



# Federal Aviation Administration

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## Memorandum

Date: November 20, 2009

To: Manager, Small Airplane Directorate, ACE-100

From: Manager, Project Support Office, ACE-112

Prepared by: Peter Rouse, Regulations and Policy Office, ACE-111

Subject: Extension of Equivalent Level of Safety (ELOS) to 14 CFR part 23, § 23.777(d) Cockpit Controls, and § 23.779(b) Motion and Effect of Cockpit Controls for the Diamond Aircraft Industries Model DA-42NG.

ELOS Memo#: ACE-05-06A

Regulatory Ref: 14 CFR, part 23, § 23.777(d)

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Diamond Aircraft Industries (DAI) requests extension of an existing ELOS, ACE-05-06, for cockpit controls, and motion and effect of cockpit controls to the model DA-42NG airplane.

### **Background:**

The DA-42NG is a derivative model airplane to be included on type certificate A57CE, along with the prior certificated model DA-42. The Model DA-42NG incorporates one thrust level in place of conventional throttle (power), condition and mixture controls since the Austro AE300 diesel engines uses a full authority digital engine control to schedule the thrust command to the engine. The major change with respect to this amended type design replaces the Thielert Model TAE 125-01 diesel engines with the Austro Model AE300 diesel engines; however, the cockpit control design is fundamentally identical for the requested ELOS extension to that of the original ELOS.

The following information provides the background information and justification for the original approval of ELOS ACE-05-06 to the Model DA-42:

The Diamond Aircraft Industries (DAI) DA-42 aircraft is a new fully composite, four place, twin-engine airplane with retractable gear, cantilever low wing and T-tail. The airplane was certified by EASA on type certificate number A005, dated May 13, 2004. The airplane is powered by two Thielert Aircraft Engines GmbH (Thielert) TAE 125-01,

aircraft diesel engines (ADE), type certificated in the United States, type certificate number E00069EN. The Thielert engine installation uses one control for power. Under the Bilateral Airworthiness Agreement (BAA) between the USA and the Austrian Exporting Civil Aviation Authority (ECAA), the Austro Control GmbH (ACG), an application for U.S. Type Certification of Diamond Aircraft Industries (DAI) Model DA-42 was made on August 2, 2004, by the DAI through the European Aviation Safety Agency (EASA). DAI has requested, through EASA, an ELOS for the provisions of 14 CFR part 23, § 23.777(d) Cockpit controls, and § 23.779(b) at Amendment 51.

### **Applicable Regulation:**

Section 23.777, Cockpit controls, and § 23.779, Motion and effect of cockpit controls, require the following:

#### *§ 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 cut-off 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.*

##### *b) Powerplant and auxiliary controls:*

| <i>(1) Powerplant Controls</i>               | <u>Motion and effect</u>  |
|--|---|
| <i>Power (thrust lever)</i>                  | <i>Forward to increase forward thrust and rearward to increase rearward thrust.</i> |
| <i>Propellers</i>                            | <i>Forward to increase rpm.</i>   |
| <i>Mixture</i>                               | <i>Forward or upward for rich.</i>  |
| <i>[Fuel</i>                                 | <i>Forward for open.]</i>   |
| <i>Carburetor, air heat or alternate air</i> | <i>Forward or upward for cold.</i>  |
| <i>Supercharger</i>                          | <i>Forward or upward for low blower.</i>  |
| <i>Turbo-superchargers</i>                   | <i>Forward, upward, or clockwise to</i>   |

|                               |  |
|-------------------------------|--|
|                               | <i>increase pressure.</i>                          |
|                               |  |
| <i>Rotary controls</i>        | <i>Clockwise from off to full on.</i>              |
| <i>(2) Auxiliary Controls</i> |  |
| <i>Fuel tank selector</i>     | <i>Right for right tanks, left for left tanks.</i> |
| <i>Landing gear</i>           | <i>Down to extend.</i>                             |
| <i>Speed brakes</i>           | <i>Aft to extend.</i>                              |

**Regulations Requiring an ELOS Finding:**

14 CFR, part 23, §§ 23.777(d), 23.779(b)

**Description of Compensating Design Features:**

The engine Full Authority Digital Engine Control (FADEC) will automatically control the thrust from the engine-propeller combination, and, if so, alleviate the need for the propeller control. Additionally, the diesel engine, by its nature, does not require a control for the fuel mixture, so the fuel mixture control is unnecessary. The use of the single power control is consistent with other single power lever approvals. It provides a consistent and equivalent level of safety to the previous control scheme used on similar airplane models.

Based on the functional identity of the respective design, we concur with the requested extension of this ELOS for the Austro AE300 engine installation's use of one power lever 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.

**FAA Approval:**

The Small Airplane Directorate concurs with the extension of ELOS ACE-05-06 for the DAI Model DA-42 to the Model DA-42NG. The DAI Model DA-42NG is granted ELOS number ACE-05-06A.

*Margaret Kline for*

Manager, Small Airplane Directorate  
Aircraft Certification Service

*11-20-09*

Date

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| ELOS Originated by:<br>Small Airplane | Project Support Branch Manager:<br>William J. Timberlake | Symbol:<br>ACE-112 |
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