AUSTRALIAN
Flying
MARCH/APRIL 2008
Australia's top-selling ABC audited aviation magazine

Cessna's GA Renaissance

VERSATILE WORKHORSE PAC 750XL

CAREERS
Becoming a jump pilot

RIDING THE MORNING GLORY
Gliding's Holy Grail

Destination NZ
Top-shelf flying

$7.25 / NZ $7.80 (INCL GST)
02
9 770004 912005
PRINT POST APPROVED PP255003/00495

POWER & PUNCH TO SPARE

Paul Phelan reviews Pacific Aerospace's PAC 750XL, and finds aeroplane capabilities that will interest any operator whose basic requirements include ruggedness and short field capabilities.

Getting eighteen parachutists to 12,000 feet in twelve minutes and then landing before they do, is something few if any other aeroplanes can achieve. Hauling a couple of tonnes of superphosphate from a short, rough rural strip is another, but an aircraft that can do both can successfully fly a lot of other challenging tasks as well.

Not many ag-aircraft designs have survived for over sixty years, and probably none has evolved as impressively as the (original) NZ-based Air Part's FU24 Fletcher, which hauled close to a ton of superphosphate despite its modest 235 hp Continental O-470 power plant.

The distinctive silhouette of the FU24, its inboard wing sections parallel with the tarmac and the outboard ends cranked up into a conspicuous Jodel-like 8° dihedral, is familiar to plane-spotters everywhere.

The genre took some time to worm its way into the affections of pilots, especially when the FU24 first encountered Aussie hot and high conditions with the traditional 'agricultural overload': "All it needs is another three or four hundred horsepower, and an Olympic weightlifter to fly it," grumped one Kiwi-turned-Aussie super-spreading pilot back in the sixties. "Also, *real* ag pilots don't trust nosewheels!"

Successive powerplant variants have included 250, 300 and 400 hp Lycomings (now we're getting somewhere!), and eventually huge American V-8 truck engines, all amply accommodated by the original Fletcher's simple and robustly over-built structure. And all along the way, the nosewheel has consistently vindicated itself, proving to be as rugged as the rest of the airframe.

But the real revolution arrived with turbine power. First came a factory-built 500 hp PT6 turboprop in 1967, followed a year later by two successive Garrett-powered versions, while after-market conversions also began, using PT6 and 500 hp Walter M601D engines.

By this time Hamilton-based Pacific Aerospace had discerned that a re-design was needed to improve strength and capacity. The Cresco was designed and certificated, initially powered by a Lycoming LTP-101 turbine, but after the first nine units PAC switched to Pratt & Whitney's PT6A-34, developing 750 (560kW) shaft horsepower. The makeover had also included an aerodynamic tidy-up. Ailerons were re-worked to include shielded horn balances at the outboard ends, with 15 vortex generators ahead of each aileron. Rudder and elevators also utilised shielded-horn balances, and the handling enhancements were notable and widely appreciated by the ag pilots whose gripes had impelled the improvements.

Another opportunity

PAC Commercial Manager Todd Stephenson reminds us that the history doesn't mean the 750 is just another variant. Impetus for a completely new model came when tourism operators realised the existing Cresco's potential as a launch pad for skydivers, and began using agricultural Crescos in that role.

US parachuting operators were interested but wanted an aircraft capable of climbing to 13,000 feet in 15 minutes carrying 18 jumpers, and PAC promptly reacted to this new demand by developing and certifying the Cresco-based PAC 750 XL. The new model added enough cabin capacity to carry up to an incredible eighteen parachute-borne adventurers, seated on benches lining both sidewalls, and the first nine aircraft were sold into that market, formerly dominated by ageing Piper Chieftains, Twin Otters, Skyvans, the occasional Nomad, and (in Europe) Pilatus Porters.

But PAC rightly anticipated that the benefits of an unusually rugged airframe, high-lift wing and excessive engine power, would also be noted by charter and tourism operators in regions like Africa and Papua New Guinea, where short-field takeoff and landing (STOL) performance is a baseline requirement. Other qualities demanded in these operating environments are task versatility, reliability despite high utilisation, and ease of maintenance – all of which are assured by the PAC 750's background and diverse genesis.

