



Federal Aviation Administration

Memorandum

Date: June 3, 2015

To: Manager, Wichita ACO, ACE-115W

From: Manager, Transport Airplane Directorate, ANM-100

Prepared by: Tina Miller, ACE-117W

Subject: INFORMATION: Equivalent Level of Safety (ELOS) Finding for a Direction Indicator on Cessna Model 680 and Model 680A Airplanes, FAA Project Numbers TC2548WI-T and Cessna-072100

ELOS Memo # TC2548WI-T-SE-5

Regulatory Ref: 14 CFR 21.21(b)(1); 25.1301(a) and (d); 25.1303(a)(3); 25.1309(a), (b), (d), and (e); 25.1316; 25.1321; 25.1327; 25.1331; 25.1333; 25.1351(d); 25.1353(a) and (c); and 25.1459(e)

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 Cessna Model 680 and Model 680A airplanes.

Background

Cessna requested an ELOS to Title 14, Code of Federal Regulations (14 CFR) 25.1303(a)(3) for the Model 680 (Sovereign) airplanes. Cessna subsequently requested to extend the ELOS finding to include Model 680A (Latitude) airplanes, based on the same rationale.

Cessna eliminated the non-stabilized magnetic compass literally referred to in § 25.1303(a)(3). The Model 680 and Model 680A contain an electric full time standby suite consisting of a secondary flight display (SFD), and a separate horizontal situation indicator (HSI). The SFD provides and displays a third source for attitude, airspeed, and altitude information. The HSI displays a third heading, utilizing a remotely mounted magnetic flux detector with gyroscopic stabilization provided by the SFD attitude source. If the data link between the SFD and HSI were to fail or if the HSI were to otherwise fail rendering the HSI heading display invalid, heading would be displayed on the SFD. All sensors used by the standby suite are independent from the primary sensors used by the two primary display systems. All functions associated with

the standby direction indicating system are independent of the main aircraft systems, including lighting, power, stabilization, and magnetic direction sensing. The standby suite will be powered by the standby battery pack located in the nose of the aircraft and will remain powered for a determined minimum time duration after loss of all normal (generators) sources of electrical power. The standby battery pack is independent from the two aircraft main batteries.

The standby suite provides a display format in a traditional attitude display over the horizontal situation arrangement. By reducing the instrument scan, this allows the flight crew to have a smoother transition to the standby instruments in a condition that would warrant its use. The direction indicator would be in close proximity with attitude, airspeed, and altitude information in a presentation very similar to the primary flight displays.

Applicable regulation(s)

14 CFR 21.21(b)(1); 25.1301(a) and (d); 25.1303(a)(3); 25.1309(a), (b), (d), and (e); 25.1316; 25.1321; 25.1327; 25.1331; 25.1333; 25.1351(d); 25.1353(a) and (c); and 25.1459(e)

Regulation(s) requiring an ELOS finding

14 CFR 25.1303(a)(3)

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

1. Loss of all heading display in the cockpit will be shown to be extremely improbable.
2. Standby heading information will be provided after loss of normal electrical power (both main engine generators inoperative) utilizing a stand-alone battery pack to power the instruments and sensor.
3. The Standby Instrument Suite consisting of the SFD, HSI and magnetometer was tested to meet the critical display environment for high intensity radiated fields (HIRF).
4. The Standby Instrument Suite was tested to meet the critical display requirements for indirect effects of lightning (IEL).
5. The software level of the HSI is level C and level B for the SFD. Heading information is normally displayed on the HSI, however if the HSI fails or losses power the heading information is automatically displayed on the SFD.

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

1. Display of standby heading meets the minimum accuracy requirements given in § 25.1327, which is 10 degrees, for all flight conditions. Additionally the SFD and HSI meet the requirements of Technical Standard Order (TSO)-C6d for heading display accuracy of 2 degrees.
2. Loss of all heading information in the cockpit was shown to be extremely improbable through the system safety process. The minimum time duration for display of standby heading information after loss of normal electrical power is the duration of diversion, descent and safe landing plus 30 minutes.
3. The magnetometer, which is remotely located in the vertical stabilizer, senses the earth's magnetic field and provides this information to the SFD. The magnetometer is located in close proximity to the primary flux valves with sufficient separation to account for common mode failures of all three systems such as HIRF, lightning, bird strike, rotorburst, etc. Both the primary and secondary systems were tested to meet the critical HIRF and IEL environments for critical display systems. Bird strike was shown by test or analysis that a single strike will not damage all three sensors. Location and wire routing of the three sensors has also taken into account the effects due to rotorburst from the APU or either main engine. The sensors are separated fore and aft such that effects of an uncontained APU rotor burst have been minimized. The wire routing going forward through the main engine rotor burst zone is separated vertically to minimize the effects of a main engine rotor failure.

FAA approval and documentation of the ELOS finding

The FAA has approved the aforementioned ELOS finding in Model 680 project issue paper SE-5 and Model 680A project issue paper G-5. 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 have been made for the following regulation(s):

14 CFR 25.1303(a)(3) Flight and navigation instruments

(documented in TAD ELOS Memorandum TC2548WI-T-SE-5)

Original Signed by
Robert Duffer

Transport Airplane Directorate,
Aircraft Certification Service

June 3, 2015

Date

ELOS Originated by Wichita ACO	Tina Miller	ACE-117W
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