Federal Aviation Administration

Memorandum

Date: March 8, 2006

From: Manager, Wichita Aircraft Certification Office, ACE-115W

To: Manager, Small Airplane Directorate, ACE-100

Prepared by: Grant Youngdahl, ASE (Flight Test), ACE-117W

Subject: ACTION: ELOS for Cabin Pressurization for Cessna Model 510. ACE-05-28

Background: Cessna letter L390-06-0516, dated February 8, 2006, requested a finding of equivalent safety for the Cessna Model 510 with respect to 14 CFR § 23.841(a). Section 23.841(a) requires that cabin pressure altitude be maintained at not more than 15,000 feet in event of any probable failure or malfunction in the pressurization system. The Equivalent Level of Safety (ELOS) is being requested because under some probable cabin pressurization control system failure conditions the cabin pressure altitude exceeds 15,000 feet for a brief period of time. Cessna's position is this brief exposure to a pressure altitude above 15,000 feet will not prevent the flight crew from safely flying and landing the aircraft, or cause permanent physiological injury to the occupants.

This request was coordinated within the Federal Aviation Administration (FAA) by Issue Paper ME-6.

Applicable regulations: The Model 510 certification basis is 14 CFR part 23 as amended through Amendment 54.

Regulation Requiring an ELOS: 14 CFR § 23.841(a) requires that; "*If certification for operation over 25,000 feet is requested, the airplane must be able to maintain a cabin pressure altitude of not more than 15,000 feet in event of any probable failure or malfunction in the pressurization system.*"

Compensating features which allow the granting of the ELOS: Refer to Cessna letter L390-06-0516, dated February 08, 2006. Compensating features that will provide an equivalent level of safety to the requirements of 14 CFR § 23.841(a), as required by 14 CFR § 21.21(b)(1), for the Model 510 are outlined in the following:

1. The stabilized cabin pressure altitude on Model 510 is set to be at least 400 feet below the limit of 15,000 feet specified by 14 CFR § 23.841(a). The altitude limiter setting for Model 510 is 14,300 ± 300 feet.

The cabin altitude limiter for the Model 510 is a reliable proven design used for many years in other Cessna models. These limiters are of the same design as the Model 525, 525A and 525B limiters in each outflow/safety valve.

2. When the critical cabin pressure control system failure was tested the cabin pressure altitude exceeded 15,000 feet for a brief time. With an aircraft altitude of 17,500 feet, the cabin pressure altitude exceeded 15,000 feet for 14 seconds and reached a peak of 16,216 feet, and stabilized at 14,015 feet. At an aircraft altitude of 25,000 feet, the cabin pressure altitude exceeded 15,000 feet for 10 seconds, reached a peak of 17,120 feet, and stabilized at 13,862 feet. For an aircraft altitude of 41,000 feet, the aircraft reached a peak cabin pressure altitude of 15,049 feet, exceeded 15,000 feet for less than 1 second, and stabilized at 13,746 feet.

3. The effects of the brief cabin altitude overshoot are compensated for by the comparatively low altitude limiter setting. Review of physiological data contained in FAA AC25-20 and AC61-107A, and SAE AIR822 and AIR825B shows the severity of hypoxia effects increase progressively with increasing cabin pressure altitude and duration of exposure. The effects are cumulative. Rate of onset and severity of symptoms increase in proportion to increase in cabin pressure altitude. Conversely, severity of hypoxia effects decrease in proportion to decrease in cabin pressure altitude. For Model 510 flight testing, as aircraft altitude increased the duration of the overshoot decreased and cabin pressure altitude stabilized at a lower altitude.

5. Cabin pressure altitude climb to the setting of the cabin altitude limiters will be accompanied by warning annunciation of excessive cabin altitude at 10,000 feet as required by 14CFR § 23.841(b)(6), except for high altitude operations where a high altitude operation advisory indication will be provided at 10,000 feet and a warning annunciated at 15,000 feet. Auto-deploy of the passenger oxygen masks will occur at 14,800 ± 200 feet. With the annunciation of a high altitude warning Aircraft Flight Manual (AFM) procedures require the flight crew to don their oxygen masks, ensure oxygen is provided to the passengers, and initiate an emergency descent. This prevents the brief exposure of the occupants to cabin pressure altitude above 15,000 feet from being a hazard.

Explanation of how these features provide an ELOS: The intent of 14 CFR § 23.841(a) is to prevent exposure of the occupants to cabin pressure altitude that could prevent the flight crew from safely flying and landing the aircraft, or cause permanent physiological injury to the

occupants. The design and tested performance of the Model 510 cabin pressure control system meet this intent. Therefore, it is believed that the features provided by the Model 510 cabin pressure control system provide an equivalent level of safety to that specified by 14 CFR § 23.841(a).

ACO Recommendation: The FAA agrees with the applicant. The design features documented in the Cessna position will provide an equivalent level of safety to the requirements of 14 CFR § 23.841(a) at Amendment 54, upon successful completion of required tests and completing compliance substantiation documentation

Concurrence:

Margaret M. Kline *3/8/06*
Margaret M. Kline, ACE-115W Date
Manager, Wichita Aircraft Certification Office

John Colomy *4/17/06*
Manager, Standards Office, ACE-110 Date

John Colomy *4/17/06*
for Manager, Small Airplane Directorate, ACE-100 Date