BRISBANE VALLEY FLYER

August 2024

BRISBANE VALLEY SPORT AVIATION CLUB INC

Watts Bridge Memorial Airfield, Cressbrook-Caboonbah Road, Toogoolawah, Q'ld 4313.

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Meeting the design purpose: pitting the Victa's Airtourer T1 against Cessna's 150. Who wins? See page 4

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Our website - bvsac.com.au

Greetings Members,

Our July meeting was held with 11 members attending. We were down on members due to the school holidays and other members that were away on holidays but we still had a great day with the usual BBQ lunch.

Myself, Ian and David attended and helped out at the Watts for Breakfast for the club. It was a very cold day but still there was a good turnout. Following the breakfast the Aerobatics club hosted a Casa brief which was on flying in to non-controlled air fields.

Our next meeting will be on Saturday the 3rd August. Please come only for the meeting and stay for lunch with friends.

Peter Ratcliffe

President BVSAC

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Victa AT-100 vs-Cessna 150G– The Better Trainer was…..

By Rob Knight

By the very nature of the exercise, a student being trained to fly is only learning to fly that particular aircraft type to which their harnesses are bolted. However, what is intended, is that the type of aeroplane they learn in will be sufficiently compatible with other types they will fly in the future that their conversions will be simple and easy. Through the I.C.A.O.[1], the signatory world civil aviation authorities have worked together to ensure that commonality of aeroplane flying characteristics is a primary part of aircraft certification, and thus far it has worked. For example, by convention, throttles are pushed forward, towards the nose of the aeroplane, to increase the power output from the engine(s). Should a designer/manufacturer produce an aeroplane whose fundamental engine control operates in reverse, where the throttle knob or lever is PULLED to increase power, it is highly unlikely the design would get certification with that feature.

This philosophy extends to the flight controls also. In regard to the elevator and ailerons, the control is pushed forward to pitch nose down and vice versa, and the control is pushed sideways (or rolled in the case of a yoke) in the direction of desired roll. The exception is the rudder. When a rudder bar/pedal is pressed, the nose yaws towards the side pressed, which is opposite to the previous control results. However, this is not significant as this variance is ignored and practice forces the student into a natural acceptance of the correct control application for desired result. It becomes a habit and because of these standards common across all aircraft, conversion and commonality between types is achieved

The two aircraft under review – the Victa AT-100 (aka T1) and the Cessna 150G - have fundamental differences. From the images below, it's obvious the Victa is a strutless low-winged aircraft and the Cessna a strutted high wing design. The Cessna has conventional ailerons and flaps, operated by separate controls, a flying-control yoke for ailerons and elevator, and an electrically operated flap system with a stepped switch for lower and raise, and an indicator for actual flap position. The Victa, on the other hand, was fitted with flaperons, a system where the flaps and ailerons were interlinked, and operated simultaneously through a mechanical "mixer" device in the control linkage. Thus, when flaps were lowered, the whole wing training edge drooped, and a belly flap below the fuselage extended.

Victa Airtourer-100, ZK-CHC

Cessna 150G ZK-CSW

Victa 100 cockpit: Spade grip control column in centre, flap lever on left sidewall. Aircraft, left seat student/solo pilot (because of flap lever position), controlled with right hand on stick and left hand on push-pull throttle knob to left of control panel. Trim lever – silver "T" aft of the control column. Length-adjustable rudder pedals were fitted for each pilot.

The ailerons and elevator were operated by a rectangular "spade" grip on a central control column, and the flaps by a three-position selector lever on the cockpit wall beside the student pilot's left knee as shown on the image to the left.

The Victa had yet another difference to more conventional trainers, the seats weren't adjustable for varying leg-lengths. Instead, the rudder pedals were adjustable on a lockable rachet system to bring them closer to the pilot or otherwise. The reason the

[1] *I.C.A.O. – the International Civil Aviation Organization.*

seats weren't adjustable was that the seat structure formed the surrounding frame for the single 29 imperial gallon (131 litre) fuselage bladder fuel tank. The tank was dippable for fuel quantity using a special, Victa-provided, curved, flexible dipstick, instead of the standard home-made broom-handle dipsticks on the Cessnas.

Seated in the aircraft, the Victa pilot enjoyed a cockpit width of 106.45 cm, whereas the Cessna 150 cramped the occupants into a mere 96cm. The joke of the day was that the 150 seated one person adequately, and two peopled only intimately.

