



U.S. Department
of Transportation

**Federal Aviation
Administration**

Memorandum

Subject: ACTION: Review and Concurrence, Equivalent Level of
Safety; ACE-02-06

Date: February 14, 2002

From: Manager, Denver Aircraft
Certification Office, ANM-100D

Reply to: Elizabeth Bumann
Attn. of: (303) 342-1083

To: Manager, Small Airplane Directorate, ACE-100

The Denver Aircraft Certification Office is currently processing an application for a Type Certificate for the Liberty Aerospace Model XL-2 airplane. The purpose of this memorandum is to request your office to review and provide concurrence to an equivalent level of safety finding for installation of a single power lever control in lieu of the traditional power lever (thrust), propeller (rpm control), and mixture controls, §§ 23.777(d) and 23.781(b).

Background:

The Liberty Model XL-2 is a 2-place, low wing, single-engined airplane with a 2-bladed fixed pitch propeller. The airplane will have a maximum gross weight of 1575 lbs (714 kg), stall speed of 44 kts, and a projected cruise speed of 119 kts. The airplane will be powered by a Teledyne Continental Motors (TCM) IOF-240-B engine rated at 125 hp (2800 rpm) at maximum continuous power. The engine has been FAA type certificated with a Full Authority Digital Electronic Control (FADEC) system to automatically control the ignition and fuel injection functions throughout the operational envelope.

The FADEC system schedules the amount of fuel for the multi-port fuel injectors and compensates for changes in altitude by monitoring the intake manifold pressure, thereby eliminating the need for a mixture control in the cockpit. The FADEC controls the fuel injector by commanding a solenoid controlled injector valve ON or OFF. Injection duration for normal operations is calculated from a schedule and compensates mixture in accordance with a map. The map is the baseline mixture for the cylinder at any normal engine condition. The FADEC compensates this mixture in response to variations in intake manifold pressure, intake air temperature, fuel pressure, cylinder head temperature, exhaust gas temperature, system voltage, engine rpm, and throttle setting.

Applicable Regulations:

In accordance with § 23.777(d), the location order from left to right of the cockpit controls must be power lever (thrust), propeller (rpm control), and mixture control. Furthermore, the powerplant control knobs must conform to the general shapes as defined in § 23.781(b).

Compensating Features:

The compensating features include:

- a) the FADEC engine will automatically control the fuel mixture based on engine speed and crankshaft position;

- b) and the propeller is a fixed pitch design, therefore requires no governor or propeller control knob; and
- c) a single power lever control will reduce pilot workload due to the removal of the mixture control.

Applicant's Position:

Liberty Aerospace plans to provide a single T-shaped power lever installed in the center console between the two cockpit seats. The control will increase engine power when moved forward and decrease engine power when moved rearward. The power control lever knobs (handle) will be black in color and shaped as required by § 23.781(b).

The control lever will not incorporate any engine shutoff features. The engine will be shutdown by turning the boost pump OFF, engine ignition system OFF, and FADEC power OFF. The cockpit lever shall be connected to the engine's throttle by a flexible push-pull control cable. The attaching hardware on both ends of the cable shall use lubricated ball and socket end fittings and bolts/nuts with double locking features. The proposed design is intended to minimize the hazard of an inadvertent disconnect of the cable system.

Recommendation:

We concur that the single power control lever provides an equivalent level of safety as envisioned in the regulations and therefore meet the requirements of §§ 23.777(d) and 23.781(b).

Ronald F. May

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Concurred by:

[Signature]

Manager, Standards Staff, ACE-110

4-18-02

Date

[Signature]

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

4/29/02

Date