U.S. Department
of Transportation

Federal Aviation Administration

Memorandum

Subject: **ACTION**: Request for Review and Concurrence with an Equivalent Level of Safety (ELOS) ACE-04-01 to 14 CFR part 23, §23.777(d) Cockpit controls and §23.779(b) Motion and effect of cockpit controls for the Thielert Supplemental Type Certificate to Install Thielert TAE-125-01 Diesel Engines in Certain Cessna 172 Series Airplanes.

Date: JUL 2 2 2004

From: Cessna Program Manager, ACE-117W

Reply to Attn. of: Todd Dixon (816) 329-4146

To: Manager, Small Airplane Directorate, ACE-100

This memorandum documents concurrence for the subject finding of Equivalent Level of Safety (ELOS). We request your office to review and concur with the proposed ELOS finding to 14 CFR part 23, §23.777(d) Cockpit controls and §23.779(b) Motion and effect of cockpit controls. The proposed ELOS will allow for the utilization of one thrust level in place of conventional throttle (power), condition and mixture controls as the Thielert TAE-125-01 diesel engines utilizes a full authority digital engine control to schedule the thrust command to the engine.

Background: The airplanes that the Supplemental Type Certificate (STC) will apply to are the Cessna 172K, L, M, N, P, R and S. These are conventional airplanes currently powered by gasoline engines and conventional controls. The Thielert engine installation will eliminate the current controls and install one control for power. The applicant has requested, by submission of type design data and materials through the Luftfahrt-Bundesamt (LBA) of Germany an ELOS for the provisions of 14 CFR part 23, §23.777(d) Cockpit controls, and §23.779(b) at Amendment 51

Applicable Regulations: The applicable regulations are 14 CFR part 23, §23.777(d) and §23.779(b), which state:

§ 23.777 Cockpit controls

(d) The control location order from left to right must be power (thrust) lever, propeller (rpm control), and mixture control (condition lever and fuel cutoff for turbine-powered airplanes). Power (thrust) levers must be at

least one inch higher or longer to make them more prominent than propeller (rpm control) or mixture controls. Carburetor heat or alternate air control must be to the left of the throttle or at least eight inches from the mixture control when located other than on a pedestal. Carburetor heat or alternate air control, when located on a pedestal must be aft or below the power (thrust) lever. Supercharger controls must be located below or aft of the propeller controls. Airplanes with tandem seating or single-place airplanes may utilize control locations on the left side of the cabin compartment; however, location order from left to right must be power (thrust) lever, propeller (rpm control) and mixture control.

§ 23.779 Motion and effect of cockpit controls.
Cockpit controls must be designed so that they operate in accordance with the following movement and actuation:
....

(b) Powerplant and auxiliary controls:

Motion and effect

(1) Powerplant controls:

Power (thrust) lever.....	*Forward to increase forward Thrust and rearward to Increased rearward thrust.*
Propellers.....	*Forward to increase rpm.*
Mixture.....	*Forward or upward for rich.*
Fuel.....	*Forward for open. Carburetor, air heat or Alternate. Forward or upward for cold air.*
Supercharger.....	*Forward or upward for low blower.*
Turbosuperchargers.....	*Forward, upward, or clockwise to increase pressure.*
Rotary controls.....	*Clockwise from off to full on.*

(2) Auxiliary controls:

Fuel tank selector.....	*Right for right tanks, left for left tanks.*
Landing gear.....	*Down to extend.*
Speed brakes.....	*Aft to extend.*

Compensating Features: The engine Full Authority Digital Engine Control (FADEC) will automatically control the thrust from the engine-propeller combination, and if so, alleviates the need for the propeller control. Additionally, the diesel engine, by its nature, does not require a control for enrichment, so the enrichment control is unnecessary. The use of the single power control, with the same shape and movement as the previous conventional gasoline throttle, and the deletion of the propeller and enrichment control, is consistent with other single

power lever approvals and provides a consistent and equivalent level of safety to the previous control scheme utilized on the airplanes models affected.

Recommendation: We concur that Thielert's substitution of one power level in place of the traditional levers of power, propeller control and mixture provides an equivalent level of safety to the regulatory requirements of §23.777(d) Cockpit controls, and §23.779(b) Motion and effect of cockpit controls.

Concurred by:

Manager, Project Support Branch, ACE-112 — Date 7/21/04

for Manager, Standards Office, ACE-110 — Date 7/21/04

Manager, Small Airplane Directorate, ACE-100 — Date 7/22/04