Cockpit visibility was also vastly disparate. The occupants appeared to sit on the Victa, with its low wing and superb, near 360-degree horizontal, and 180-degree vertical visibility through its clear Plexiglas canopy. The Cessna, billed since 1960 as having "Omni-Vision", had used the term after they inserted a rear window. Thus fitted, it did have a similar amount of horizontal visibility, but the high wing excluded virtually all vertical visual access to the sky. The Aerobat version did have two small skylights, but these were too small to have any real value in seeing other aircraft.

Looking at a relevant comparison we find the following:

	Victa AT-100 (T1)	Cessna 150G
Physical Specs:		
Engine:	Continental 0-200-A	Continental 0-200-A
Cruise Fuel Consumption	16.5 kg/hr (or 22.75 litres/hr)	16.5 kg/hr (or 22.75 litres/hr)
Wing Span	7.92m (26 feet)	10.21m (33ft 6in)
Wing Area	11.2 m^2 (120.56 ft^2)	14.8 m^2 (159.31 ft^2)
Wing Aspect Ratio	5.65:1	6.7:1
Wing Loading	66.82 kg/m^2 (13.69 lb/ft^2)	49.054 kg/m^2 (10.047 $lb\backslash ft^2$)
Empty weight	476 kg (1050 lb)	444.6 kg (980 lb)
Maximum Take-Off Weight	748.44 kg (1650 lb)	725.76 kg (1600 lb)
Power Loading	7.48 kg/hp	7.25 kg/hp
Glide ratio	6.5:1	8:1
Cockpit Width	1.0645 m	0.96 m

Performance:		
Cruise (at 2400 RPM)	86 kias	90 kias
Vy (Best Rate of Climb airspeed)	70	67 KTAS
Rate of Climb at Vy	644 fpm	667 fpm
Glide/Approach speed	70 kias	60 kias
Take-off distance	224 m (735 ft) (unconfirmed)[2]	225 m (735 feet (from POH)
T-O distance over 15 m	380 m (1250 ft) (unconfirmed)[3]	423 m (1385 ft from POH)
Landing Roll	Not given in POH except as a "P" chart calculation	136 m (445 feet from POH
Landing distance over 15 m		328 m (1075 feet from POH)
Stall speed Full Flap	46 kias	42 kias
Roll rate	110 degrees per second	Not available

With over 3300 hours instructing in Victa Airtourers T1, T2 and T3s, and in excess of 700 hours instructing in Cessna 150 and 152s, the following is my personal comparative assessment as to the quality of pilot produced by each type.

[2] *From Wikipedia, not flight manual.*
[3] *From Wikipedia, not flight manual.*

Overall, the Victa AT-100 was lighter to handle. Without doubt, it remains the liveliest light aircraft type that I have ever flown. Comparatively, the Cessna 150 was also light on the controls by other aircraft standards, but was most definitely heavier to handle, and much slower to respond to control inputs than the Victa. The control yoke in the Cessna did provide an easy path to later type conversions but in my experience the Airtourer's spade-grip left no lasting ill effects. Also, a point regularly raised against the Airtourer, was that one flew with one's right hand and worked the throttle with the left, the reverse to yoke controlled aircraft including the 150. Although the issue does alarm some converting pilots, changing hands is never a real issue except with the most truculent students and it's hard to combat determined ignorance.

The preflight was straight forward. The only significant inspection that I recall was the curved piece of soft metal bar under the tail tie-down point had to still be curved. A hard landing could cause the curve to flatten and this could indicate the rear fuselage had suffered distortion that might have changed the longitudinal dihedral angle and thus adversely affect the longitudinal stability. I never saw a straightened one on a pre-flight.


Victa AT-100, four-point harness

In the cockpit, after setting the rudder pedals for the correct leg length, we addressed the four-point safety harness. This was very necessary if the student was converting from another type, and instructors needed to ensure they correctly latched all straps to the central buckle, or the loose strap with its metal tongue could flail around dangerously.

Start-up procedures were in common, as were taxi and run-ups. The engine was common between the two so there were effectively no differences in engine handling. The Victa had a hand-operated brake, hydraulically acting on both wheels so no differential braking was available. The Cessna used toe-brake pedals on the tops of the rudder pedals and hydraulic differential braking was available to assist with tight radius turns on the ground.

