SWISS BLISS

The Pilatus PC-7: Swiss precision in a two-seat trainer

BY MARK R. TWOMBLY

Performance specifications, like a resume, define an airplane in the abstract but reveal little about character. Consider this partial curriculum vitae for the Pilatus PC-7 Turbo Trainer: takeoff ground roll at sea level, 787 feet; rate of climb at sea level, 2,150 feet per minute; maximum cruise speed at 20,000 feet, 225 KTAS. The numbers describe a high-performance machine but offer no glimpse of its personality. The Turbo Trainer's appearance speaks volumes on that point.

If romantic Italians rather than pragmatic Swiss had designed the PC-7, the angular vertical fin and crooked wing might share the softer lines of the long, long nose and beautifully sculpted canopy. But no matter; the PC-7's make-my-day appearance works. If you're thinking a toothy shark's grin belongs on the flanks of the engine inlet scoop, check with the Bolivian air force. They've done it to their fleet.

PC-7s are in use around the world as military trainers. Pilatus recently assigned a demonstrator to the

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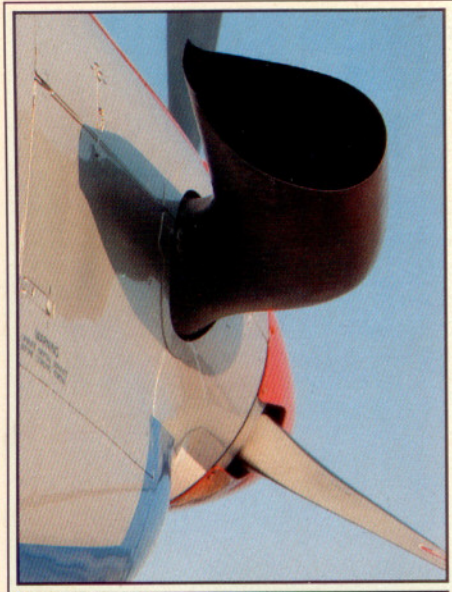
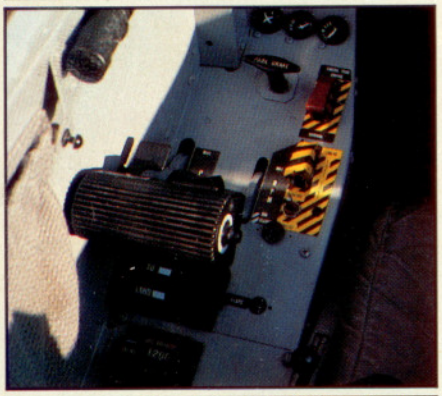
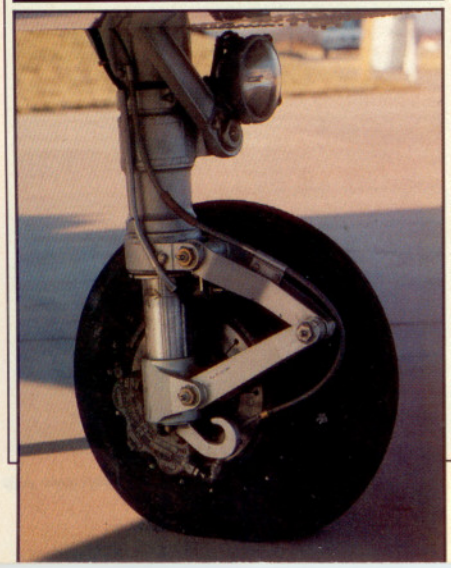






United States with the goal of selling them to civilians. However, the name Turbo Trainer may be inappropriate for the civilian market. The PC-7 is not the answer to a shortage of Piper Tomahawks and Cessna 152s—not at $1.5 million a copy, excluding avionics.

