



Federal Aviation Administration

Memorandum

Date: September 3, 2010

To: Manager, Wichita ACO, ACE-115W

From: Manager, Transport Airplane Directorate, ANM-100

Prepared by: David Fairback, ACE-116W

Subject: INFORMATION: Equivalent Level of Safety (ELOS) Finding for High Altitude Takeoff and Landing Operations up to 15,000 feet for Cessna Aircraft Company's Model 680 Airplane, FAA Project # Cessna-066650

ELOS Memo#: Cessna-066650-SG-5

Regulatory Ref: 14 CFR 21.21(b)(1); 25.841(a), (b)(6), & (b)(8); 25.1309(c); and 25.1447(c)(1)

This memorandum informs the Wichita ACO Manager of an evaluation made by the Transport Airplane Directorate on the establishment of an equivalent level of safety finding for the Cessna Aircraft Company Model 680.

Background

In accordance with the provisions of § 21.21(b)(1), Cessna Aircraft Company submitted a request for an equivalent level of safety to the requirements of § 25.841(a), (b)(6), & (b)(8). Cessna Aircraft Company wishes to obtain approval for takeoff and landing operations at airports with elevations up to 15,000 feet and to do so without activation of the 10,000 feet cabin altitude warning. Cessna Aircraft Company designed a multiple limit cabin altitude warning system that they believe will provide an equivalent level of safety (ELOS) to the requirements of § 25.841(a), (b)(6), & (b)(8).

Cessna requested and received an equivalent level of safety finding for the Model 680 for takeoff and landing operations up to 14,000 feet. This is documented in Memorandum TC2548WI-T-SG-1, dated May 3, 2004. This new memorandum addresses subsequent changes to enable takeoffs and landings at airport elevations up to 15,000 ft.

Cessna requested and received an exemption from the § 25.1447(c)(1) requirement to automatically present oxygen dispensing units to occupants before the cabin pressure altitude exceeds 15,000 feet for takeoff and landing operations at airports with elevations up to 15,000

feet. The § 25.1447(c)(1) exemption and this ELOS finding are both necessary for takeoff and landing operations at airports with elevations up to 15,000 feet. Refer to Regulatory Docket No. FAA-2010-0290, Exemption 10089, for the approved exemption.

Applicable regulation(s)

§ 25.841(a), (b)(6), & (b)(8) – Pressurized cabins

Regulations requiring an ELOS

§ 25.841(a), (b)(6), & (b)(8) – Pressurized cabins

Section 25.841(a) – Pressurized cabins

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)

1. To assure that the cabin altitude will not exceed 8,000 feet any time the aircraft altitude is greater than 25,000 feet, the cabin pressure controller incorporates the following rate of change multipliers, which affect the selected rate when the discrete signal is active:
 - (a) If the selected landing altitude is between 8,000 and 11,000 feet, the multiplication factor = 1.66.
 - (b) If the selected landing altitude is greater than 11,000 feet, the multiplication factor = 2.80.
2. When the aircraft is descending for landing at an airport altitude greater than 8,000 feet, the controller does not allow the cabin altitude to rise above 8,000 feet until the aircraft altitude descends below 24,500 feet.
3. A cyan CABIN ALTITUDE CAS message is posted whenever the pressurization controller high altitude discrete signal is active. If the cabin altitude is above 9,650 feet for more than 30 minutes in flight in either the high altitude mode or the ">14K" mode, the cyan message changes to amber, accompanied by the single chime and MASTER CAUTION.
4. The flight manual procedure requires crew use of supplemental oxygen if the cabin altitude is above 9,650 feet after the Cabin Pressurization Control System (CPCS) has been in the high altitude mode or the ">14K" mode for more than 30 minutes. The airplane flight manual (AFM) also includes wording that recommends the use of supplemental oxygen after exposure to a cabin altitude in excess of 12,000 feet. Furthermore, in the oxygen system description portion of the AFM, Cessna provides additional advisory information informing the flight crew of operating rule requirements with respect to time, cabin altitude and the use of supplemental oxygen.

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. By increasing the cabin pressure rate of change, exposure to cabin altitudes in excess of 8,000 feet is minimized. The rates are such that by the time the aircraft altitude exceeds 25,000 feet the cabin altitude is at or below the required 8,000 feet. During descent into a high elevation field the increased cabin rate of change minimizes the likelihood of landing pressurized. This mode of operation is only active when the pressurization controller's discrete signal is active.
2. By not allowing the cabin altitude to exceed 8,000 feet until the aircraft has descended below 25,000 feet during a high elevation landing minimizes the occupant's exposure to cabin altitudes in excess of 8,000 feet.
3. By presenting a cyan advisory message the crew is alerted that the pressurization system is in the high altitude mode, the warnings are shifted, and that the cabin altitude is above the standard 8,000 feet. Secondly, when the cyan advisory message changes to an amber caution message after 30 minutes of operation above 9,650 feet cabin altitude while in the high altitude mode, the crew is alerted that they have been exposed to elevated cabin altitudes for an extended duration and that oxygen should be used.
4. The use of supplemental oxygen following the changing of the cyan advisory message to an amber caution message after 30 minutes of operation in the either the high altitude mode or ">14K" mode is described in the AFM supplement. The use of supplemental oxygen is an accepted method for compensating for higher than 8,000 feet cabin pressure altitudes.