Before take-off checks - the Victa trim was set by a slot-locking silver lever between the seats, working on a rubber bungee to the elevator system. It was marked with a take-off position and one simply pulled the lever to the left and dropped it into the appropriate slot to hold the lever in that position. The Cessna had the ubiquitous Cessna trim wheel working a metal trim tab on the elevator and a mechanical indicator marked with a take-off setting. Flaps were set to 1 notch (8°) in the Victa, with its mechanically linked lever (beside the student's left knee), and 10° with the electric flap toggle switch in the Cessna and its mechanical flap position indicator on the front of the port door frame. Sitting on the ground on a hot day, gave the definite advantage to the Cessna with its shadowing high wing, in the Airtourer, although some aircraft were fitted with over-head sun screens, hats were necessary. At this time, the bubble canopy gave the Victa pilots vastly better visibility in regard traffic on approach to land.

Neither aircraft had an advantage on a normal take-off. On paved runways the Cessna might have had a slightly shorter roll and climb to 15 meters but generally only on hot days. The given take-off distances show little difference between the aircraft when flown properly. On grass, or with water on a paved runway, the Cessna had a definite advantage as its tires were larger and provided less drag so runway length required was generally reduced. Both aircraft were rotated on take-off at 45 to 50 kias, and both were climbed out at 70 kias.

Where a crosswind existed, the Victa was easier to handle because its low wing was less influenced by the wind effects. The Victa also had a shorter arm from the fin/keel surface aft of the centre of gravity so it suffered less weathercocking than the Cessna 150 making it easier to control directionally. There was no difference in the technique required for a crosswind take-off.

The rates of climb were similar and, apart from the restricted visibility inherent in most high-winged single engined aircraft against bubble canopy visibility, there was little between them. The Victa had a slightly lower nose attitude for its Vy speed. Vx was seldom used except for ensuring the student knew what it was for, and the Cessna, here, was somewhat further disadvantaged by requiring its nose even higher yet than the Victa and required "S" turns to clear traffic/obstacles ahead.

Level flight training was inevitable carried out at 2400 RPM in both aircraft. In this condition, the Cessna was about 6 knots faster. However, training pilots is not an air race and this was of no consequence to pilot proficiency in any way. Maintaining level flight required quite different efforts by each pilot. The Victa, being so light and lively, needed mere fingertip pressures on the spade, whilst the Cessna yoke did need fingers around it. The actual magnitude of control movement between the aircraft for the same result was quite dissimilar. Millimetres of control movement in the Victa needed much more on the Cessna yoke to achieve the same result in nose attitude change of degrees of roll. This had the beneficial result in training pilots not to over control. Several times, when converting students to the Victa from Cessnas and Pipers the student's first attempt at an entry into a steep turn resulted in a stall in a turn – they used too much aileron, and the roll rate caught them by surprise and they snatched the stick back and we got the stall buffet. The Victa really was a finger-tip control aircraft.

Apart from the oh-so-lively controls in the Victa, the only other advantage when turning was the excellent visibility afforded by the Victa's low wing and bubble canopy.

The stall handling between the aircraft was quite different. The Cessna was very conventional in that the standard instructing patter of demonstrating the decaying airspeed with the controls becoming heavier and less responsive fitted well. However, in the Victa, whose controls were always light anyway, control pressures and aircraft control responses to any inputs, was much less discernible to the students. Another notable difference was the nose attitude in a level-flight stall – the critical angle was higher in the Victa because it had a lower aspect ratio wing. The Cessna, with its higher aspect ratio, had a lower critical angle which could be seen as a lower nose attitude when the stall break occurred. The high-pitched squeal of the reed in the Cessna's audible stall warning device occurred a few knots ahead of the buffet developing in advance of the stall break so there was plenty of warning. The buffet caused by the airflow beginning to break away from the wings and impacting the tailplane was relatively gentle and not in any way alarming. The stall break was gentle and clean, and exit/recovery was immediate upon reducing the angle of attack to unstall. Handled properly, a basic stall (no power, no flap) could be carried out with total height lost less than 100 feet on the altimeter. The Victa stall warning was an audible horn, also purloined from a motor vehicle (a Ford 105E Anglia), electrically operated by an angle-of-attack trigger on the port wing leading edge, at about half span. For some reason, the manufacturer had the warning set up so it didn't activate unless flaps were lowered, a point that many instructors found laughable. Did Victa assume that stalls didn't occur unless the flaps were down?

