Exemption No. 3748

UNITED STATES OF AMERICA
DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
KANSAS CITY, MISSOURI 64106

In the matter of the petition of	*	
	*	
PILATUS AIRCRAFT LTD.	*	Regulatory Docket No. 23189
	*	
for an exemption from § 23.49(b)(1) of the Federal Aviation Regulations	*	

GRANT OF EXEMPTION

By letter dated June 22, 1982, Messrs. D. C. Klockner and O. Masefield, Pilatus Aircraft Ltd., CH-6370 Stans/Switzerland, petitioned on behalf of Pilatus Aircraft Ltd. for an exemption from a portion of Part 23 of the Federal Aviation Regulations (FAR) to permit the type certification of their Model PC-7 airplane with a maximum weight stalling speed of 63.5 knots; i.e., 2.5 knots over the required regulatory limit.

Sections of the FAR affected:

Section 23.49(b)(1), which provides, in pertinent part, that the stalling speed (V_{SO}) of a single engine airplane at maximum weight may not exceed 61 knots.

Section 23.561, which provides, in pertinent part, that the airplane must be designed to give each occupant every reasonable chance of escaping serious injury in a minor crash landing when proper use is made of belts or harnesses and the occupant is subject to ultimate inertia forces of 3 g's upward, 9 g's forward, and 1.5 g's sideward.

The petitioner's supportive information is as follows:

At this time, there is no FAA type certificated airplane to fulfill the demand for privately operated high performance, fully aerobatic aircraft. As a result, operators fly ex-military jet or World War II fighter aircraft which may have exceeded their design fatigue life. These airplanes were not intended for civil operation and were designed for maximum performance, often at the expense of safety. They are difficult to acquire, awkward to maintain, expensive to operate, noisy, pollutive, and extremely fuel-inefficient. Their failure to comply with current minimum safety standards presents a risk to the general public.

In contrast, the Pilatus PC-7 is a modern, safe, economical and environmentally-acceptable airplane whose availability as a viable and affordable alternative is in the best interests of private aircraft operators and the public.

The primary intention of § 23.49(b)(1) is to prevent or minimize injury to the occupant of the aircraft in the event of an emergency or crash landing by keeping down the speed at which such an incident occurs.

Pilatus contends that the PC-7, although exceeding the stalling speed limitation (by 2.5 knots), complies with, and achieves, the objective of the regulation by providing the greatest possible occupant protection. This is accomplished as follows:

1. Both occupants are provided with a military-standard, five-belt, safety harness to exclude the possibility of an occupant striking his head on the instrument panel or of being thrown out of his seat. The two shoulder straps of the harness are of the inertia-reel type and the harness is fitted as standard equipment to all PC-7 aircraft.

2. Both seats are equipped with head restraints to prevent whiplash injury.

3. The airframe is constructed to provide maximum occupant protection. To eliminate the stress problems attendant with all wing root attachment, the wing is manufactured as a single structure and bolted and spigoted to the bottom of the fuselage. The center-section of the wing thus provides an extremely strong cockpit floor structure. Four massive U-section longerons form the basis of the stiff box-section cockpit and provide maximum energy absorption with minimum structural distortion. The windshield support structure is strengthened to provide protection of roll-over.

4. High structural strength provides excellent "crashworthiness." The strength of the structure is shown by the permitted sink rate of 13 feet per second (30% in excess of FAR requirements) and a design fatigue life of 20,000 hours or 40,000 landings. Fatigue life calculations are based on 'FALSTAFF' (Fighter Aircraft Loading Standard for Fatigue Evaluation) load spectrums.

Pilatus further contends that the safety qualities of the PC-7 during the approach and landing phase, will preclude many of the normally "unavoidable" crash landings and are so far in excess of FAR minimum requirements as to provide adequate compensation for the marginally excessive stalling speed.

Safety features include:

1. Excellent stability about all three axes in all conditions, including the approach configuration, ensuring minimum pilot work-load.

2. Excellent stall and post-stall characteristics.

3. An aural stall warning system actuated by an angle-of-attack transmitter.

4. An angle of attack (AOA) indexer system. This provides the pilot with a constant indication of the correct speed for a 1.3 x V_{SO} approach. The accuracy of the AOA indexer ($\pm$ 1 knot) is so superior to that provided by airspeed indication that the PC-7's approach speed (1.3 x V_{SO}) actually falls within the permitted approach speed spectrum of an aircraft with a V_{SO} of 61 knots using airspeed indication (FAR § 23.1323(a) allows an ASI error of five knots). Thus, the aircraft with a V_{SO} of 61 knots, using airspeed indication, has a maximum permitted approach speed (1.3 x 61, +5) of 84.3 knots. The PC-7, using AOA indication, has a maximum approach speed (1.3 x 63.5, +1) of 83.5 knots.