Though not well known in the United States, Pilatus Aircraft Limited has been designing and building military trainers, light transports and sailplanes since 1939. The company manufactures the PC-7 and PC-9 military trainers and the STOL PC-6 Turbo Porter, which for a time was built under license in the U.S. by Fairchild Aircraft. The airplanes are built in Stans, Switzerland. A subsidiary, Pilatus Britten-Norman Limited on England's Isle of Wight, manufactures the Islander, Turbine Islander and Defender, a military surveillance version of the Turbine Islander.

The PC-7 was designed in the mid-1970s as an alternative to jet trainers. The cockpit, handling, and 550-shp Pratt & Whitney PT6A-25A engine are similar to what primary students would face in a jet trainer, yet the military saves big money on the initial purchase price, fuel, and maintenance compared to a pure jet. Since 1978, 397 have been delivered, including 40 to the Swiss air force. Not all have gone to the military. Two are operated by Swiss companies, a private European owner has a pair, and three have been brought into the United States by general aviation pilots looking for something a lot more quiet, comfortable, modern, and reliable than a vintage military fighter or trainer.

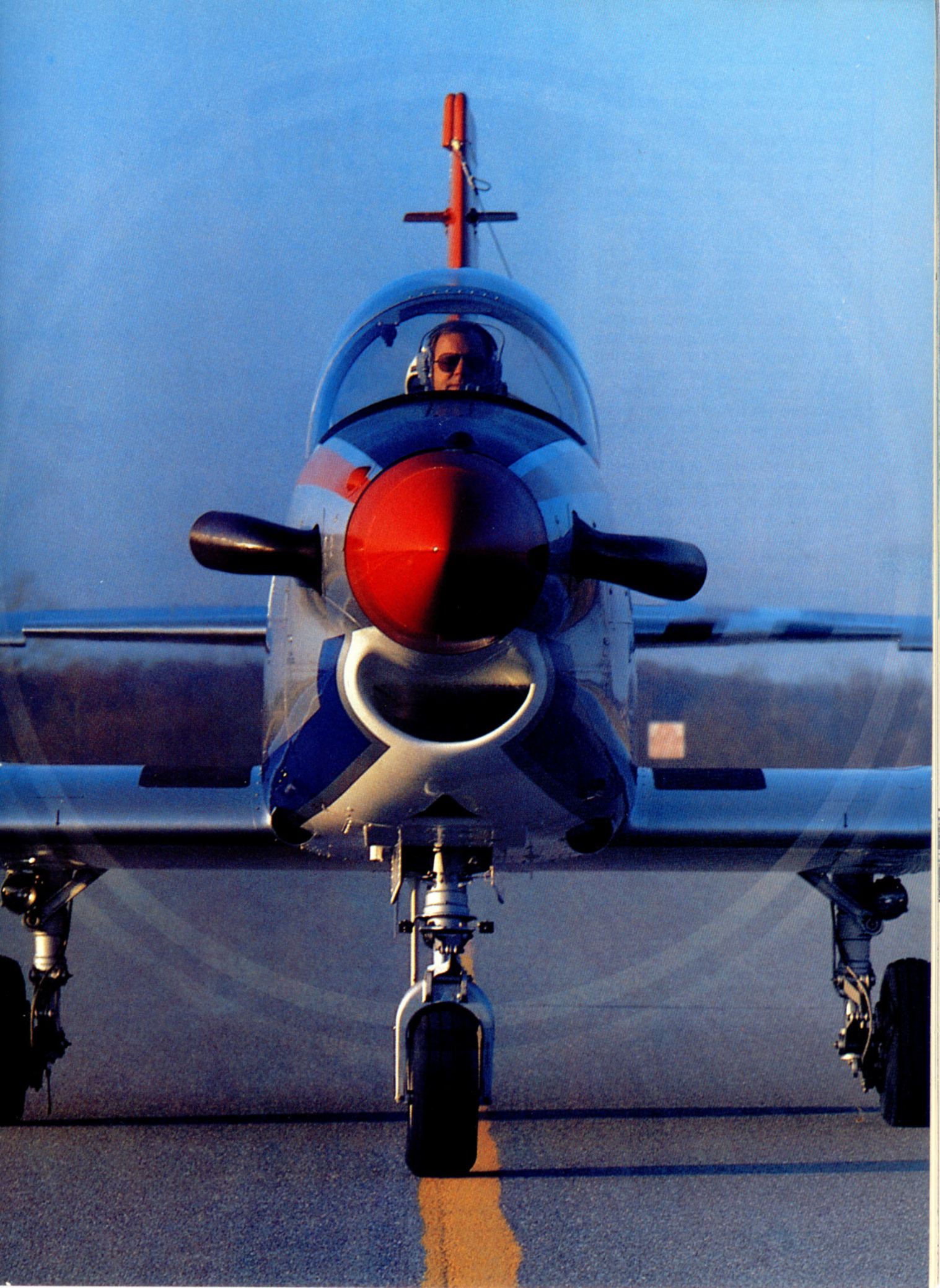
Pilatus, sensing a small but promising civilian market in the United States, has launched an effort to sell the PC-7 not just to wealthy individuals, but to airlines and other operators of large aircraft for use as an unusual attitudes trainer. Wouldn't it be helpful, Pilatus reasons, if a four-striper who finds that his Boeing 727 suddenly has assumed knife-edge flight can, thanks to PC-7 training, roll out upright and level with little more than raised eyebrows. The pitch is not without precedent. Swissair, the national airline of Switzerland, operates one PC-7 as a trainer. Ab initio students destined for Swissair transports spend about six hours learning how to extricate the PC-7 from unusual attitudes.

