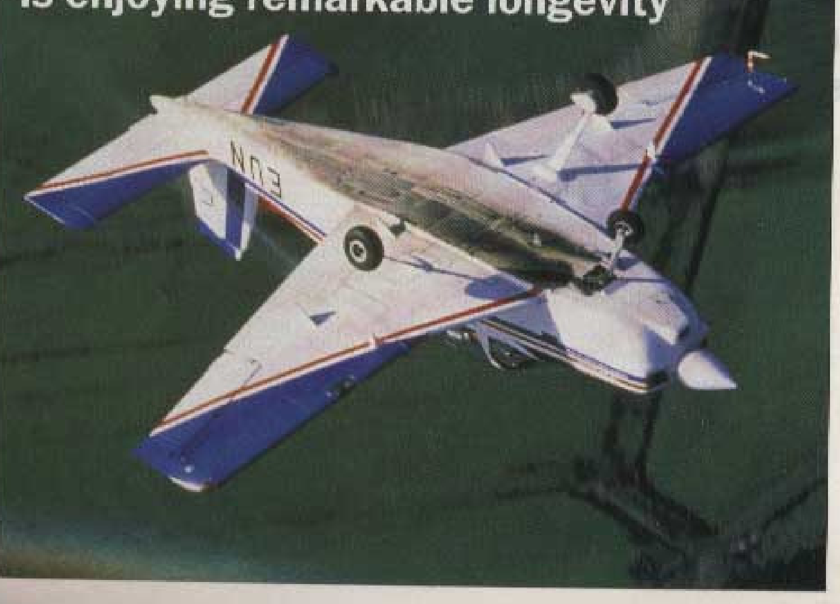
Victa's simple and rugged airframe has been combined with a well-proven powerplant to provide a cheap and credible military trainer

Still kicking

Upgraded with a powerful engine, the Pacific Aerospace CT4 trainer is enjoying remarkable longevity



PAUL PHELAN/**HAMILTON**

BUILT FOR THE FLOURISHING flying-school market of the early 1960s, Australia's successful Victa Airtourer and Aircruiser trainer aircraft benefited from the same kind of lateral thinking which their manufacturer, Merv Richardson, applied in inventing, manufacturing and marketing the world's first mass-produced centrifugal-slasher lawn mower.

An unusual Airtourer design feature was the almost exclusive use of pop rivets throughout the simple and rugged structure, although solid rivets were retained in highly critical stress areas. Another feature was the intelligent use of automobile parts, such as a Ford Anglia front-suspension unit in the nosewheel strut, to minimise maintenance costs — operators still say that the unit gives less trouble than any other light-aircraft leg.

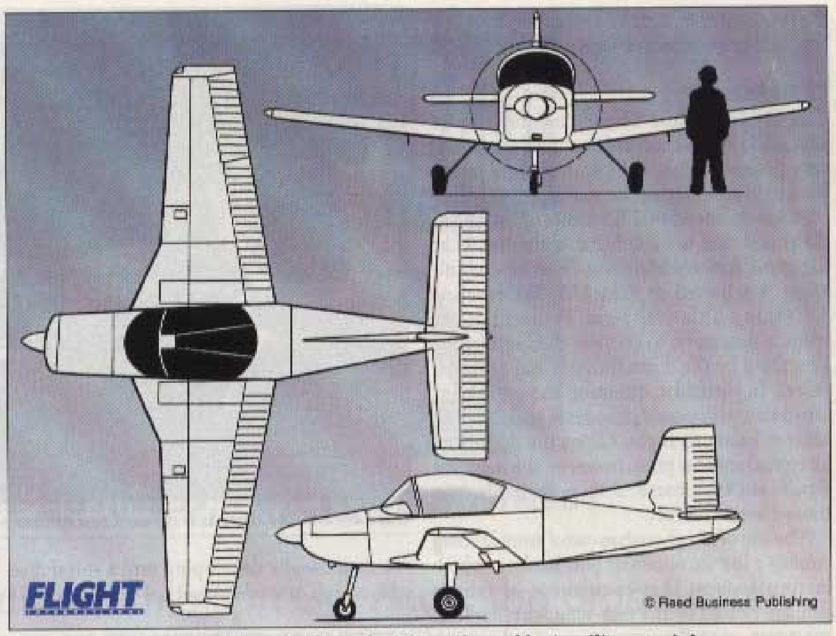
The original, slightly underpowered, 75kW (100hp) model was first re-engined with an 85kW Textron Lycoming O-235C1 engine and enjoyed strong acceptance. It later evolved through major aerodynamic and structural changes to become the CT2 Aircruiser with a 155kW Teledyne Continental IO-360H engine and constant-speed propeller. After the design and manufacturing rights were sold to New Zealand's Aero Engine Services, a predecessor company to the present manufacturer, Pacific Aerospace, the CT4 series was developed, with the same 155kW Continental engine. From two CT4 prototypes was developed the CT4A, of which 75 were built, offering some aerodynamic refinements to reduce control forces, and obtaining civil certification under US Federal Aviation Regulations (FAR) Part 23 at a maximum all-up weight (MAUW) of 1,100kg. In addition, 19 special military variants were built with an MAUW of 1,200kg in the normal category.