Section 25.841(b)(6) – Pressurized cabins

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)

1. When taking off from an airport higher than 14,000 feet, the high altitude mode discrete signal from the pressurization controller and the rate multipliers are active until the aircraft altitude exceeds 24,500 feet or the cabin altitude drops below 8,000 feet, whichever occurs first.
2. The bleed air monitor logic has been modified to reset the cabin altitude warning only when the ">14K" mode has been selected. When the ">14K" mode is not selected, operation of the cabin altitude warning system is unchanged from the presently certified configuration.
3. The flight manual procedure addresses crew use of supplemental oxygen if the cabin altitude is above 9,650 feet after the Cabin Pressurization Control System (CPCS) has been in high altitude mode or ">14K" mode (Cabin Altitude warning settings shifted above their normal settings) for more than 30 minutes.

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. The cabin altitude rates are the same as the presently certified configuration and continue to show that by the time the aircraft altitude reaches 24,500 feet the cabin altitude is at or below the required 8,000 feet.
2. The aircraft warning system must see inputs from both the pressurization controller high altitude signal and the ">14K" switch signal before the red CABIN ALTITUDE warning, oxygen mask drop, and emergency pressurization activation shift from 14,500 to 15,750 feet. No switch configuration will allow the pressurization system to be in the ">14K" mode when the aircraft is above 24,500 feet.
3. The flight manual procedure requires crew use of supplemental oxygen if the cabin altitude is above 9,650 feet after the Cabin Pressurization Control System (CPCS) has been in the high altitude mode or the ">14K" mode for more than 30 minutes. The airplane flight manual (AFM) also includes wording that recommends the use of supplemental oxygen after exposure to a cabin altitude in excess of 12,000 feet. Furthermore, in the oxygen system description portion of the AFM, Cessna provides additional advisory information informing the flight crew of operating rule requirements with respect to time, cabin altitude and the use of supplemental oxygen.
4. The information provided in the AFM supplement ensures that the flight crew is provided with the procedures and cautions when operating in the ">14K" mode.

Section 25.841(b)(8) – Pressurized cabins

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)

1. The intent of 25.841(b)(8) is to ensure that the cabin pressure sensors and supporting architecture are installed in such a way that the crew is alerted, without delay, to a loss of cabin pressure. The Model 680 aircraft modified to land or takeoff between 14,000 feet and 15,000 feet maintains the identical sensor and mounting locations as the current Model 680 aircraft.
2. The emergency descent profile would still be initiated by the 10,000 foot warning which remains unchanged from the original flight testing. Above 24,500 feet, the cabin pressure warnings are shifted out of the high altitude mode or the ">14K" mode.
3. At altitudes below 24,500 feet, automatic presentation of the oxygen masks would occur at 15,750 feet if the aircraft is in ">14K" mode as allowed by Exemption 10089. If the aircraft is not in ">14K" mode the oxygen mask will be presented at 14,500 feet.

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. The sensor and mounting locations are identical to the presently certified configuration and are compliant with the regulation.
2. Shifting of all functions and warnings out of high altitude mode over 24,500 feet allows the system to provide the same level of safety during an emergency descent, including automatic oxygen mask drop at 14,500 feet.
3. At altitudes below 25,000 feet, a decompression would automatically activate the supplemental oxygen system providing the passengers with oxygen to compensate for the effects of higher cabin altitudes. The AFM supplement provides the crew with necessary guidance for the use of oxygen following this event.

FAA approval and documentation of the ELOS finding

The FAA has approved the aforementioned equivalent level of safety finding in project issue paper SG-5. This memorandum provides standardized documentation of the ELOS finding that is non-proprietary and can be made available to the public. The Transport Airplane Directorate has assigned a unique ELOS Memorandum number (see front page) to facilitate archiving and retrieval of this ELOS. This ELOS Memorandum number should 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 regulationx:

14 CFR 25.841(a), (b)(6), & (b)(8) – Pressurized cabins (documented in ELOS memo Cessna-066650-SG-5)

Original signed by

Robert K. Hettman for Victor Wicklund

Manager, Transport Airplane Directorate,
Aircraft Certification Service

9/3/10

Date

ELOS Originated by Wichita ACO:	Program Manager Tina Miller	Routing Symbol ACE-117W
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