Pilatus also hopes to sell a few more to discerning private pilots, but it is an unpredictable market, as Beech Aircraft has discovered. Since 1953 Beech has been turning down offers from civilians to purchase T-34 Mentors. Beech has built more than 1,500 of the single-engine, tandem-seat primary trainers for the U.S. Air Force, Navy, and foreign customers. About a third of the deliveries have been PT6A-25A-powered T-34C Turbine Mentors. Last fall, when the Navy ordered its final batch of 19, Beech decided it was at last time to open the order book to civilians. The price for an IFR-equipped, 400-shp civilian version was set at $1.355 million. Beech talked to several prospective buyers, but the December 31 deadline for ordering passed without a single purchase.

One of the three PC-7 owners in the U.S. is Charles H. Nogle, of Champaign, Illinois. Nogle is president of the T-34 owners' club and a partner in a company that is developing an Allison 250-B17-powered conversion of the T-34. The first person to import a PC-7 to the U.S. was Richard Bertea, of Irvine, California. Bertea became interested in the PC-7 after buying a Pilatus glider. Both Bertea and Nogle are U.S. sales agents for the Turbo Trainer. The third U.S. owner is scheduled to take delivery of his airplane this spring.

A propeller may be mounted to the front of the 550-shp Pratt & Whitney turbine engine, but the PC-7 Turbo Trainer was designed to teach pilots to fly jets.

Pilatus also is trying to establish a beachhead in the U.S. military for the PC-9, a scaled-up version of the PC-7 with a 950-shp PT6A engine. The company is promoting it as a replacement for the USAF's aging Cessna T-37 jet trainers. Sixteen manufacturers, all foreign, are vying for a USAF contract for up to 650 aircraft. It would be a reversal of post-World War II tradition for the USAF to select a single-engine, propeller-driven, tandem-seat trainer but Pilatus believes that at $2 million each (when bought in large batches), the PC-9 is the most cost-effective choice among the pure jet, turboprop and piston-powered candidates. One other potential customer is the U.S. Navy, which is said to be considering replacing its T-34s through a joint procurement with the



USAF. A civilian version of the PC-9, which would cost an estimated $2.5 million to $3 million, is not available, so those interested in acquiring a state-of-the-art military trainer must be content with the PC-7 and its virtues.

