the fuel firewall shutoff valve. The fuel firewall shutoff valve position is annunciated to the crew.

Explanation of how design features or alternative standards provide an ELOS to that intended by the regulation

ELOS Memo No. TXTAV-014180-P-05

Page 3

The intent of § 25.1141(f)(2) is to mitigate the potential for the flightcrew to select an inappropriate position for, or be unaware of the position of, powerplant valves that are controlled from the flight deck.

When the engine is running, the metering valve positioning is dynamic and readily ascertained from engine indications and from engine behavior. Pilot control of the metering valve is essentially controlled by moving the throttle lever. The engine thrust is directly related to N1 (fan speed). The FADEC calculates the appropriate N1 speed setting corresponding to the TLA position selected. The FADEC sets this N1 through the control of the metering valve. If the N1, N1 BUGS, N2 (high pressure turbine speed), and interstage turbine temperature (ITT) are in the normal range then the metering valve is operating properly. If any of these parameters fall out of normal limits, crew alerting system messages are annunciated, there are associated abnormal engine indication system (EIS) indications, and faults posted. Flightcrew corrective actions are addressed in the Airplane Flight Manual (AFM) procedures.

The FADEC's monitoring of the operating condition of valves within the HMU with associated flightcrew procedures provide an equivalent level of safety as that established by § 25.1141(f)(2).

FAA approval and documentation of the ELOS finding

The FAA has approved the aforementioned ELOS finding in project issue paper P-05. 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 must be listed in the Type Certificate Data Sheet under the Certification Basis section. An example of an appropriate statement is provided below.

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

- 14 CFR 25.1141(f)(2) Powerplant controls: general
 (documented in TAD ELOS Memorandum TXTAV-014180-P-05)

CHRISTOPHER R PARKER Digitally signed by CHRISTOPHER R PARKER
 Date: 2017.08.03 13:55:23 -07'00'

Transport Airplane Directorate,
 Aircraft Certification Service

Date

ELOS Originated by: Wichita ACO	ACO Manager: Margaret Kline	Routing Symbol: ACE-115W
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