The stall warning activated ahead of the developing buffet, but the Victa's buffet was significantly more powerful than the Cessna's, and was a far more commanding warning to the pilots. The stall developed a little more quickly than the Cessna, and the break/nose sag and any wing sag, came a little faster. However, there were no issues in the exit/recovery. There was a tendency to lose a little more height in exiting/recovering from the stall compared to the Cessna, but only a hundred feet or so. The stall developed more quickly in the Victa, when stalling in a turn, particularly when climbing, but recovery was very similar to the Cessna when in level flight. Stalling in a descending turn was more alarming in the Victa as the rates of roll and, more particularly, the descent, was higher so the airspeed rose even more quickly thus being more alarming to the student.

The stall exit (or recovery characteristics) was totally adequate in all instances in both aircraft, but the lighter, livelier controls of the Victa taught precision elevator control to unstall quicker than the Cessna, because the startling nose drop resulting from excessive forward stick to exit (when too much forward stick was used) was a better teacher than whacking the student around the ears for doing so. While both aircraft perfectly adequately taught the student the rudiments of the stalling exercises, the Victa had a definite edge and, in my opinion, produce a sharper pilot, with a greater degree of precision in their control inputs.

In the glide, the Cessna certainly had the better range, a further reflection of the different aspect ratio of the wings. However, this is not a characteristic that echoes adverse training results. Neither aircraft made a better glider pilot than the other.

For an approach, the Cessna 150G had 40° of flap extension available, which made steep approaches steep and effective. This was one of the two greatest advantage the Cessna had over the Victa. The designs were different, the Cessna had only the ubiquitous flap design, single slotted fowler flaps on the inboard trailing edge of each wing, whereas the Victa had flaperons which allowed the entire trailing edge to droop as a simple flap when the flaperons were lowered/extended. The Victa also sported a belly flap for added drag, which the Cessna did not. The other Cessna advantage was in landing distances required. Mostly benefits of the slightly lower stall speed allowing a slightly lower minimum approach speed, and the 40 ° of available fowler flap extension, approaches could be made slower than the Victa and the large extended flap area would kill airspeed quickly, minimising float and shortening the resulting ground roll. The Cessna also had larger wheels and tires, which afforded better braking, and the brakes themselves, were differential, compared to the Victa brake handle that worked both brakes simultaneously.

The Victa was fully aerobatic whereas the Cessna 150G could not legally match this. It wasn't until 1970 with the production of the 150K Aerobat that aerobatics became a legal possibility. However, all 150s were approved for spins when operated in their "utility' category.

Neither the Victa nor the Cessna would stabilize in a spin after entry. Neither would spin naturally, both had to have the spin encouraged by application of full nose-up elevator and full rudder in the direction required for the spin at about 10 to 15 knots prior to the stall break. Both dropped the wing on the side of rudder application and would roll, pitch nose down and begin to autorotate.

The Cessna would remain in a state of autorotation for about a turn and a half before the stalled wing unstalled itself and the aircraft entered a spiral dive with increasing airspeed. I have heard of 150's stabilizing in a spin, but these were all being operated outside the utility category and thus had a centre of gravity further aft than the utility category could provide. The Victa, "fell" out of the spin after about only ¾ of a turn, into a similar spiral dive but the rotational rate was faster than the Cessna, and more scary for the inexperienced pilot. Both aircraft could easily exceed their Vne in the resulting dive. Here the Victa's limit load factor of +/- 6G was an advantage over the Cessna's +4.4G

All-in-all, I believe the Victa did produce a slightly better pilot than its competitor, the Cessna 150G, the variation was neither spectacular nor significantly. Considering that these two competing aircraft were in their heyday in the late 1960s and into the early 70s, many retiring airline pilots in Australian and New Zealand airlines did their first solos and subsequent training to professional levels in these aircraft. For these men and women to have achieved the lofty heights of their professions utilising the skills taught by these two seat trainers is voice enough to indicate their very successes. It's only in the smaller points that advantages can be seen, and then only by experienced instructors and flight examiners who are looking for the more subtle results of what each aeroplane has taught its students. In general, the Victa produced pilots with better feel for the aeroplane being flown. The type better demonstrated what can be gleaned from the feel in the stick of the aeroplane in flight, a product of its light and lively controls. The Cessna taught pilots to maintain a better lookout because the enwrapping high wings so limited lookout in turns that checking for other traffic MUST be done ahead of the turn, visibility is too limited once the bank is applied. Other than those two points, there was little between pilots trained in either.

