Federal Aviation Administration

Memorandum

Date: AUG 0 8 2006

From: Manager, Atlanta Aircraft Certification Office

To: Manager, Small Airplane Directorate, ACE-100

Prepared by: Robert Bosak, ACE-118A

Subject: Equivalent Level of Safety to § 23.779(b)(1); MT Propeller, MTV-9 on LAKE Model 250, Finding No. ACE-05-33

This memorandum requests your office to review and provide concurrence with the proposed finding of equivalent level of safety (ELOS) to the "Motion and effect of cockpit controls" requirements of 14 CFR, part 23, § 23.779(b)(1).

BACKGROUND:

The LAKE Model 250 airplane is a 3151 pound single-engine, 4 or 6 place, airplane powered by a 250 hp Lycoming IO-540-C4B5 with or without a turbocharged engine. MT Propeller Entwicklung GmbH, located in Germany applied for Validation of a European Aviation Safety Agency (EASA), Supplemental Type Certificate (STC) to allow installation of their MTV-9 reversible propeller.

MT Propeller has requested an Equivalent Level of Safety (ELOS) for their reversible propeller installation. The reversing system is activated by a switch located next to the engine power lever. The switch controls the reversing of the propeller, and propeller reverse thrust is controlled by movement of the throttle lever forward instead of aft.

14 CFR, part 23, § 23.779(b)(1) requires that single or multiengine, normal, utility, acrobatic, or commuter category airplanes demonstrate compliance with power (thrust) lever and propeller control motions to control forward and rearward propeller thrust. The reaction of the aircraft should correspond to the direction of the throttle input, thereby preventing pilot confusion or mishandling. This is especially true with the high pilot workload during the landing roll.

APPLICABLE REGULATIONS:

The following regulations were considered in this ELOS request:

1. 14 CFR §§ 23.153, Control during landings and 23.231(a), Longitudinal stability and control.

2. 14 CFR § 23.779(b)(1), Powerplant and auxiliary controls: Power (thrust) lever states: "Motion and effect - Forward to increase forward thrust and rearward to increase rearward thrust."

3. 14 CFR § 23.933(b) Reversing Systems:
   (b) For propeller reversing systems.
   (1) Each system must be designed so that no single failure, likely combination of failures, or malfunction of the system will result in unwanted reverse thrust under any operating condition. Failure of structural elements need not be considered if the probability of this type of failure is extremely remote.
   (2) Compliance with paragraph (b)(1) of this section must be shown by failure analysis, or testing, or both, for propeller systems that allow the propeller blades to move from the flight low-pitch position to a position that is substantially less than the normal flight, low-pitch position. The analysis may include, or be supported by the analysis made to show compliance with Section 35.21 for the type certification of the propeller and associated installation components. Credit will be given for pertinent analysis and testing completed by the engine and propeller manufacturers.

4. 14 CFR § 23.1309. Equipment, systems, and installations. A Failure Modes and Effects Analysis (FMEA) and Fault Tree Analysis (FTA).

5. 14 CFR § 23.1322, (Amendment 17) requires the crew be notified of rearward propeller thrust actuation. In addition, any warning system must satisfy 14 CFR § 23.1367.

6. 14 CFR § 23.1581(a), § 23.1583 and 14 CFR § 23.1585. Adequate information and operating procedures will be required in the Airplane Flight Manual (AFM) Supplement.

COMPENSATING FEATURES:

The propeller reversing control is a guarded two position switch, which is located next to the engine power lever. With the switch in the downward (secured) position, the reversing system is switched off, and with the switch in the upward (unlocked) position, the reversing system is activated. When the reverse switch is in the upward position and the reverse system is actuated, the reverse thrust can be adjusted with forward movement of the power lever. In this condition an amber indication light is on and shows that the reverse mode is active.

The Applicant's safety analysis conclusions were as follows:

"Due to the clear switch position (secured or unlocked) and the indication light, the Pilot is fully aware of the active operation mode and operating errors due to unknown operation modes are extremely unlikely. Unintended activation of the reverse system in flight and outside the allowable operation conditions is prevented by a switch guard which has to be opened intentionally, an air pressure switch in the airspeed indication system and a centrifugal latch inside the propeller. Compared with the traditional reversing systems which do not incorporate any comparable safety devices an increased or at least equivalent level of safety is demonstrated. The system will not be used to decrease the landing distance and is therefore not comparable to a conventional reverse system. The purpose of the reverse system in this case is mainly to get an improved maneuvering capability of the aircraft on ground or water. The operation is limited to 20Kts. At this low speed, an operating error by the pilot will be recognized and can be corrected by the pilot immediately. A hazardous situation is therefore extremely unlikely. This speed limitation represents an equivalent safety feature for the wrong input by the pilot. It will make no difference for the pilot and airplane if the reverse thrust is increased below 20 kts on the water."

RECOMMENDATION:

We concur that MT Propeller's use of a guarded switch, air pressure switch, and centrifugal latches in the propeller in lieu of the traditional power lever motion provides an equivalent level of safety to the regulatory requirements of § 23.779(b)(1) Motion and effect of cockpit controls.

Concurred by:

Christina L. Marsh *7/10/06*

Manager, Aircraft Certification Office, ACE-115A Date

John Colomy 8/9/06

Manager, Standards Office, ACE-110 Date

ACTING John Colomy 8/9/06

Manager, Small Airplane Directorate, ACE-100 Date