Apart from the higher-capacity fuselage, transition from the Cresco involved an optional cargo pod, changes to the flap system to improve STOL performance even further, added tailplane and fin area and other aerodynamic refinements, along with factory-added skydive steps, toe-holds and grab rails, and a pilot-closeable jumping door for high-speed descents. They also wanted, and got, a wide CofG range to make the aircraft tolerant of CG shifts at dropping speed, single-point refuelling for fast turnarounds and docile low-speed handling, because nobody wants to get into a spin in a sky-full of parachutists. The cabin is now over 1.37m wide and more than 4m long from the back of the pilot seat to the rear bulkhead. The skydive version also has a mike jack near the rear door, external & internal grab rails, and even lighting for night jumping. All this adds up to the world's first purpose-built para-jumping aeroplane.

The 750XL has since proven to be an even more capable super-spreader than the Cresco, and PAC also offers it in that configuration, with some already out there spreading. But its

ABOVE: Ample space on the panel for all the instrumentation you'd ever need.

LEFT: Extra tailplane and fin area compared with the earlier Cresco model, and changes to the flap system have further enhanced STOL capabilities.

BELOW: Well adapted workhorses in a tough environment.

built-in qualities have also made it a popular utility aeroplane, a prospect that PAC planned for right from the start. In this variant the cabin provides 6.8 cubic metres of cargo space, and another two in the cargo pod, which has three large drop-down doors on the left side. Cargo door size is variable, the larger (parachuting) door measuring 127cm high by 119cm wide, with a sill height of 112 cm. The floor is completely flat except for the main spar housing a little to the rear of the crew seats, and the aircraft comes with eight quick-install seat attachment points in the floor, along with cargo attachment points and a "skydive partition" behind the cockpit.

The 13m-span constant section wing is a one-piece structure, with a spar that runs right through the forward cabin, and a 3.5˚ dihedral on the outboard sections that enhances stability as well as providing ample tip clearance on narrow unmade strips. Single-slotted electrically operated flaps, spanning 7m, now offer two positions: 20˚ and 40˚. The three-bladed constant-speed Hartzell prop is fully feathering and reversible, and static propeller clearance is a generous 380-460mm.

Agricultural heritage

Cables secure the nosewheel and strut against dropping out if a torque-link fractures. The outer cowl is Kevlar with glass fibre-resin forced plastic ducting. Engine foreign-object damage protection is total. In the lower cowl, the filtered engine-air intake faces aft into an "inertial separator" plenum chamber, which is fed from ports on both sides. Four fuel tanks, forward and aft near each wing root, all feed into respective fore-and-aft sump tanks, and automatic selective pumps are used to empty the aft tanks first. Total fuel is 861 litres with 841 useable, which provides for three hours of productive flying. Five drain points and a filter drain protect the fuel system from contamination risk, and single-point refuelling is standard. A ground power socket is located on the left hand rear fuselage.

Replacing the Cresco's sliding canopy are two upwards-opening crew doors which are great for ventilation, and are closed by operating a very firm over-centre lock. But there's also a 4-step removable ladder that can be fixed to the skydive step for entry through the main cabin door, and this is the easiest way for crew to board unless a portable step-up is available. There's more than ample space in the cockpit for two crew, and for all the instrumentation you'll ever need. Our aircraft, awaiting delivery to a Papua New Guinea operator, was fully IFR with dual flight instrumentation including autopilot, radar altimeter, transponder, dual GPS VHF Nav/Comms and weather radar. An engine, electrical and fuel systems annunciator panel sits right above the primary flight panel. A blue light indicates beta-range operation; the generator warning is a low voltage light which illuminates at about 25v. The fuel-filter warning-light operates if differential upstream and downstream pressure is about to initiate a filter bypass. A separate fuel-pressure warning operates below about 0.14bar (2 PSI). Other warning lights are operated via a magnetic-chip detector in the forward part of the gearbox, and by a differential air-pressure sensor on the main intake filter, which is designed to detect clogging by dust, fertiliser or ingested birds (but possibly not elephants.) The standard avionics panel contains the minimum avionics equipment required for flight, but ours has considerable additional optional equipment.

Stall warning is provided by a lift detector vane/switch in the

ABOVE: Typical workday in the PNG highlands.

LEFT: Visibility and manoeuvrability make the PAC 750 at home in the bush.

OPPOSITE PAGE: Early rotation reduces prop and gear damage on rough strips.

right hand leading edge of the centre wing, which provides audible warning to the pilot of impending stall. Located in the overhead panel beside the pilot's left ear, the warning horn sounds about 5 -10 knots above stall speed.

