



U.S. DEPARTMENT
OF TRANSPORTATION

Federal Aviation
Administration

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Memorandum

Aircraft Certification Office
c/o American Embassy
APO New York 09667-1011

Subject: ACTION: Equivalent Level of Safety of Grob
EGRETT, Spinning, Finding No. ACE-91-01

Date: June 25, 1991

From: Manager, Brussels Aircraft Certification
Office, AEU-100

Reply To
Attn. of: CM/vk/2168:91

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

Background:

Burkhart Grob Luft-und Raumfahrt GmbH & Co. KG, manufacturer of the EGRETT Model G520 airplane proposes to use a stick pusher system in lieu of demonstrating compliance with Part 23 of the Code of Federal Regulation, Section 23.221, "Spinning".

Applicable Regulations:

The applicable Federal Aviation Regulation (FAR) states:

"23.221 * * * * *.

(d) Airplanes "characteristically incapable of spinning". If it is desired to designate an airplane as "characteristically incapable of spinning", this characteristic must be shown with -

(1) A weight five percent more than the highest weight for which approval is requested;

(2) A center of gravity at least three percent aft of the rearmost position for which the approval is requested;

(3) An available elevator up-travel four degree in excess of that to which the elevator travel is to be limited for approval; and

(4) An available rudder travel seven degrees, in both directions, in excess of that to which the rudder travel is to be limited for approval."

Applicant's Position:

A rational analysis performed at the Grob company has shown that at the high altitude of 50,000 feet, the operating limits of the airplane will be exceeded during spin recovery.

The only way to comply with § 23.221 at all altitudes is to install a stick pusher system. This system is designed in such a way that all stall and consequently the entry into a spin is safely prevented at all attitudes and altitudes. Therefore compliance with FAR 23.221(d) will be shown. The system is specified in GROB specification "AOA Computer", report no. SSC-520/91/1 which was transmitted to FAA with letter RR/2066/300, dated 29 May 1991.

FAA's Position:

The Grob proposed stick shaker/pusher system features are:

1. Two Angle of Attack (AOA) computers will operate in a fail safe mode.
2. The AOA system will illuminate a warning light actuated by the failure monitor if a discrepancy occurs in any of the following:
 - a. AOA potentiometer
 - b. AOA heater
 - c. Flap position switch
 - d. Stick pusher
 - e. Power input
3. An un-commanded operation of the stick pusher will not occur as a result of a single failure in the AOA.
4. The reliability of the AOA system will be better than 10^{-7} .
5. The system will provide a signal to activate a stall warning light and horn.
6. The system will operate the stick shaker mode for 4 seconds prior to illuminating the warning light, activating the horn and the stick pusher mode.
7. A Press-To-Test feature will be incorporated in the AOA computers.
8. All warning indications will be powered from the airplane battery bus to ensure uninterrupted system operation.
9. The shaker/pusher system will meet the requirements of Radio Technical Commission for Aeronautics (RTCA) Document No. RTCA/DO-160C, "Environmental Conditions and Test Procedures for Airborne Equipment."

10. Normal and Emergency Operating procedures, and system description will be included in the G520 airplane Pilot Operating Handbook.

Compensation Features:

- 1) Two AOA computers will be provided working in fail safe mode.
- 2) The AOA system will provide a failure monitoring output to a warning light if discrepancies in the following circuits exist:
 - * AOA potentiometer
 - * AOA heater
 - * Flap position switch
 - * Stick pusher
 - * Power input
- 2) The AOA system is designed in such a way that a single failure would not result in an unwanted operation of the stick pusher.
- 4) The reliability of the complete AOA system is $> 10^{-7}$ (as per NPA 25B-154).
- 5) A stick shaker, a stall warning horn and a stall warning light (physical, audible and visual) will be activated simultaneously 5 to 10 kts. (according to FAR 23) prior to stall. at c_{AMAX} (stall is not fully developed) a signal from the stall warning vane will be filtered to provide stick pusher activation before any spin rotation can develop. At the same time the auto-pilot will be automatically switched off (Note: After activation of the stick pusher the pilot has to engage the auto-pilot manually). The system filter design will prevent unwanted pusher operation due to gusts. If required, the filter parameters will be provided to the LBA and FAA for review.
- 6) A press to test button is provided for both AOA computers. This device activates the stick shaker, the stall warning light and horn when the aircraft is on the ground or in the air and the stick pusher when on the ground only.
- 7) The G520 Pilot's Operating Handbook will give the pilot information about the system and what actions to perform in case of failure indication.
- 8) All warning indications are routed to the aircraft battery bus. This will ensure operation of the stick pusher system in the event of complete AC/DC loss.
- 9) The stick pusher system will meet the requirements of DO-160C (refer to report No. SSC-520/91/1).
- 10) The G520 high altitude airplane may only be flown by qualified and trained pilots. The training will include a detailed introduction to the stick pusher system.

Summary:

The stick shaker and the other stall warning means (stall warning light and horn) will alert the pilot in order to prevent a stall and the probability to entry into a spin. If these warnings are ignored by the pilot the stick pusher is activated by the AOA computer to prevent these unsafe conditions.

The press to test provision enable the pilot to check the function of the stick pusher system on ground (pre-flight test) and also during flight (in-flight test).

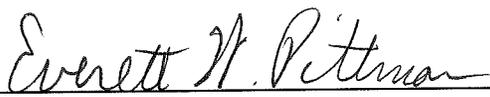
Failure monitoring is by means of a warning light.

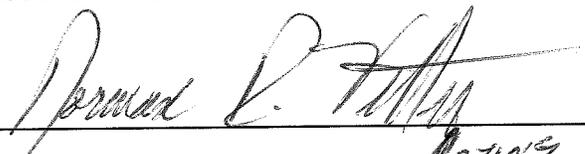
Taking into account the fail safe design of the AOA system and the reliability of 10^{-7} , one can honestly say that the stick pusher system can be considered to provide an equivalent level of safety as envisioned in the regulations and thus meets the requirements of paragraph 23.221(d).

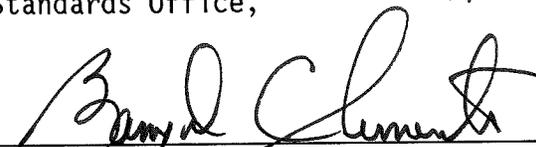
Recommendation:

We concur that the Grob stick pusher system will make the EGRETT airplane incapable of spinning by preventing an inadvertent stall. Therefore, incorporation of the proposed stick pusher system is considered as providing an equivalent level of safety as envisioned in the regulations and thus meets the requirements of paragraph 23.221(d) of the FAR.

Concurred by:

	<u>6/26/91</u>
Everett W. Pittman Brussels Aircraft Certification Office, AEU-100	Date

	<u>7/3/91</u>
Standards Office, <i>Active</i> Manager ACE-110	Date

	<u>7/3/91</u>
Barry D. Clements Aircraft Certification Service, Small Airplane Directorate	Date