U.S. Department of Transportation

Federal Aviation Administration

Memorandum

Subject: ACTION: Action: Review and Concurrence, Equivalent Level of Safety ; ACE-02-09

Date: June 21, 2002

From: Program Manager, ACE-117W

Reply to Attn. of: Tina L. Miller 316-946-4168

To: Manager, Small Airplane Directorate, ACE-100

ELOS#

Attn: Roger Chudy, Project Officer, ACE-110

Background

On August 12, 1994, the Luscombe Aircraft Corporation in Altus, Oklahoma, made application to the FAA to amend Type Certificate Data Sheet A-804 by adding the new Model 11E. The Model 11E airplane is a derivative of the Model 11A that was type certified in October 1948 in accordance with the applicable requirements of CAR 03. The major exterior changes made to the Model 11A type design include:

- Installation of the Continental IO-360-ES engine rated at 185 HP.
- "Conventional" Landing Gear changed to Tricycle Landing Gear.
- New Engine Cowling contour.
- New Windshield contour.

The G-1 Issue Paper dated August 14, 2001, established the certification basis for the Model 11E as CAR 3 dated December 15, 1946, as amended by 3-1 through 3-4 and numerous sections of FAR Part 23 effective February 1, 1965. This certification basis includes the one-turn spin requirements of CAR 03.1350-N or a demonstration that the airplane is characteristically incapable of spinning per the requirements of CAR 03.1350-NU. All spin entries required by the normal category spin test matrix contained in AC 23-15 were attempted in accordance with the FAA-Approved Luscombe Spin Flight Test Plan (Report No. 11E-FTP06, Rev. B). In no case could a full one-turn spin be produced. During all power-off entries, the aircraft response was typically sluggish and did not result in a spin entry, but instead, the test airplane remained fully controllable about the lateral and directional axes using normal control inputs. The most energetic response noted while attempting to spin the test airplane was during power-on entries to the left. Under these conditions, the airplane exhibited an abrupt roll-off to a nose-down attitude for approximately one-quarter turn, at which point the airplane began a steep spiral with airspeed accelerating. Recovery from diving flight was complete by one-half turn using normal control inputs. Stall speed and characteristics testing demonstrated that the Model 11E is up-elevator limited, and a pronounced aerodynamic stall "break" does not occur.

Due to the structural design of the airplane, it is not possible to perform all of the "characteristically incapable of spinning" test requirements specified in CAR 03.1350-NU. Of the four criteria specified, only sub-paragraphs (a) and (b) can be demonstrated with the Model

11E. These requirements are: (a) a demonstration at a maximum weight 5% in excess of the maximum to be approved, and (b) a demonstration at 3% aft of the rearmost center of gravity to be approved. The demonstrations specified in sub-paragraphs (c) and (d) cannot be accomplished without introducing major structural changes to the type design in the areas of the elevator and rudder. It is not possible to increase up-elevator travel by the 4° required by sub-paragraph (c) and rudder travel by the 7° required by sub-paragraph (d). Both elevator and rudder control surface travel is limited by contact with major airframe structural components and not by adjustable stops.

The FAA revised FAR 23.221 at Amendment 23-42, effective February 4, 1991. This revision replaced the previous "characteristically incapable of spinning" criteria with a new spin resistance criteria. Advisory Circular 23-15, dated January 2, 1997, provides additional guidance on the application of spin resistance criteria. An editorial change to 23.221 was made at Amendment 23-50, effective February 9, 1996, but this did not change the requirements in a substantive way.