Changes between CT4A and B were in the main durability enhancements, but also included a revised oil system, suitable for aerobatics, wiring-loom upgrade, and new fuel-filler system. Certificated under FAR 23, 114 CT4A and B models were built and sold mainly as basic military trainers. The Royal Thai Air Force operates about 24; the Royal New Zealand Air Force has 18; and 50 were sold to the Royal Australian Air Force (RAAF), which has since disposed of its CT4s to eager private enthusiasts, and contracted out its flight screening to the Ansett-British Aerospace-owned Australian Air Academy. This organisation flies 12 CT4B civil variants, built in 1989, on several flight-screening and basic-training contracts for the Australian Defence Force, as well as on airline pilot training for Ansett and various foreign carriers.

Always a nimbly responsive handler with forgiving flight characteristics nevertheless, the CT4 was again re-engined in two development projects in 1990. The first was the CT4C, an Allison 250-B17D turbine-powered proposal for the Royal Thai Air Force. In the second, the subject of this report, the aircraft was fitted with a 225kW Lycoming AEIO-540-L1B5 aerobatic engine to qualify it for bidding on the US Air Force's enhanced-flight-screener programme. The latter redesign also incorporated a Hartzell three-bladed constant-speed propeller, and a 56mm forward shift of the wing to accommodate the additional weight and accompanying centre-of-gravity shift.

Full fatigue-life testing was carried out by the Australian Aeronautical Research Laboratory, resulting in the availability of a fully documented fatigue life of up to 14,000h, depending on the aircraft's role. Pacific is now promoting the type on the basis of its relatively low maintenance demands and direct operating costs compared with more advanced military trainers, and as being therefore suitable for countries without a sophisticated engineering capability, but still in need of a high-performance trainer. The added power also solves any hot-and-high performance degradation problems which hotter countries might experience.

The CT4E's most notable performance enhancements include a rate of climb improved by some 500ft/min (2.5m/s), giving a sea-level climb of 1,500ft/min With half fuel, we achieved a 1,700ft/min climb during the evaluation. Few of the changes made during the metamorphosis are visually apparent, but in all CT4 models they include an increase in wing area through a leading-edge extension at the wing root, and an altered wing section and chord, first implemented when the power was upgraded to 155kW.



The CT4's niche is now in straight-through airline pilot and basic military training

Unchanged are the light, balanced, instantly positive, and generally delightful handling characteristics which helped (at least) this pilot to survive a commercial-licence flight-test 35 years ago. In the company of aerobatics-competent demonstration pilot Steve Gunn I was about to find that trebling the original Victa's horsepower has not diminished those characteristics. The small trainer has been transformed into what any general-aviation pilot would find a breathtaking performer in the air, the experience enhanced by the aircraft's small overall size.

