



# Federal Aviation Administration

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## Memorandum

Date: June 4, 2015

To: Manager, Wichita ACO, ACE-115W

From: Manager, Transport Airplane Directorate, ANM-100

Prepared by: Bob Adamson, ACE-118W / Jeff Englert, ACE-116W

Subject: INFORMATION: Equivalent Level of Safety (ELOS) Finding for Use of a Single Fire Extinguishing Bottle for Protection of Both a Class C Baggage Compartment and APU Installation on a Cessna Model 680, Model 680 (S/N 680-0501 and on), and Model 680A Airplanes, FAA Project Numbers TC2548WI-T, AT5438WI-T, and Cessna-072100

ELOS Memo # TC2548WI-T-P-6

Regulatory Ref: 14 CFR 25.601, 25.851(b), 25.901, 25.857, 25.1195, 25.1301 and 25.1309

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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 Cessna Model 680 and Model 680A airplanes.

### Background

Cessna submitted a request for an ELOS finding to Title 14, Code of Federal Regulations (14 CFR) 25.857 and 25.1195 for Model 680 airplanes. Cessna subsequently requested to extend the ELOS finding to include the Model 680A airplanes, based on the same rationale.

The Model 680 and 680A designs include a fire extinguishing system for a Class C baggage compartment that can also be used for fire extinguishing of the auxiliary power unit (APU) (non-essential, flight operational) installation. This is accomplished by adding the necessary plumbing and valves between the single high discharge rate Halon bottle of the baggage compartment fire extinguishing system and the APU fire extinguishing system. When the single high discharge rate bottle is discharged to either the Class C baggage compartment or APU installation, the bottle is left empty. As a result, the other compartment is without fire extinguishing capability for the remainder of the flight.

**Applicable regulation(s)**

14 CFR 25.601, 25.851(b), 25.857, 25.901, 25.1195, 25.1301, and 25.1309

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

14 CFR 25.857 and 25.1195

**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. The APU and the baggage compartment have separate fire/smoke detection systems. No failure or malfunction in one system can adversely affect function of the other.
2. If the APU provides bleed air for cabin and baggage compartment heating/cooling, the cabin system is isolated from the baggage compartment by at least a check valve. Any fire originating in the APU compartment is isolated to that compartment by the firewall and the APU bleed air shutoff valve.
3. The APU and the baggage compartment have no common wiring. No single electrical fault can cause a fire in both compartments.
4. The shared fire bottle, its plumbing and controls are entirely outside the APU rotor non-containment zone. An APU rotor non-containment will not affect the APU compartment fire protection system.
5. The baggage compartment is entirely outside the APU rotor non-containment zone. An APU rotor non-containment will not cause a fire in the baggage compartment, which could necessitate fire extinguishing in both compartments.
6. The baggage compartment is in the engine rotor non-containment zone. The APU compartment is entirely outside the engine rotor non-containment zone. An engine rotor non-containment cannot cause an APU compartment fire.
7. The probability of either a baggage compartment fire or an APU fire is remote. The probability of a fire protection system failure is 1E-5. Consequently, the probability of an uncontrolled fire on the same flight in either compartment is extremely improbable.
8. There are no common cause failures that could result in a simultaneous baggage compartment fire and APU fire.
9. There are no shared cockpit controls. Each system is provided with separately located, appropriately labeled controls. Shared annunciation is limited to the status of the common baggage/APU (HDR) fire extinguisher bottle. In the event of a Baggage/APU (HDR) Fire Bottle Low message, both the baggage compartment heat (if installed) and APU systems shall be rendered inoperative.

10. The shared bottle is provided with two separate discharge fittings and squibs. Each squib has a dissimilar electrical connector, which prevents electrical cross-connection. The bottle mounting and discharge fitting arrangement is deliberately asymmetric, which prevents mechanical cross-connection of the two systems.
11. While the probability of a baggage compartment fire and APU fire on the same flight is extremely improbable, airplane flight manual (AFM) procedures specify that the APU not be operated if the baggage/APU (HDR) fire extinguisher has been fired. Alternately, AFM procedures specify that the baggage compartment heating system not be operated if the baggage/APU (HDR) fire extinguisher has been fired.
12. In the event the baggage/APU (HDR) fire extinguisher bottle is discharged for either a baggage compartment fire or APU fire, AFM procedures specify to land as soon as possible at nearest suitable airport.
13. In the event the baggage/APU (HDR) fire extinguisher bottle is discharged for a baggage compartment fire, the minimum extinguishing concentration (3% metered for Halon) has been shown to be maintained for a duration (time) equal to (or greater than) the maximum diversion time for the routes allowed in service and that time is specified in the AFM procedures as a limitation.

### **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 compensating factor(s) raise the level of safety to that required by §§ 25.857 and 25.1195 by limiting common cause failures (e.g., The APU and the baggage compartment have separate and independent fire/smoke detection systems.), flight operations (e.g., In the event the baggage/APU shared fire extinguisher bottle is discharged, AFM procedures specify to land as soon as possible at nearest suitable airport.), and inappropriate flightcrew actions (e.g., Discharge of the bottle to the wrong compartment due to crew pushing the wrong discharge switch will be prevented.) to provide a system performance and reliability equivalent to independent systems. While not directly compliant with §§ 25.857 and 25.1195, these compensating factors provide an ELOS.

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

The FAA has approved the aforementioned ELOS finding in Model 680 project issue paper P-5, Model 680 Model 680 (S/N 680-0501 and on) issue paper P-6, and Model 680A project issue paper G-5. This memorandum provides standardized documentation of the ELOS 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 25.857 Cargo compartment classification, and

14 CFR 25.1195 Fire extinguishing systems

(documented in TAD ELOS Memo TC2548WI-T-P-5)

Original Signed by

*Victor Wicklund*

June 4, 2015

Transport Airplane Directorate,  
Aircraft Certification Service

Date

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