Applicable Regulations

CAR 03.135-N, 03.1350-NU
FAR 23.221(a)(2)

Regulations Requiring an ELOS

CAR 03.1350-NU

Description of compensating features which allow the granting of the ELOS (including design changes, limitations or equipment need for equivalency) and explanation of how features provide an equivalent level of safety to the level of safety intended by the regulation

The FAA has evaluated the test results achieved by the DER pilot, and concurs that the characteristics of the Luscombe Model 11E prevent demonstration of one-turn spins as specified in CAR 03.1350-U. In spite of aggressive attempts to develop a spin, accomplishment of all spins attempted in accordance with the FAA-Approved Luscombe Spin Flight Test Plan (Report No. 11E-FTP06, Rev. B; reference the spin matrix contained in AC 23-15), in no case could a full one-turn spin be produced. The most dynamic response was obtained following an aggressive accelerated power-on entry to the left. In this case, the airplane exhibited an abrupt roll-off to a nose-down attitude for approximately one-quarter turn, and then entered a steep spiral with airspeed accelerating. Recovery from diving flight was complete by one-half turn using normal control inputs. Stall speeds and characteristics testing further demonstrated that the Model 11E is up-elevator limited, and a pronounced aerodynamic stall "break" does not occur.

It is impractical to demonstrate the "characteristically incapable of spinning" test requirements specified in CAR 03.1350-NU due to the structural design of the Luscombe Model 11E airplane. Both elevator and rudder control surface travel is limited by contact with major airframe structural components and not by adjustable stops. Major structural design changes in the areas of the elevator and rudder would be required to permit an increase of 4° in up-elevator and of ±7° in rudder travel. Of the four criteria specified in CAR 03.1350-NU, only sub-paragraphs (a) and (b) can be demonstrated with the Model 11E. These requirements are: (a) a demonstration at a maximum weight 5% in excess of the maximum to be approved, and (b) a demonstration at 3% aft of the rearmost center of gravity to be approved. The demonstrations specified in sub-paragraphs (c) and (d) cannot practically be accomplished.

The FAA revised FAR 23.221 at Amendment 23-42, effective February 4, 1991. This revision replaced the previous "characteristically incapable of spinning" criteria with a new spin resistance criteria. Advisory Circular 23-15, dated January 2, 1997, provides additional guidance on the application of spin resistance criteria. An editorial change to 23.221 was made at Amendment 23-50, effective February 9, 1996, but this did not change the requirements in a substantive way.

The FAA changed FAR 23.221 in 1991 to recognize new design techniques that provide significant improvements in spin resistance in normal category airplanes. At the time of this change, the criteria for demonstrating an airplane is characteristically incapable of spinning were removed from the regulations. This change provides an alternative for the manufacturer to demonstrate that the design of an airplane makes it resistant to the development of a spin. Specific criteria are contained in the regulation and associated guidance material (AC 23-15) to accomplish such a demonstration. The FAA believes that satisfactory demonstration of spin-resistant characteristics provides a level of safety equivalent to that required by CAR 03.1350-NU, and further is consistent with the most recent requirements of FAR Part 23.

Applicant's Position

The Luscombe Aircraft Model 11E meets the level of safety intended by the spin airworthiness standards of the Certification Basis established by the G-1 Issue Paper of August 14, 2001. In spite of exhaustive attempts, it has not been possible to cause the airplane to enter a spin condition. Luscombe proposes a finding by the FAA that a demonstration of spin resistance, as specified in the current requirements of FAR 23.221, provides an equivalent level of safety to the requirements contained in CAR 03.1350-NU. Luscombe has revised Luscombe Report 11E-FTP06 (Luscombe Spin Flight Test Plan) to include the additional flight testing required to demonstrate compliance with the spin resistance requirements that were added to Part 23 of the Federal Aviation Regulations in Amendment 23-42, effective 2/4/91. A successful flight test demonstration of these controllability, abused controls and stalls from unbalanced flight requirements will provide the basis for the FAA to reach an equivalent level of safety finding.

FAA approval and documentation of the ELOS

The FAA agrees that a satisfactory flight test demonstration of spin resistance in accordance with the criteria specified in FAR 23.221(a)(2), Amendment 23-50, provides a level of safety equivalent to that specified in CAR 03.1350-NU.

original signed by
Tina L. Miller
FAA Program Manager
Wichita Aircraft Certification Office

Concur

Signature: _____
Manager, SAD Standard Staff, ACE-110

Date: 7/22/02

Concur

Signature: _____
Manager, Small Airplane Directorate, ACE-100

Date: 7/23/02