Exemption No. 5785

UNITED STATES OF AMERICA
DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
RENTON, WASHINGTON 98055-4056

In the matter of the petition of

Dornier Luftfahrt GmbH **Regulatory Docket No. 27499**

for an exemption from § 25.161(d)
of the Federal Aviation Regulations

GRANT OF EXEMPTION

By letter LREZ-1481/93 dated October 26, 1993, Charles Krause, Airworthiness Engineer, Dornier Luftfahrt GmbH, D-7990 Friedrichshafen 1, Federal Republic of Germany, petitioned for an exemption from the engine-out lateral/directional trim requirements of § 25.161(d) of the Federal Aviation Regulations (FAR).

Section of the FAR affected:

Section 25.161(d) requires that the airplane maintain longitudinal, directional, and lateral trim (and for lateral trim, the angle of bank may not exceed five degrees) at 1.4 V_{S1} during climbing flight with (1) the critical engine inoperative; (2) the remaining engines at maximum continuous power; and (3) the landing gear and flaps retracted.

V_{S1} is defined in Part 1 of the FAR as the minimum stalling speed or the minimum steady flight speed in a specific configuration.

The petitioner's supportive information is as follows:

> Dornier Luftfahrt's application for a type certificate for the Model 328 airplane was filed on October 1, 1987. Included in the certification basis of this airplane is § 25.161(d), as amended by Amendment 25-38.

Flight tests of the Dornier 328 have shown that one-engine-inoperative flight at low airspeeds has a rolling moment more significant than expected due to the influence of propeller airflow. The present aileron trim system design fulfills the lateral trim requirements of § 25.161(d) at heavy and medium gross weights, but not at light gross weights. However, there is no operational requirement for climb speeds as low as 1.4 V_{S1} at light gross weights, since the airplane's climb performance is based on a speed of 135 knots indicated airspeed (KIAS) for all weights in the enroute configuration. Climb at 1.4 V_{S1}, as specified in § 25.161(d), would be at a speed of approximately 130 KIAS.

Dornier believes that the Model 328 has satisfactory trim capability at its operational speed at light gross weights and meets the requirement at medium and high gross weights, and that this degree of trim authority offers an acceptable level of safety.

Dornier Luftfahrt believes that an exemption:

1. Would be in the public interest because it would allow the scheduled delivery and operation of Dornier Model 328 airplanes in the contracted configuration, without the adverse financial effects that would otherwise be felt by both the manufacturer and the prospective operators by a redesign to increase the lateral trim capabilities or delayed certification; and

2. Would not result in any reduction in the level of safety from that existing in the world fleet of airplanes whose certification basis includes the lateral trim requirement for twin-engine airplanes.

Dornier Luftfahrt acknowledges that its petition was not submitted in accordance with the 120-day requirements of § 11.25(b)(1), but indicates that it submitted the request when it did because the FAA discovered late in the certification program that the airplane was not in compliance with the literal requirements of the rule. Dornier Luftfahrt consequently requests that the publication and comment requirements of § 11.27(c) be waived in order that delivery commitments not be adversely impacted, and because of its assertion that an acceptable level of safety appropriate to this twin-engine airplane will be provided.

The FAA finds, for good cause, that action on this petition should not be delayed by publication and comment procedures because a delay in acting on the petition would be disruptive to the flying public and create a major economic burden on the manufacturer and operators.

The FAA's analysis/summary is as follows:

The FAA has carefully considered the information provided by the petitioner and has determined that there is sufficient merit to warrant granting this petition for an exemption to § 25.161(d) for lateral trim.

Section 25.161(d) of the FAR requires that sufficient trim be available to maintain hands-off flight at $1.4V_{S1}$, with the critical engine inoperative and the remaining engines at maximum continuous power.

This requirement originally was contained in CAR 04, which was the airworthiness standard in effect in the early 1940's. The overriding consideration in the original rule was that the ability to provide adequate trim should be required "for any flight condition which it is reasonable to assume will be maintained steadily for any appreciable time." The "best rate of climb speed" was the speed originally referenced in the rule. The best rate of climb speed was chosen because that was the speed most likely to be flown in a steady-state climb. This best rate of climb speed was later interpreted to be $1.4V_{S1}$ as a convenience in testing, in accordance with advisory material available at that time.

For a given trim tab deflection, the rolling moment due to trim decreases with decreasing airspeed. The rolling moment due to asymmetric propeller slipstream stays the same (or increases slightly) as airspeed decreases. Since the stall speed decreases as gross weight decreases, the required minimum trim speed ($1.4V_{S1}$) also decreases with decreasing gross weight, and eventually a lower speed will be reached at which trim cannot be maintained. For the Dornier 328, the speed at which the roll trim becomes inadequate to maintain hands-off roll trim is 130 KIAS, which corresponds to a gross weight approximately halfway between minimum and maximum gross weight.

However, the Dornier 328 Airplane Flight Manual (AFM) scheduled engine-out (enroute) climb speed is a constant 135 KIAS for all gross weights, and it is possible to achieve hands-off lateral and directional trim at that speed. For airplanes with four or more engines, § 25.161(e) requires only that sufficient trim be available to maintain hands-off flight at the scheduled enroute climb speed, which the twin-engine Dornier 328 achieves. Since the cleanup and acceleration to enroute climb speed is a transient maneuver, there would seem to be no good reason for the pilot to fully trim the airplane until the steady-state climb configuration and airspeed have been achieved. Since the Dornier 328 has an enroute climb speed schedule that allows for hands-off trim at all allowable gross weights, the FAA considers that the design of the Dornier 328 provides an acceptable level of safety.

The one-engine inoperative enroute climb speed is provided in the FAA Airplane Flight Manual. This speed is also close to the best rate of climb speed, and is more relevant in terms of the overriding trim authority concern than the $1.4V_{S1}$ contained in the current rule. The FAA has determined that it is not necessary to show compliance with the strict wording in § 25.161(d) with regard to lateral trim, and may consider rulemaking in the future to correct § 25.161(d) to address this discrepancy between required and acceptable engine-inoperative trim speeds.

In conclusion, the FAA has determined that: (1) the existing requirements are unnecessarily restrictive for twin-engine airplanes; (2) the Dornier 328 meets the intent of the rule; and (3) the trim speed explicitly stated in the rule is not directly relevant given current procedures and interpretations.

In consideration of the foregoing, I find that a grant of exemption is in the public interest, and will not adversely affect safety. Therefore, pursuant to the authority contained in §§ 313(a) and 601(c) of the Federal Aviation Act of 1958, delegated to me by the Administrator (14 CFR 11.53), the petition of Dornier Luftfahrt for exemption from the lateral trim requirements of § 25.161(d) is granted.

Issued in Renton, Washington, on 11/5/93

/s/ Darrell M. Pederson, Acting Manager
Transport Airplane Directorate
Aircraft Certification Service