Power situation indicators are all digital and indicate torque, Np (Turbine RPM), inter-turbine temp (ITT), compressor RPM (Ng), Oil temp/pressure and fuel pressure/flow. Indicators are provided for (manual) aileron and rudder trim, electric elevator trim with a manual backup, and flap position. The aircraft comes in various optional IFR and VFR categories and in any of three optional configurations – skydive, passenger/cargo, and agricultural. Certification is under the standards set by the FAA FAR 23 utility category.

But will it fly?

You bet! Having flown the Cresco about fifteen years earlier I looked forward to seeing how its flying characteristics could possibly have been improved. (Especially because on the first flight we'd be well under MTOW.) My demo pilot is veteran instructor Roger Cruickshank from the nearby Hamilton-based Waikato Aero Club,

who shows me around the very professionally laid-out cockpit.

The improvements started with even more crew space because of the widened fuselage. The tricycle gear configuration and seating well forward of the leading edge give excellent forward and downward static and ground manoeuvring visibility with the tarmac visible about 8m directly ahead, but, because of the long narrow nose there is full forward visibility a few degrees either side of the centreline. Dual controls have dust-proof electric trim and press-to-talk radio switches are on either control-stick grip, with a manual trim-override within easy reach. Intercom is of high quality when headsets are used.

Pilot seat positions are adjustable for rudder pedal reach, and the checklist is organised logically in relation to the check items' location.

Ambient temperature was 20˚C (ISA+5). Engine handling is not FADEC-controlled and starting is manual, with fuel in at 15 -18% N1 (RPM) and ITT peaking at about 620˚. The engine becomes self-sustaining at about 52% N1 and settles to ground idle at 500˚C.

There's no need to apply power to taxi because the idling prop gradually changes pitch to pick up a little thrust, and taxying on flat ground can be accomplished at idle. Nosewheel steering is available through the pedals up to 20˚ to the left and right of neutral, and beyond that point the aircraft can be turned by moderately braking the inside wheel. Braking throughout this whole operation was even, grab-free and extremely smooth. The power lever is rigged for a wide beta-range movement arc to avoid inadvertent reverse operation, but reverse is also available for emergency stopping and tight

manoeuvring. When rolling backwards, stopping is achieved by moving the prop control to forward thrust as braking may cause an aft-loaded aircraft's tail skid to contact the surface.

First we fly a couple of circuits – one off Hamilton's main runway and one off the adjacent grass strip which is equally popular with local flyers. All controls are well balanced and effective through the entire speed range; the aircraft is stable but highly responsive and a pleasure to fly, with ego-friendly landings made easy by those factors and the long-stroke oleo legs.

"Okay, let's try a max performance takeoff," suggests Cruickshank.

This was always going to be fun. Following his instructions and holding the aircraft on the brakes, I bring up the torque until they can no longer stop forward motion, and then release them and almost simultaneously rotate on his command, achieving very

positive climb, initially at about 35 KIAS. At his urging I then lower the nose to a more intelligent airspeed, by which time we've climbed spectacularly to about 300 feet. At best-rate speed of 91 KIAS the VSI needle was up against the limit stop of 3,000 fpm so our rate of climb was somewhere well in excess of that.

With ample sky now beneath us, we further explore the aircraft's general handling. Stick and rudder pedal forces remain light and positive through all working manoeuvres, which became apparent after a simulated parachute dropping run, flown at 80 KIAS. Once the aircraft is stabilised in this regime with power and trim, control remains positive and easy. Flight with 20˚flap at 60 KIAS is no more demanding. In all power, flap position and airspeed changes the aircraft is quite trim-sensitive, but compensating electric trim operation soon becomes automatic once you know what to expect from a particular configuration change. The landing flare in particular requires considerable back stick, and a little up-trim bias helps rotation in the flare. It's necessary to forget about holding the nose up while braking, as this reduces the steering effectiveness.

So much for the light weight operation, but what about the real world? With bush operators in mind, we head back to Hamilton to load some ballast, reflecting that 18 parachutists represent a similar weight to maybe a tonne and a half of coffee beans, drilling equipment or mail bags.

We flew to a nearby farm airstrip which didn't look very long at all, but were easily able, after a 60 KIAS approach, to stop in about half its length with a little reverse thrust, and amazingly, to take off again straight ahead without backtracking.