Personal preference: I have owned Cessna 150s, including a G model, and, although I have always enjoyed flying them, to me, the Victa remains my training aircraft of choice. I think it is really the light and oh-so lively controls that make the Victa so nice to fly.

Happy Flying

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Victa 100 – Airtourer T1, ZK-CHF, Waitemata Aero Club 1971. At Ardmore, New Zealand.

VS

Cessna 150H, ZK-CSW. At Rukuhia, New Zealand

A lesson in the Learning

Accident Report AO-2019-043

Date: **Monday 12 August 2019**
Time: 08:30

Type: Piper PA-36 Pawnee Brave PT6 Turbine
Owner/operator:
Registration: VH-TVU
MSN: 36-7760088
Fatalities: Fatalities: 0 / Occupants: 1
Other fatalities: 0
Aircraft damage: Substantial
Category: Accident
Location: Traralgon, near Latrobe Regional Airport, VIC - Australia
Phase: En route
Nature: Ferry/positioning
Departure airport: Latrobe Regional Airport, VIC (TGN/YLTV)
Destination airport: Coffs Harbour, NSW
Investigating agency: ATSB
Confidence Rating: Information verified through data from accident investigation authorities

Narrative:
Following a loss of engine power, a Piper PA-36 Pawnee Brave PT6 Turbine (modified Piper PA-36-300 Pawnee Brave 300) clipped powerlines during the ensuing force landing to open paddock terrain at Traralgon, Gippsland Region, Victoria, shortly after takeoff from Latrobe Valley Airport (YLTV) in Morwell, Victoria.

The airplane sustained substantial damage and the sole pilot onboard was not injured.

The aircraft departed Latrobe Regional Airport, Victoria on a ferry flight to Coffs Harbour, New South Wales. The aircraft had recently been sold and the new owner had arranged for the aircraft to be ferried to New Zealand. Shortly after take-off, the engine power reduced to below idle. Faced with limited options, the pilot conducted a forced landing into a paddock. During the approach, the aircraft struck power lines and subsequently contacted a fence and tree stumps during the landing. The pilot suffered minor injuries and the aircraft was substantially damaged. The ATSB found that the engine power loss was probably the result of water-contaminated fuel, and that the methods used to detect and remove the water before the flight were unreliable. An inspection of the fuel control unit also detected additional contamination that may have hindered fuel flow to the engine. Finally, the aircraft was utilising the chemical hopper as a ferry fuel tank, contrary to the recommendation of the aircraft manufacturer, and no approved technical data could be provided on the installed fuel system.

I leave you to think about this one.

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The Art of Turning onto a Selected Compass Heading

By Rob Knight

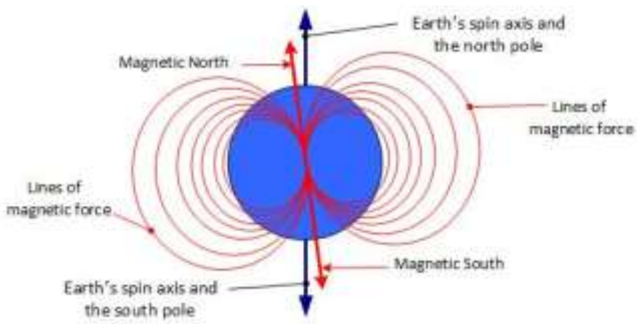
Scientists and historians can't agree on when the principles behind magnetic compasses were first discovered but about 3,000 years ago, Chinese scientists discovered that rubbing an iron bar (such as a needle) with a naturally occurring magnet, called a lodestone, would temporarily magnetize the needle so that, when suspended, it would indicate north.

Early western seafarers' compasses were made of a magnetized needle attached to a piece of wood or cork that floated freely in a bowl of water. As the needle would settle, the marked end would point toward magnetic north. That device and process has now developed into the vastly more sophisticated modern aircraft compass.

In essence, the earth's magnetic field, also known as the geomagnetic field, is the magnetic field that extends from the Earth's interior, through the earth itself, and out into space. It acts as if the centre of the earth has an iron bar magnet speared through its very centre, and the lines of magnetic force that emanate from this bar magnet are what our compass needles (or "compass cards" in a modern aircraft compass) align themselves with.

