



Memorandum

U.S. Department
of Transportation

**Federal Aviation
Administration**

Subject: **ACTION:** Equivalent Level of Safety to
§ 23.145(b)(2); Aero Vodochody Ae 270, Finding No.
ACE-05-14

Date: **OCT 14 2005**

From: Manager, Project Support Office, ACE-112

Reply to
Attn. of: **Lowell Foster**
(816) 329-4125

To: Acting Manager, Small Airplane Directorate,
ACE-100

This memorandum requests your office to review and provide concurrence with the proposed finding of Equivalent Level of Safety (ELOS) to the Longitudinal Control requirements of § 23.145(b)(2) of 14 CFR, Part 23.

BACKGROUND

The Aero Vodochody Ae 270 is an 8,377-pound single-engine, 10 place, airplane powered by an 850 shaft horsepower (SHP) Pratt & Whitney PT6-66A turboprop engine. Aero Vodochody was not able to meet literal compliance with 14 CFR Part 23, § 23.145(b)(2), during the flight-testing of the Ae 270 airplane. Consequently, they have developed a proposed equivalent Method of Compliance (MOC) to this regulation that will offer the same level of safety as provided by the rule. Aero Vodochody submitted the procedure to the CAA as a proposed Equivalent Level of Safety to this regulation and requested the Federal Aviation Administration (FAA) to give them credit for the system by accepting it as a safety equivalent to § 23.145(b)(2), Longitudinal Control.

APPLICABLE REGULATIONS

Section 23.145(b)(2) requires that it must "...be possible to carry out the following maneuvers without requiring the application of single-handed control forces exceeding those specified in Section 23.143(c). The trimming controls must not be adjusted during the maneuvers." Additionally, Section 23.145(b)(2) describes the flight conditions where the airplane must meet the requirements of (b). Those flight conditions are, "With landing gear and flaps extended, power off, and the airplane as nearly as possible in trim at $1.3V_{SO}$, quickly apply takeoff power and retract the flaps as rapidly as possible to the recommended go around setting and allow the airspeed to transition from $1.3 V_{SO}$ to $1.3V_{S1}$. Retract the gear when a positive rate of climb is established."

REGULATIONS REQUIRING AN ELOS

In considering the current design, the applicant has requested an ELOS for one specific condition of the *Longitudinal Control* Section of 14 CFR, Part 23. The FAA has determined that an appropriate level of safety can be provided by the issuance of an ELOS, in accordance with the provisions of 14 CFR, Part 21, § 21.21(b)(1).

DESCRIPTION OF COMPENSATING FEATURES

Discussion

During the Ae 270 prototype certification flight tests, it was found that the literal execution of the maneuver according to § 23.145(b)(2), can be safely performed, however, the single-handed control force limit of 50 lbs. required by the Federal Aviation Regulation (FAR) 23 regulation, § 23.143, is exceeded by approximately 17 lbs. Section 23.145(b)(2) is a bailed landing, go-around maneuver. The longitudinal trim control is located immediately to the left of the engine power lever. It has a large radius and a single forward or aft hand motion to rotate the wheels result in a large trim change. When conducting a bailed landing go-around in Normal operation, the pilot can easily and quickly re-trim to reduce the nose up pitch force, by using a single forward movement of the trim wheel. This action is common knowledge to the pilot and is a normal action when conducting any bailed landing go-around maneuver. Since re-trimming is a normal pilot action in this maneuver and since re-trimming the Ae 270 can be so easily and quickly accomplished, lowering the pitch force to well within the required limit, this re-trimming action should provide an equivalent level of safety to the intention of this rule.

Specific compensating features proposed by Aero Vodochody are:

Aero Vodochody is proposing the following Approved Flight Manual (AFM) procedure to re-trim the airplane, lowering the pitch control forces to well within the limit required by the § 23.143.

The procedure for a bailed landing, go-around maneuver is specified as a "CAUTION" in the AFM. Aero Vodochody assumes that the "CAUTION" is more appropriate, since this amplifies the importance of the maneuver execution according to the proposed procedure and this way the pilot is notified in a higher degree about the aggravated situation in case of non-compliance with this procedure.

The proposed wording addressing the maneuver execution in the part "Amplified Procedures" is as follows:

CAUTION

PERFORMING OF A BALKED LANDING, GO-AROUND WHILE MAINTAINING PROPER AIRSPEED WILL RESULT IN A HIGH NOSE-UP PITCH FORCE REQUIRING A STRONG PUSH ON THE CONTROL WHEEL. TO MINIMIZE THIS PUSH FORCE, THUS ALLOWING A SINGLE-HANDED CONTROL OF THE AIRPLANE, APPLY A SINGLE

*NOSE DOWN ROTATION OF THE TRIM WHEEL IMMEDIATELY
AFTER MOVING THE POWER CONTROL LEVER TO THE MAX.
POWER SETTING POSITION.*

The proposed procedure in the “Checklist” part contains the following sequence of items:

BALKED LANDING

- | | |
|---|-----------------------|
| 1. Power Control Lever | TAKE-OFF POWER |
| 2. Pitch Trim | TRIM NOSE DOWN |
| 3. Propeller Control Lever | Check MAX. RPM |
| After reaching the engine takeoff power: | |
| 4. Climb at airspeed 75 to 85 KIAS | INITIATE |
| 5. Landing Gear
(after positive climb is reached) | UP |
| 6. M_K , ITT, n_g , n_p , oil pressure/temperature
(for maximum values refer to Fig. See Fig. 2-4) | CHECK |
| 7. Airplane | TRIM |

CLIMB FOLLOWING BALKED LANDING

- | | |
|--|---------------|
| 1. Climb Speed | 85 to 90 KIAS |
| 2. Wing Flaps at airspeed 85 KIAS minimum | 20° |
| 3. Climb Speed | 100 KIAS |
| 4. Wing Flaps at airspeed 100 KIAS minimum | 0° |

The maneuver executed per the procedure, provides the same safety level as originally intended in § 23.145(b)(2) for single-handed force limits.

FAA POSITION

The language of the rule requires that the “trimming controls must not be adjusted during the maneuvers.” Moreover, based on the preamble from the rule change document, the original intent of the temporary control forces was to allow time for the pilot to trim the forces, so they are manageable with one hand. Limiting the movement of the trim controls in Amendment 23-14, for the maneuver in FAR 23.145(b)(2), was based on the “Study of Control Force Limits for Female Pilots.” The focus was on defining a minimum force, where female pilots could maintain control of the airplane over a sufficient time to trim out the high control forces. The study also points out the time duration that female pilots could hold the temporary forces. These durations were on the order of 30 to 40 seconds for a 50-pound one-hand force.