5. Furthermore, aircraft not equipped with an AOA indexer normally have one specified approach speed, calculated for maximum weight conditions. The PC-7's AOA indexed approach speed is automatically and progressively reduced as fuel is used. Thus, after approximately 30 minutes flying, the PC-7's AOA indexed approach speed is less than that specified for an aircraft with a maximum weight V_{SO} of 61 knots.

6. Minimized system management requirements to reduce pilot workload and distraction. The fuel delivery system has an automatically activated backup system. The trim system is all-electric and is thumb switch operated from the control column or power control lever.

During the flight development phase, the PC-7 had a flap angle, in the LAND position, of 60°. This gave a stalling speed of 60.8 knots. However, aircraft lateral stability in the approach configuration, while within normally acceptable limits, was considered by Pilatus, to be only marginal in the context of basic pilot training requirements. With the concurrence of the Swiss Federal Office for Civil Aviation, the flap angle for landing was reduced to 50°. This considerably enhanced lateral stability while only slightly increasing stalling speed (to 63.5 knots). Bearing in mind the high crashworthiness of

the PC-7, Pilatus considers that the increased safety aspects of the improvement in lateral stability during the approach phase more than offsets the slightly increased risks imposed by the higher stalling speed.

In response to FAA request, Pilatus provided additional information and substantiating data in Pilatus Engineering Reports No. 7578 titled, "Pilot Seat and Harness Ultimate Load Tests," dated November 10, 1982, No. 7579 titled, "Emergency Landing Condition Cockpit Analysis," dated February 14, 1983, and No. 7927 titled, "Specification for Restraint Harness."

Comments on Published Petition

A summary of the petitioners request was published in the Federal Register on August 2, 1982, (47FR 33355), and interested persons were afforded the opportunity to participate in this rulemaking process. No comments were received during the comment period.

The Federal Aviation Administration's (FAA) Analysis/Summary is as Follows:

The FAA has carefully reviewed the information contained in the petitioner's request for exemption.

1. The FAA recognizes the fact that when airplane crewmembers and passengers are restrained by improved protection systems, such as in the PC-7 airplane, the probability of injury is reduced in a minor crash landing when it occurs at the slowest possible airspeed (the stall speed).

2. The regulations limit the stall speed to 61 knots and require the airplane to be designed such that occupants are protected from serious injury in minor crash landings in which the ultimate forward deceleration is 9 g's.

3. The Pilatus test reports show that the seats, attachment fittings, and safety harnesses installed in the Model PC-7 airplane are able to withstand the loads involved as a result of the higher stalling speed.

The FAA agrees that the proposed exemption would be in the public interest because:

1. The airplane manufacturer has shown that the airplane and occupant restraint system are capable of withstanding the greater loads imposed by a higher stall speed.

2. U.S. Certification of the Pilatus Model PC-7 would make available to the public an airplane whose characteristics and capabilities are not available in currently certificated types.

3. The airplane, with this exemption to the applicable rules, will meet the level of safety intended by the rules.

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 Sections 313(a) and 601(c) of the Federal Aviation Act of 1958, as amended (the Act), delegated to me by the Administrator (14 CFR 11.53), and Section 603 of the Act, Pilatus Aircraft Ltd. is granted an exemption from § 23.49(b)(1) to the extent necessary to allow type certification of Pilatus Model PC-7 airplanes with a maximum weight stalling speed of 63.5 knots. This exemption is subject to the following conditions and limitations:

1. The maximum takeoff or landing gross weight must not exceed 4190 pounds (1900 kilograms).

2. The stall speed as determined in accordance with § 23.49(b)(1) must not exceed 63.5 knots.

3. Each seat is to be equipped with a Pilatus PC-7 Harness Assembly manufactured by G. Q. Defence Equipment Ltd., Woking, England, Part No. G.Q.D. 14081.

4. The operating limitations portion of the Airplane Flight Manual (AFM) for the airplane must include a limitation that no takeoff or landing shall be made on a runway whose length is less than the takeoff or landing distance shown in the performance section of such AFM for the existing altitude and temperature conditions.

Issued in Kansas City, Missouri, on *May 24, 1983.*

/s/

Murray E. Smith, Director
Central Region