So, where's the problem? It seems simple enough - Just turn onto your new direction and, "Rob's your uncle".

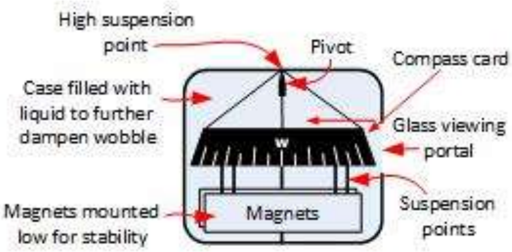
But it's not always. Because of the way that aircraft compasses are constructed, when bank is used to turn, aircraft compasses produce characteristics which make them quite unsuitable for aviation purposes and, unless these characteristics are known and allowed for, a pilot will be eligible for National Super before the compass settles down on the desired heading.



Lines of magnetic force

The compass needle lines itself up with the lines of force in the magnetic field but the lines of magnetic force are only parallel with the earth's surface at the magnetic equator. As we move closer to the poles the lines of force pass through the earth's crust at increasingly sharper angles called magnetic dip. Because the compass needle aligns itself with these lines, so it points either further and further skyward, or deeper and deeper underground as we leave or approach the poles. Ultimately, in high latitudes closer to the poles, these lines of inclined magnetic force are so steep as to make a magnetic compass needle useless. The angle of the lines of force that create the issue is called "dip".

Most modern light aircraft are fitted with the 'P' type compass as illustrated in Fig. 1 on the left. In these, the compass needle is replaced by a "compass card" which is read from the side instead of above. Here, the effect of dip is minimised by suspending the card from a very high pivot and attaching the magnets much lower than the card as shown in the sketch. However, whilst minimising the effects of dip tilting the card, a low-slung compass now has errors when turning or accelerating. Compensating for these is simply a matter of technique.



Schematic view of a "P" type aircraft compass.

As the previous image depicts, to aid compass card stability and minimise needle slope caused by the magnetic dip, compass cards are mounted on a very high pivot and the magnets themselves are mounted very low, which causes the weight of the magnets to hold the compass card parallel to the earth's surface. As long as the aircraft is flying in a straight line at a constant speed the compass is accurate and as simple to follow as the white centre-line on the interstate highway.

But alas, aeroplane's bank to turn and, when an aircraft banks and turns, there is an acceleration towards the centre of that turn which causes the rate of turn of the compass card to be different to the rate of turn of the aeroplane. As the compass doesn't turn at the same rate as the aeroplane, it becomes impossible to always roll out onto a desired compass headings with accuracy. However, all is not lost. The error is measurable and with care, practice, and technique, it is easily compensated for.

The solution:

1. Make all turns at a constant rate so the compass error is steady and predictable, and
2. Follow a table of error corrections.

For turning onto compass headings, we use a constant rate 1 turn. This is a shallow banked, gentle turn that achieves a turn rate of just 3^{O}/second. So how does a pilot know when they are doing a rate 1 turn? First a little background.

In a rate 1 turn the aeroplane will complete 180° of turn in 1 minute or 360° of turn in 2 minutes. Many aircraft carry instruments that will indicate the rate of turn, e.g., artificial horizons with bank indications, Turn and Slip Indicators, or a Turn Co-ordinators.

To visualise the approximate angle of bank in degrees that will provide a Rate 1 turn, apply the following formula: -

$$\frac{TAS}{10} + 7$$

In other words, if we are flying at 90 knots, then the approximate angle of bank for a Rate 1 turn will be 90 divided by 10 = 9 and 9 + 7 = 16. So, 16° should provide a turn with a rate close to 3°/second. Remember, though, this is ONLY an approximation but it will do.

So, now the pilot has the rate 1 turn sorted, an understanding of the compass error corrections is all that is needed to resolve the issues.

Low Slung/High Pivot Compass Errors

In essence there are two fundamental errors in an aeroplane compass that influence its ability to correctly indicate direction whilst in a banked attitude, turning errors and acceleration errors. Turning errors have the greatest effect when turning through North and South and the least onto headings of East and West. Acceleration errors occur when on headings of East and West.

