mounted accessory gearboxes driving two 300A DC generators provide electrical power. Distribution is via dual Pilatus-developed buses, each capable of driving all essential systems. Batteries provide engine start and drive the mission system before engine start.

Pilatus expects many of its PC-21 deals to involve service provision – it will be contracted to provide a fixed number of aircraft or annual flying hours. Finite element modelling has been used to consider through-life costs, as well as a design tool and for virtual static and fatigue testing. PO1 is equipped with strain gauges to allow load measurement and ensure that predicted loads match reality. Two more test airframes will be built: SO1 for ultimate load trials and SO2 for fatigue testing.

Pilatus has applied for a patent for the PC-21 wing leading edge, which is designed to dissipate the energy of a birdstrike spanwise, preventing birds from penetrating deep into the wing structure, which reduces the need for costly and lengthy repairs.

Birdstrike requirements and a desire to have no forward canopy arch to impair the pilots' forward view meant the canopy was redesigned using tapered stretched acrylic and a slightly altered shape. The high-speed sledge test of the crew escape system is planned for next month at Martin Baker's Northern Ireland facility in the UK.

In another move to identify life-cycle costs early, Pilatus assembled the first wing by fitting all the internal systems, then removing them, adding the top skin and reassembling the system through the access panels to prove the maintenance concepts.

Aluminium structure

The PC-21 is predominately aluminium, with carbonfibre used "where there is an advantage". The material has not been used in the primary structure, but has been used in the wing/fuselage fairing, around the engine cowling and ahead of the cockpit where the ability to create three-dimensional composite structures is an advantage, says Cervia. A PC-21 wing can be built in one-fifth of the time it takes to build a PC-9 wing, says Smith. Pilatus has an annual production capacity for 40 PC-21s in place.

Computerised design tools also helped reduce the cost of prototype aircraft as digital mock-ups and dynamic models were used, allowing Pilatus to delay the start of the first aircraft production until later in the design evolution. PO1 parts manufacture started in April 2000 with assembly beginning in January the following year. "That makes it more [production] representative and therefore cheaper to build," says Smith, adding that PO1 was built on production tooling. PC-21 build time is expected to be half that of the PC-9.

Computational fluid dynamics (CFD) was coupled with windtunnel tests to develop aerodynamics. The CFD code was used in an engineering flight simulator so pilots could evaluate stalls and spins two years before metal was cut, says Smith. Data from the PoC aircraft was used to prove the engineering simulator and fine-tune it, he adds.

"We have kept the first aircraft flying constantly. We wouldn't gain a lot from the second aircraft"

JOHN SENIOR, PILATUS

Pilatus plans the first flight of the second PC-21 towards the middle of 2004. The company decided last year to delay the first flight of PO2 as it felt it would gain little in terms of manufacturing knowledge by building the second aircraft early. Senior says: "We have kept the first aircraft flying constantly. We wouldn't gain a lot from the second aircraft."

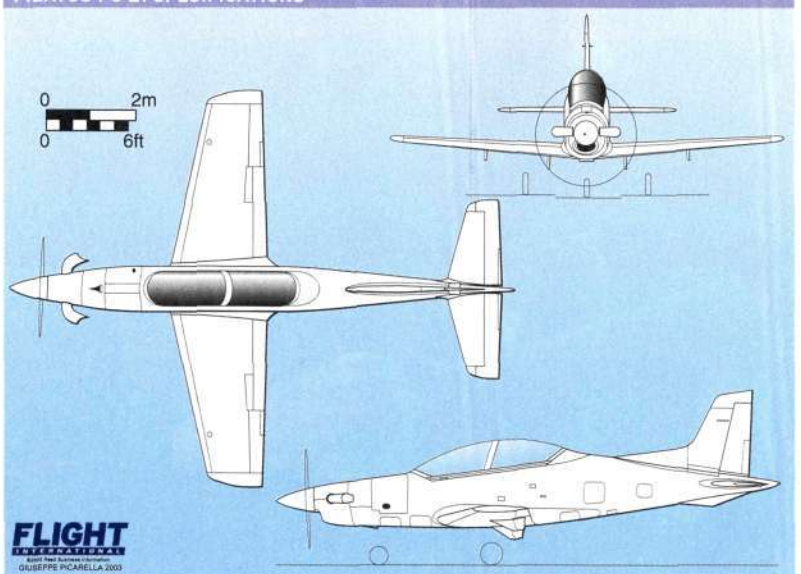
The second aircraft will now be built close to or after final design freeze and will be "more or less a production aircraft", he adds. This removes potential certification issues with two non-production representative aircraft, says Senior. PO1 is essentially an aerodynamic test airframe, while PO2 is the systems test prototype. Delaying PO2 means the "impact on development costs is dramatic", adds Smith.

He says PO2 will have minor differences from the first aircraft, including some structural strengthening as "PO2 is to last longer than PO1". Ramseier adds that the second PC-21 will have an autopilot and FMS, not fitted in PO1. The autopilot will allow single-pilot IFR operation modern air traffic management regimes.

Ramseier says these aids will be useful when air forces deploy the aircraft any distance that requires operation in civil airways. Wainwright adds that flying training is not just about producing fast jet pilots, and that PC-21s will train pilots destined for multi-engined aircraft. "We have to be smart and reflect the wider requirement," he says, noting that modern transport and maritime patrol aircraft are fitted with HUDs, FMS, and glass cockpits. Smith says two customer evaluations have "substantially confirmed the state performance and its fitness for purpose" for Phase II, III, and some elements of Phase IV.

The company believes it can sell at least 300 aircraft over 20 years. ■

PILATUS PC-21 SPECIFICATIONS



Powerplant	**1,600shp 1 x P&WC PT6A-68B**	**Maximum external load (kg)**	**1,150**
Wing span (m)	8.8	Cruise (kt)	340
Length (m)	**11.2**	**V_{MO} (kt)**	**370**
OEW (kg)	2,250	M_{MO}	M0.72
Maximum take-off weight (kg)	**4,250**	**V_D (kt)**	**420/M0.80**
Maximum load (kg)	2,000	Ceiling (ft)	38,000
		Crew	**Two**