It appears to be a much larger airplane than it really is. Maximum gross takeoff weight is 4,189 pounds, just 189 pounds more than a Cessna T210N. To complete the comparison, the PC-7 is 10 inches higher and 3 feet 11 inches longer, has a 2-foot 8-inch-shorter wing span, and almost twice as much continuous horsepower. The airplane sits high off the ground on a narrow gear that appears to be robust enough to handle carrier landings. Hard-line warbirders may object to a nosewheel, but for docile runway behavior the tricycle gear can't be beat.

Michael A. Clarke, an ex-USAF pilot who is working as an independent sales agent for Pilatus, is my check pilot in HB-HMB, Pilatus's U.S. demonstrator. The fun begins as soon as we step up on the wing, slide the big canopy back, wriggle into the cockpit and strap into parachutes and five-point restraint systems. Each cockpit is fully equipped with power controls, instruments and IFR avionics. The PC-7 is flown solo from the front seat because most emergency systems are located up front.

To a pilot reared on general aviation trainers, the cockpit at first seems a confusing mass of instruments, gauges, switches, yellow and black-striped emergency handles and annunicators. Sixteen warning lights stacked in two rows of eight fill the lower right panel by my knee, each connected to a Master Caution light on the eyebrow panel. Ah, here is the stick, itself bristling with ominous little red buttons and the obligatory spring-loaded trigger. Squeezing it has no effect on the innocent Cessna parked squarely in my sights across the ramp. The PC-7 is equipped with six underwing hard points, but the Swiss government forbids the export of weaponry.

Clarke guides me through a detailed pre-start, starting, and pre-takeoff check list. First, flip a switch to close the electrically actuated canopy. A pneumatic seal automatically inflates to plug air leaks and block exhaust fumes from entering the cockpit. Next, toggle the battery, fuel boost pump, and starter switches to get the turbine turning. As the engine begins to spool up, flip the ignition switch on. At 17- to 22-percent rpm, introduce fuel by pushing the hefty PCL (Power Control Lever) forward from cutoff to idle. That's it. Wait for rpm to stabilize at about 55 percent, then off with the starter, ignition, and boost pumps and on with generator, radio master, inverter, and gyro compass.

When the needle on the accelerometer climbs to 5 Gs positive or dips to 2 Gs negative, a warning horn advises the pilot that load limits are close at hand.

Propeller rpm is controlled by a lever hidden beneath the PCL. Minimum prop speed is 1,825 rpm, maximum is 2,200. When it's time to taxi, you need only move the lever forward about halfway, then forget it until engine shutdown. That brings the prop out of feather position to about 2,000 rpm, enough for all but maximum performance maneuvers while still keeping the noise level down.

The PC-7 does not have propeller reversing for braking (few military jets have thrust reversers, so Pilatus elected to do without), and the nosewheel castors. Consequently, main wheel brakes must be used during taxiing for directional control and to keep the speed down, even when the engine is idling. The drive from ramp to runway is simple thanks to that nosewheel.

Flaps and trim—pitch, yaw, and roll—must be set before takeoff. The split flaps are deployed 23 degrees for takeoff, 50 degrees for landing. Rudder

trim is adjusted with a rocker switch on the PCL. The switch position is ideal because each change in power necessitates a change in rudder trim. A single stick-mounted button commands pitch and roll trim. The proper takeoff position for each trim tab is marked on three small indicators on the left side panel. Even with trim set, full right rudder is required at the beginning of the takeoff roll to counteract the torque of the Pratt & Whitney.

The engine lags momentarily as the PCL is advanced to the stop for takeoff, and then the power comes on in a rush. Work the rudder to track the centerline, and at 70 knots rotate to a 10- to 15-degree pitch-up attitude. The PC-7 flys off smoothly and climbs smartly. Retract gear and flaps, adjust pitch to maintain a cruise climb speed of 110 knots, and steal a glance at the altimeter winding up at about 2,500 fpm.