For a parachuting aeroplane which may sometimes be flown by a relatively inexperienced pilot, stall behaviour is important. There is no wing washout, and it is not missed in the stall, which is almost a non-event. A deliberate stall in a steep climbing turn demonstrated the extreme degree of mishandling that would be needed to get into that situation, but the 750 controls simply became mushy without any tendency to drop a wing, and full recovery was achieved simply by easing off back pressure and adding power, of which there is always plenty in reserve.

In standard conditions an innocuous full-flap, power-off stall occurred at about 37 KIAS at minimum weight, later in the day increasing to 58 KIAS at gross weight. Flapless, those figures increase by about 10 knots. Stall characteristics remain mild in all configurations; the aircraft is fully controllable down to and below the stall with both aileron and rudder, producing a very gentle nose drop and no unpleasant surprises, even as post-stall controllability with rudder and aileron movement was further tested. A moderate power application was used to fly straight out of the stall without wing-drop.

ABOVE LEFT: Configured to the task, the 750 has cabin capacity for up to 18 parachutists (or about a tonne and a half of coffee beans).

ABOVE: With short field ops a baseline requirement here, the 750 was a logical choice.

ABOVE RIGHT: With under-belly cargo pod and eight removable seats, it's a formidable competitor in the shorthaul cargo market.

Pretending to be an ag pilot, I found the 750 just as easily handled on lower-level tasks, with precise and positive rudder response for skidding around obstacles, and crisply prompt elevator control for flying over them.

Utility operation

All the capabilities we've observed come together to make this aircraft a highly useful passenger/cargo carrier, particularly on high-frequency short-haul and short-field operations that are typical of many developing countries. At MTOW with ambient temperatures at ISA + 5 and at MTOW of 3,405 kg and sea level, the 750XL demonstrates it can meet or beat all flight manual figures. This translates to a 315m takeoff ground roll, 110m stopping distance, climb to 12,000' in 12 minutes from brakes release, and 168 kt cruise at 10,000' at ISA.

This quite amazing aircraft has already attracted huge international interest in countries where it has a natural role as a rugged utility aircraft capable of handling a range of operational environments.

PNG operators bluntly admit they see the 750 as an Islander replacement. We spoke to Damon Roberts, a senior pilot with Goroka-based 7th Day Adventist Aviation, which gives the aircraft full marks after six months of operation and is now awaiting its second unit:

"We use the aircraft for a variety of mixed passenger and cargo type operations. It's configured in the utility role with

eight removable seats and an under-belly cargo pod. One of the primary crops up here is coffee, which comes in 50 kg bags, and we're able to go pretty close to a Twin Otter payload on some of those shorter legs. On short runs we're able to haul up to about 1200 kg with approximately three hours fuel and being single-engined they're obviously cheaper to run. We can get the aircraft airborne with a similar ground roll to a turbo C206, but carrying between two and three times the 206 payload so it's a very effective machine. It's also a very rugged aeroplane, which our demanding short, steep and rough strips require."

Asked about their shortest strip, Damon quoted a typical strip as 'about 400 metres long on a 14° slope at a little over 5,000 ft'. Average stage lengths are low, and it's not uncommon for a pilot to finish a day's work with a dozen more landings on that kind of strip, so until now it's always been Islander and turbo C206 country:

"The reason we chose that aircraft is basically that there aren't any other options on the market right now that can do what this one does."

PAC 750s are now flying in New Zealand, the USA, Australia, Switzerland, the UK, Sweden, South Africa, Papua New Guinea, Czech Republic, Italy and Germany. Configurations include utility, passenger, skydiving, top dressing, and aerial survey (photographic & geophysical.)

Africa now has six aircraft with five more on order. Two of these will be on lease to the United Nations World Food Programme in Africa. They also have the aircraft approved by the major oil companies operating in Africa as the only single engine aircraft they permit (including helicopters) on their contracts.

Total deliveries stood at 36 aircraft with a further seventeen on order, and PAL (Not PAC any more) plans to double its present production rate of 12 aircraft per annum. The vast majority of forward-ordered aircraft are now in the utility configuration with a few also from skydiving operators in Europe and the USA and two more for aerial survey work.

Other military, paramilitary, and tourism-based and survey applications suggest further unexplored markets and there seems to be no reason this remarkable performer shouldn't find even more eager customers in markets where honest performance, reliability and cost-effectiveness are still demanded.

Our thanks to Relapse Media for the African and PNG images. See more at www.relapse.co.nz ■