Pacific no longer claims the CT4E to be a generally affordable flying-club aeroplane; its niche is clearly now in the straight-through airline pilot and basic military-training markets. Particularly in the latter role, it will offer a plausible and versatile high-performance basic-trainer alternative for small-fleet military and paramilitary users which cannot justify the capital investment and operating costs of comparable turboprop equipment. An attractive trainer feature is the simple Cessna-style spring steel-leaf undercarriage, which, however, has been known to leave a skid mark under the mainplane of the early model Victa to commemorate an especially inept touchdown.

THE COCKPIT

Cockpit entry from the non-slip upper-wing walkway is made relatively easy by a handgrip. Seating is "snug", but comfortable, with a five-point aerobatic harness and roll-protection structure providing good crew-survival characteristics. A high-quality helmet-integral intercom offers clear crew communication.

A military-cockpit ambience, deriving largely from the USAF specification's requirements, has been achieved, with features including a fighter-style upward- and rearward-hinging single (jettisonable) canopy designed for similarity with Royal Australian Air Force fast jets. As an almost essential feature for high-performance training, there is full control duality, including flight, engine, propeller, brake and flap controls in the side-by-side cockpit, to allow hands-on monitoring by the instructor of all student control input as it is applied.

Our prototype aircraft did not have dual flight instruments, although space is provided for an instructor's full six-instrument side panel. Engine instruments are centrally mounted with radios to their right, easily visible from both seats. The stick-type flight controls are fitted with "witch's hat" electric-trim switches for rudder and pitch. An electric trim-interrupt system is provided for elevator-trim runaway; no aileron trim is provided or necessary. The radio rack is also easily accessible from either pilot seat, and instrumentation includes a G meter at the extreme left of the primary flight panel, which would be difficult for the instructor to monitor. An optional third (aft) observer seat is offered.

Starting the big fuel-injected engine is easy, as always in Lycoming's piston series. Visibility through the one-piece windscreen and bubble canopy is excellent; rudder pedal-controlled nosewheel steering is positive; and braking so powerful that it readily skidded the small (600 x 6) wheels on the wet grass. Take-off flap is 15° and performance from Hamilton's into-wind grass airstrip was quite startling, because of the combination of a 25kt (45km/h) wind, the brute force of 225kW in an aircraft of this size, and large, effective flaps.

THE TAKE-OFF

The CT4E became unstuck comfortably at around 55kt, and seemed inclined to enter a very positive climb, but Gunn advised me to hold it down to accelerate to the recommended flaps-up speed of 73kt indicated airspeed (IAS), and then to a comfortable climb at 95 kt for good forward visibility. The best climb angle is achieved at 82kt IAS. We reached 5,000ft in a little over 3min. Frequent use of trims is necessary, to counter the high forces generated by the comparatively huge engine power. In particular, attention to rudder trim associated with power changes is important to achieve balanced flight. Given the destiny of its typical student pilot, however, the need for significant trim corrections is desirable in a trainer in this market.

The use of a higher-than-usual wing loading confers a low incremental gust loading, which in turn reduces that component of fatigue damage caused by the non-manoeuvring load spectrum, as well as improving speed performance. Attention to power setting in recoveries is needed, however, to avoid exceeding design-limit speeds. During climb and trimmed cruise, the aircraft has sound inherent stability in all axes, but the unaccustomed pilot tends to overlook attention to maintaining trim because of the lightness of the controls.

At 7,500ft, 75% power of 637.5mm (25.5in) manifold pressure and 2,450RPM, produced a cruise speed of 144kt IAS, from which almost any manoeuvre in the CT4E's repertoire can be initiated without diving to reach entry speed; a loop is thus performed from straight and level flight simply by smoothly applying back stick for 3.5G initially. The G meter and the ample reserve of power around a loop or barrel roll, give the ability to sustain easily the selected flightpath and make for tidy aerobatics.

