



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

ACE-100

1998 MAY 20 AM 8:26

Memorandum

Subject: **ACTION:** Requesting Review of and Concurrence With,
Equivalent Level of Safety (ELOS), Raytheon Aircraft
Company Model 3000, FAR §23.841(b)(6), Pressurized
Cabins ; Finding No. 97-7

Date: May 12, 1998

From: Program Manager--Raytheon Projects
ACE-117W

Reply to: Michael Imbler
Attn. of: (316) 946-4147

To: Manager, ACE-100
Attn.: Robert Alpiser, ACE 112

Background:

The Raytheon Model 3000 is an all metal, low wing monoplane of conventional construction, powered by a single P&W PT6A-68 engine. The crew compartment will be pressurized to a maximum differential of 3.6 psig, and the airplane will be certified to a maximum altitude of 31,000 feet MSL. Because the airplane cabin altitude will exceed 10,000 feet routinely in normal aircraft operation (i.e., any time the aircraft is at or above approximately 21,000 feet), Raytheon has chosen not to install a warning indication at the pilot station to indicate when a cabin pressure altitude of 10,000 feet is exceeded as is required by FAR §23.841(b)(6).

Applicable Regulations:

FAR §23.841 Pressurized cabins.

(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.

Applicant's Position: Note: Applicant's Position is copied verbatim from the Applicant's Equivalent Level of Safety Staff Study (Letter No.940-98-04-166).

Amendment 23-17 brought into Section 23.841 of Part 23 a warning indication when the cabin pressure altitude of 10,000 feet is exceeded. The preamble for this change indicated the proposal was adopted due to a large number of small airplanes having such a warning and many pilots came to rely on this warning.

The purpose of the cabin pressure altitude warning requirement is to indicate a warning at the pilot station when the cabin pressure altitude exceeds 10,000 feet mean sea level (MSL).

The reason for the rule change is to preclude a possible hazardous condition if a malfunction in the cabin pressurization system occurs at altitudes above 10,000 feet MSL. If there was no warning for cabin pressure altitude, the cabin pressure altitude could slowly increase undetected to the airplane altitude and the crew and passengers could become unconscious due to hypoxia. The effects of hypoxia are usually encountered when the flight crew is exposed to altitudes above 10,000 feet MSL during extended flights.

Based upon agreement with FAA on previous certification programs, it is appropriate to provide a warning note in the Aircraft Flight Manual Emergency Procedures Section as to the necessary action by the pilot regarding use of oxygen in case such a warning light should illuminate.

Normal operating procedures for the Model 3000 require the crew member and the passenger to don oxygen masks during preflight procedures and wear the masks at all times throughout the flight envelope. The cockpit pressure is limited to 3.6 psi differential, which means that the cockpit pressure altitude will exceed 10,000 feet routinely in normal aircraft operation (i.e., any time the aircraft is at or above approximately 21,000 feet). A CKPT ALT caution annunciation is provided to alert the pilot(s) if the cockpit altitude exceeds 19,000 feet, which is slightly above the cockpit pressure altitude at the 31,000 feet certification ceiling with a nominal 3.6 psi cockpit pressure differential. For flight at or below the certification altitude, this warning would indicate that a failure of the pressurization system has occurred. An aural warning tone from the audio system is provided when the CKPT ALT annunciation illuminates. The aural warning tone is cancelable by the pilot(s), but the visual annunciation remains illuminated until the cockpit altitude is reduced.

The purpose and intent of FAR 23.841(b)(6) regarding, the appropriate warning indication at the pilot station to indicate when the safe or preset pressure differential is exceeded, is met in the Model 3000. The part of the rule that is not literally met is the cabin pressure altitude warning at 10,000 feet.

Consider the required pilot action, should such a warning be provided and triggered. Based upon demonstration of regulatory compliance on past certification programs, RAC could either demonstrate that a safe emergency descent in a predetermined specified time to a safe altitude (i.e. 10,000 MSL) was possible or provide an oxygen system which would automatically present oxygen masks to passengers and crew for donning. Neither the safe emergency descent demonstration nor the automatically presented oxygen masks would of course be a legitimate option, since the crew member and the passenger are already on oxygen. It is obvious that no action is required. It is also obvious that it is not appropriate to provide a warning when no action is required other than possibly to cancel the warning. It is RAC's position that, depending on circumstances that may exist or be happening at a particular time, an additional hazard could be introduced merely by presenting the red light. Additionally, contributing to or creating a habit of canceling red lights that may come on in flight that require no action is a safety consideration in itself.

As additional information the oxygen regulator that will be part of the gaseous oxygen system of the Model 3000 is a TSO'd item that meets the requirements described in FAR §23.1443(b).

FAR §23.1443(b) states that "...the minimum mass flow of supplemental oxygen required for each flight crew member, may not be less than the flow required to maintain, during inspiration, a mean tracheal oxygen partial pressure of 122 mmHg up to and including a cabin pressure of 35,000 ft... when breathing 20 liters per minute BTPS."

It is RAC's conclusion that the Model 3000 cabin altitude warning system has been analyzed and found to be compliant to the requirements of FAR §23.841 except for the 10,000 feet annunciation. It has been further determined that an Equivalent Level of Safety to FAR §23.841(b)(6) exists.

FAA Position:

Requiring (by AFM procedure) that the pilot and crew/passenger don oxygen masks (and initiate oxygen flow) during preflight procedures and wear the masks at all times throughout the flight envelope is sufficient to satisfy the intent of FAR §23.841(b)(6).

Compensating Features:

The compensating features include:

- a) AFM procedures to require that the pilot and crew/passenger don oxygen masks (and initiate oxygen flow) during preflight procedures and wear the masks at all times throughout the flight envelope.
- b) A CKPT ALT caution annunciation is provided to alert the pilot(s) if the cockpit altitude exceeds 19,000 feet which would indicate a failure of the pressurization system at the 31,000 feet certification ceiling.

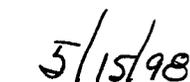
Conclusion:

We concur that the Raytheon Aircraft Company proposed AFM procedure, together with the proposed CKPT ALT caution annunciation provides an equivalent level of safety as envisioned in the regulations and thus meets the requirements of FAR §23.841(b)(6).

Approved by:

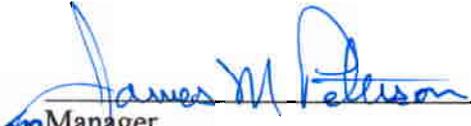


Program Manager--Raytheon Projects



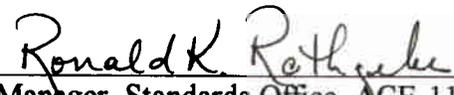
Date

Concurred by:



for Manager,
Wichita Aircraft Certification Office
ACE-115W

15 May 98
Date



Acting Manager, Standards Office ACE-110

5-20-98
Date



Manager,
Small Airplane Directorate,
Aircraft Certification Service, ACE-100

5/21/98
Date