It is a dream to fly. A propeller may be out front, but the Turbo Trainer was designed to teach pilots to fly jets. It has a solid, stable feel thanks to high wing loading, and light and responsive controls. The ailerons are actuated by control rods, and the rudder and elevator are attached to stabilizer spars with ball-bearing hinges. A set of springs and a bobweight in the pitch control mechanism match stick forces to airspeed. Clutching the beefy stick grip is like shaking hands with a power lifter. Dare it be said the controls fall easily to hand?

In no time we're level at 7,500 feet msl and feeling pretty cocky— right hand caressing stick, left hand poised on PCL, head swiveling to check for bogeys. The moment passes when I notice my combat flight suit reflected in the canopy: tweed sports coat, strawberry-colored necktie and tassle loafers.

We make ready to sample a few unorthodox attitudes. The PC-7 is certificated under Federal Aviation Regulation Part 23 in both the Utility and Acrobatic categories. Maximum operating weight in the Utility category is 5,952 pounds. At the lighter acrobatic weight, it is approved for +6 G and -3 G maneuvers with the exception of snap rolls. Inverted flight is limited to 30 seconds. The PC-7's sturdiness, power, and speed range—71 KIAS stall in clean configuration to the 270-KIAS Vne—provide a wide, safe envelope for us to practice a few loops, rolls, an Immelman, and multiple-turn spins. Stalls are preceded by a slight buffet, which proves a helpful warning at the top of one poorly executed loop. On the next attempt, pulling harder on the stick at the beginning and on the pull-out triggers a horn to call our attention to the accelerometer. When the needle hits +5 Gs or -2 Gs, the alarm sounds. Spin recoveries call for a half-turn of patience after applying opposite rudder and forward stick.

The toughest part of flying the Turbo Trainer is keeping the ball centered. Each change in power or attitude sends the ball careening to one side of the glass. Rudder pedal pressure is heavy at higher speeds and I find myself continually jabbing the rudder trim switch to align the ball.

I must confess a failure to check cruise performance. Straight and level is an attitude of last resort in the PC-7. Pilatus claims a maximum cruise speed of 225 KTAS at 20,000 feet on 275 pph of fuel. Clarke said he cruised at 220 KTAS at 10,000 feet, burning 300 pph, when he ferried the PC-7 from southwest Florida to Washington, D.C. At a more sedate 176 KTAS cruise, fuel flow drops to 180 pph, according to book figures. Standard useable fuel capacity is 822 pounds (123.6 gallons), good for 600 nm, according to Pilatus. Optional external underwing pod tanks add 532 pounds (80 gallons) and boost range to 1,000 nm. Built-in oxygen is available as an option. A separate compartment aft of the cockpit holds 55 pounds of baggage, preferably in duffles that can be stuffed into the small space.

The PC-7 takes time to slow down from fast cruise to the 135 KIAS gear and flap extension speed. Fortunately, shock cooling is not an issue so the power can be pulled back early. The unobstructed view from the cockpit is a

real asset in the traffic pattern. Downwind is flown at 110 to 130 KIAS with flaps in takeoff position, slowing to 100 KIAS and full flaps on base and 90 KIAS on final.

It's a simple matter to nail the correct approach attitude by coordinating pitch and power to satisfy the eyebrow-mounted angle-of-attack (AOA) indicator. If the V-shaped light at the top of the indicator is glowing red, you are too fast. A red inverted V on bottom, too slow. Green circle in the middle—just right. The AOA, however, knows nothing of glidepath, so it would be possible to fly a perfectly stabilized approach and undershoot or overfly the runway if your eyes are glued to the AOA and not the intended landing spot.

My first landing is made in a right crosswind. Visions of a $1.5-million ground loop dissolve as the PC-7 touches down wing low and tracks true on its tricycle gear. Flaps to takeoff position, PCL forward, counter the surge of power with rudder, and check for rotation speed. Long gone. Stick back momentarily as we rocket to pattern altitude. I feel the need for a few more hours of this joy. Clarke allows me 15 minutes, then diplomatically suggests calling it quits.