Visibility off the wingtip for monitoring the progress of these manoeuvres is also superior, and visibility over the nose in all attitudes is ample. While obviously consuming more fuel, the aircraft has the advantage that it saves training time in aerobatics by eliminating time absorbed in regaining height between sequences. A further advantage will be understressing, because of the modest demands placed on the engine, which is rated for full continuous power, however.

Power-off stalling requires a high nose attitude, with stall breakaway occurring at 54kt IAS with full flap and wings level. A flaps-up stall in a 60° bank occurs with ample buffet warning at 84kt IAS, with all stalling speeds in other configurations lying between those extremes. The CT4E resists autorotation in spin sequences, and use of classic spin-entry techniques from a stall normally results in oscillations during the incipient spin phase, of up to two turns, the manoeuvre then usually developing into a spiral dive with a high rate of descent.

Once aboard, the student is exposed to a military-cockpit ambience

AEROBATICS PERFORMANCE

Relatively precise control input is therefore necessary to ensure entry into a developed erect spin. The manufacturer recommends spin-recovery initiation over 5,000ft above ground level, and before 110kt IAS, to avoid design-limit speed exceedances. Full opposite rudder and full forward elevator with ailerons neutral achieves recovery in one to one and a half turns. The CT4E typically indicates 50-70kt IAS in a spin to the left, and 40kt IAS or less when spinning to the right.

A quick rate-of-roll trial resulted in rolling from 60° left to 60° right in less than 2s, and several aileron rolls were accomplished in fewer than 6s. Aileron control remains good in a vertically climbing roll, even as speed reduces. A tail slide is best achieved with power off, because even moderate power causes the aircraft to begin to rotate interestingly, and slightly unpredictably, around the propeller axis as speed is lost.

To prevent control snatching under reverse aerodynamic loads, controls must be firmly held rigid as speed reduces to zero and becomes negative, but, with pre-planning (and experience), the aircraft can be positioned by slight variations of entry angle, either to nose-over or to fall over on its back in the tail-slide recovery. On this trial, the aircraft nosed over, with the pendulum effect of the heavy engine taking us about 10° past the vertical in the recovery. Although inverted spins are prohibited, I felt it might be easy to enter one inadvertently from a tail slide, and noted that a recovery procedure is prescribed. Snap rolling is best achieved at around 90kt IAS; vertical rolls and rolls off the top are entered at 170kt IAS. Stall turns should be initiated before speed reduces below 50kt IAS, to ensure ample rudder control.

The CT4E is rated to 6G positive and 3G negative, with 2G and 0G limits on operation with flap extended. The aircraft will sustain inverted flight for about 6min, the period limited by low fuel-pressure indication (if pilot discomfort doesn't get there first). The CT4E stabilises at around 130kt inverted at normal power settings. Controls remain almost uniformly light and responsive throughout the whole range of speeds and aerobatic routines, except that, as would be expected, the ailerons become slightly stiffer approaching the CT4E's never-exceed speed of 207kt. Despite its apparently small size, the rudder provides ample authority in all crossed-control manoeuvres, including a slow roll.

As I became more comfortable with the aircraft, my rusty aerobatic capabilities became less of a problem; and fun replaced fear in the more alarming sequences. The whole flight was conducted in moderate turbulence associated with nearby thunderstorms, and the solid ride resulting from high wing loading was appreciated.

RETURN TO BASE

On return to Hamilton shortly after dark, the into-wind, unlit, grass runway was unavailable and our landing options were reduced to that of facing a vigorously gusting crosswind of up to 25kt from the right. Following a powered approach reducing to 70kt IAS with full flap, the quick and positive control response made an easy task of placing the right main wheel on the runway, while holding the downwind wing airborne until its flying speed was lost. Even then, aileron was effective and, still holding the nosewheel off, I found that there was ample rudder to hold the CT4E straight until elevator control was lost at about 30kt.

At the end of the lengthy session, I was conscious that the cockpit still did not feel cramped and the level of pilot comfort had remained high throughout. ❑