



# Memorandum

U.S. Department  
of Transportation  
**Federal Aviation  
Administration**

Subject: **ACTION:** ELOS for FAR §23.841(b)(6) –Cabin  
Pressurization for High Altitude takeoff and Landing  
Operations. ACE-05-11

Date: August 11, 2005

From: Manager, Wichita ACO

Reply to: Mr. Grant Youngdahl  
Attn. of: ACE-117W

To: Manager, Small Airplane Directorate, ACE-100

Attn:

**Background:** Cessna Aircraft Company intends to certify the Model 510 Mustang for takeoff and landing at airports up to 14,000 feet elevation. 14 CFR 23.841(b)(6) requires crew warning indication when cabin pressure altitude exceeds 10,000 feet. Without special design features, altitude warnings would occur which would be an unacceptable nuisance for normal operations. Cessna, therefore, has designed a cabin environmental and pressurization control system that inhibits cabin pressure altitude warnings under specific conditions for these high altitude operations. Cessna requests an equivalent level of safety finding to allow approval of this design feature.

This request was coordinated within the FAA by Issue Paper ME-1.

**Applicable regulations:** The Cessna Model 510 Mustang will be certified to the certification basis shown in Stage 4 of Issue Paper G-1, which is:

Federal Aviation Regulations (FAR) Part 23 effective February 1, 1965 as amended by Amendments 23-1 through 23-54, with Special Conditions as identified below. Additional Special Conditions, ELOS and Exemptions may be incorporated during the project.

Summary of Special Conditions:

Special Condition	Title
23.45	General
23.51	Takeoff Speeds
23.53	Takeoff performance
23.55	Accelerate-stop distance
23.57	Takeoff path
23.59	Takeoff distance and takeoff run
23.61	Takeoff Flight Path
23.63	Climb: General
23.66	Takeoff climb: One-engine inoperative

<b>Special Condition</b>	<b>Title</b>
23.67	Climb: one engine inoperative
23.73	Reference Landing approach speed
23.75	Landing distance
23.77	Balked landing
23.177	Static directional and lateral stability
23.201(e)	Wings level stall
23.203 (c)	Turning flight and accelerated turning stalls
23.251	Vibration and buffeting
23.253	High speed characteristics
23.735	Brakes
23.1195	Fire Extinguishing Systems
23.1197	Fire Extinguishing Agents
23.1199	Extinguishing Agent Containers
23.1201	Fire Extinguishing Systems Materials
23.1323	Airspeed indicating system
23.1505	Airspeed limitations
23.1583	Operating Limitations
23.1585	Operating procedures
23.1587	Performance information
23-XXX-SC	HIRF Special Condition
23-XXX-SC	HIRF SC for FADEC

FAR Part 34 as amended by the Amendment in effect on the date of certification;

FAR Part 36 as amended by the Amendment in effect on the day of application.

**Regulation Requiring an ELOS:**

14 CFR §23.841(b)(6) requirements are as follows:

(b) Pressurized cabins must have at least the following valves, controls, and indicators, for controlling cabin pressure:

(6) Warning indication at the pilot station to indicate when the safe or preset pressure differential is exceeded and when a cabin pressure altitude of 10,000 feet is exceeded.

**Compensating features which allow the granting of the ELOS:**

Compensating factors, which Cessna believes would provide an equivalent level of safety to the requirements of 14 CFR 23.841(b)(6), as required by 14 CFR 21.21(b)(1), for the Model 510 are as follows:

1) The high cabin altitude warning is reset to occur simultaneously with the automatic passenger oxygen mask deployment. The automatic passenger oxygen masks deploy feature has been set to occur at 14,800 ± 200 feet.

- 2) The high cabin altitude warning reverts to the original setting of  $9,800 \pm 200$  feet whenever the aircraft altitude exceeds 24,500 feet or the cabin altitude decreases below 8,000 feet. This includes all operation at elevations of less than 8,000 feet.
- 3) The Model 510 crew alerting system is designed to provide a white advisory message to the crew with the aircraft below 25,000 feet, the cabin altitude above 10,000 feet, and the aircraft takeoff field altitude or selected landing field altitude above 8,000 feet. An amber caution is provided to the crew after 30 minutes of flight operation in this condition. The airplane Flight Manual (AFM) will include instructions that when the caution is annunciated that the pilot is required to begin continuous oxygen use, which shall continue until the annunciation is extinguished.
- 4) The maximum cabin altitude climb and dive rates are increased for high altitude airfield operation to minimize the amount of time the cabin is above 8,000 feet while the aircraft is above 24,500 feet. The cabin rates are modified as function of airfield elevation. At airfields of 9,500 feet and below, the normal maximum  $+600/-500$  feet/minute is retained. When operating out of a 14,000 foot airfield, the maximum rates increase to  $+2,500/-1,500$  feet/minute. Between these two altitudes, the maximum cabin rates are linearly proportional to the end points.
- 5) When landing at an airport between 8,000 feet and 14,000 feet, the cabin pressure altitude will not exceed 8,000 feet prior to the aircraft descending below 24,500 feet.
- 6) The outflow valves incorporate a pneumatic cabin pressure altitude limit feature that will override any other control limit. The altitude limiters are set to  $14,300 \pm 300$  feet. This allows operation at airfields up to 14,000 feet with no residual cabin pressure controlled by the maximum altitude limiters.

**Explanation of how these features provide an ELOS:**

The intent of 14 CFR 23.841(b)(6) is to warn crew when the safe or preset cabin pressure altitude limit is exceeded. The system features described previously are designed to meet this intent. Therefore, Cessna believes the features provided by the Model 510 cabin pressure control system provide an equivalent level of operational safety to meet the intent of 14 CFR 23.841(b)(6).

**ACO Recommendation:**

The FAA concurs with the applicant's position that the intent of 14 CFR 23.841(b)(6) is to warn the crew when the safe or preset cabin pressure altitude limit is exceeded. The system features described above are designed to meet this intent. The FAA has previously granted equivalent level of safety to other airplanes with similar operating characteristics and features.

The FAA Approved Airplane Flight Manual (AFM) must include limitations and procedures, which are found to be acceptable for all operating modes. After holding or

otherwise operating, with the high altitude mode selected, at altitudes below 25,000 feet for more than 30 minutes of time an amber caution is provided to the crew. When operating in the high altitude mode a red warning will be annunciated when the cabin altitude exceeds 15,000 feet. The airplane Flight Manual (AFM) will include instructions that when either the amber caution or red warning is annunciated the pilot is required to begin continuous oxygen use, which shall continue until the annunciation is extinguished.

The compensating features and procedures noted in this memorandum will provide an equivalent level of safety to the requirements of 14 CFR 23.841(b)(6) at Amendment 23-54, upon meeting the requirements stipulated in this memorandum, including the required AFM limitations and procedures, successful completion of all testing and inspections required to show compliance, and completion of the required compliance substantiation documentation.

<u><i>C.D. Riddle</i></u>	<u>8/11/05</u>
for Margaret Kline, ACE-115W	Date
Manager, Wichita Aircraft Certification Office	

Concurrence:

<u><i>Patrick R. Mullen</i></u>	<u>8/26/05</u>
for Manager, Standards Office, ACE-110	Date

<u><i>John Colomy</i></u>	<u>8/31/05</u>
Acting Manager, Small Airplane Directorate, ACE-100	Date