Will Pilatus find a larger civilian role for the PC-7? Certainly it has qualities to recommend it as a specialized trainer or alternative to a decades-old warbird: the power and reliability of the PT6 engine, the security of a certificated, new-production airframe, and the modern, functional cockpit. Pilatus has successfully struck a balance between a forgiving, easy-to-fly primary trainer and a challenging, high-performance aerobat that demands skill and precision to fly well. Not to be ignored is its considerable ramp appeal. PC-7 pilots are assured of commanding center stage at every airport they visit.

Although about half the PC-7's components are manufactured in North America, an unfavorable exchange rate has inflated the price of the complete airplane. Five years ago, the Swiss franc was worth about 47 cents in U.S. currency. In March 1988, it was priced at about 70 cents, a 49-percent increase. Short of enlisting in the Tentera Udara Diraja Malaysia or one of 14 other foreign militaries operating the Turbo Trainer, those who find the PC-7 irresistible but unaffordable can always hope for an about-face in the value of the U.S. dollar abroad. □

Pilatus PC-7 Turbo Trainer

Base price: $1,500,000

Note: Specifications and performance figures are given for Acrobatic category weight and, in parentheses, Utility category weight.

Specifications

Powerplant	Pratt & Whitney PT6A-25A 550 shp (flat-rated from 650 shp)
Recommended TBO	3,000 hr
Propeller	Hartzell HC-B3TN-2 constant speed
Recommended TBO	3,000 hr
Length	32 ft 1 in
Height	10 ft 6 in
Wingspan	34 ft 1 in
Wing area	178.7 sq ft
Wing loading	23.5 lb/sq (33.3 lb/sq ft)
Power loading	7.6 lb/hp (10.8 lb/hp)
Seats	2
Empty weight	2,932 lb
Max ramp weight	4,213 lb (5,977 lb)
Max takeoff weight	4,189 lb (5,952 lb)
Max landing weight	4,189 lb (5,655 lb)
Zero fuel weight	3,668 lb
Fuel capacity, std	833 lb (822 lb usable) 125.2 gal (123.6 gal usable)
Fuel capacity, w/opt tanks	1,365 lb (1,354 lb usable) 205.3 gal (203.6 gal usable)
Baggage capacity	55 lb

Performance

Takeoff distance, ground roll	787 ft (2,559 ft)
Takeoff distance over 50-ft obst	1,312 ft (3,871 ft)
Rate of climb, sea level	2,150 fpm (1,290 fpm)
Max level speed, sea level	209 KTAS
Max level speed, 20,000 ft	225 KTAS
Cruise speed/Range w/45-min rsv, std fuel (fuel consumption)	
18,000 ft	176 KTAS/730 nm (180 pph)
20,000 ft	225 KTAS/634 nm (275 pph)
Max operating altitude	25,000 ft
Service ceiling	33,000 ft
Landing distance over 50-ft obst	1,673 ft (2,626 ft)
Landing distance, ground roll	968 ft (1,657 ft)

Limiting and Recommended Airspeeds

Vx (best angle of climb)	75 KIAS
Vy (best rate of climb)	110 KIAS
Va (design maneuvering)	175 KIAS (181 KIAS)
Vfe (max flap extended)	135 KIAS
Vle (max gear extended)	135 KIAS
Vlo (max gear operating)	135 KIAS
Vno (max structural cruising)	270 KIAS
Vne (never exceed)	270 KIAS
Vs1 (stall clean)	71 KIAS (83 KIAS)
Vso (stall in landing configuration)	63.5 KIAS (74 KIAS)

All specifications are based on manufacturer's calculations. All performance figures are based on standard day, standard atmosphere, sea level, gross weight conditions unless otherwise noted. □