Acceleration Error:

When flying on headings of East or West, if the airspeed of the aeroplane changes the compass will show an apparent change in direction. This is caused by the low suspended magnets being tilted by the speed change and, when the needle is tilted the dip has greater effect.

To remember which way the compass swings with speed changes, the word *sand* says it all. The compass swings **S**outh under **A**cceleration – **N**orth under **D**eceleration (**SAND**).

Turning Errors:
As shown in the previous sketch, the mounting of the compass card is such that its centre of gravity is considerably lower than the elevated pivot point. When the aircraft is banked in a turn, the compass card is also banked because of centrifugal force. While the card is banked the dip causes the compass card to swing and change apparent direction.

Turning errors are greatest when turning onto north or south. They are zero as the aeroplane turns through east and west. The mnemonic for easily remembering whether to overturn or under turn is the word **ONUS** – **O**verturn on **N**ortherly headings, and **U**nder turn on **S**outherly ones.

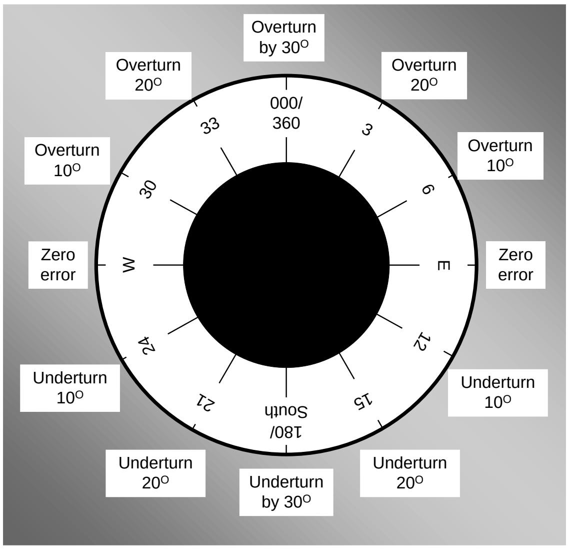


Table of turning errors at rate 1.

Example-1. To carry out a left turn starting from EAST intending to fly North. We set up a balanced level flight left turn at rate 1 and hold it steady until the compass shows that we have over-turned North by 30°. Roll out of the turn, balancing with rudder, and the compass will swing back and read North (360).

Example-2. For a left turn onto South from flying West, we would, again, enter a balanced left turn at rate 1 and roll out when the compass read 30 BEFORE South, i.e. on 21 (210°). When turning onto intermediate headings, for northerly headings roll out late by the overturn error and for southerly, roll out early by the under-turn error.

But what does all this mean to a pilot?

Apart from making all compass turns at rate 1 and ensuring that the airspeed remains constant, it means that a pilot must allow for errors in the compass reading when turning onto any heading except east or west. As depicted on the previous page, when a pilot is turning onto north from, say, 090° (east), the turn must be continued until the compass indicates 30° past north (330° in this case).

Thus, it can be seen that, when turning onto north, the compass turns faster than the aeroplane. It is said to be "lively" and it over-reads by up to 30° in a rate 1 turn. It is still lively when turning onto either 3 (030°) or 33 (330°). However, the compass over-read is only 20° on these headings. Turning onto 6 (060°) or 30 (300°) the over-read is reduced to just 10°.

When turning onto south, the opposite happens – the compass rate of turn is slower than the aeroplane's (it is now said to be "sluggish") and reads less than what it should. Therefore, the aeroplane's nose will arrive at south when the compass still reads 30° less than that. To put figures on it – when turning from East onto South, the pilot needs to roll out of the rate 1 turn when the compass reads 15 (150°). From west, the turn exit needs to be on 21 (210°), each being 30° before the South index mark arrives under the lubber line[4].

Obviously, if the pilot wants to fly directly east or west, as long as the rate-1 turn is maintained, there is no error to compensate for so they simply roll out when the compass reads the desired value, but these are the only directions that allow a pilot to do this.

[4] Lubber line – the line against which a compass direction is read: like a vertical cross-hair.

The aeroplane's flight profile makes no difference. The process works equally well whether the aeroplane is climbing, in level flight, or descending. The only requirements are that the airspeed does not change during the turn process, and the turn is held at a constant rate 1.

The last question. *I fly an ultralight and I don't have an instrument that tells me when I have a rate 1 turn established, what can I do? My IAS in cruise is around 70 knots*.

At that IAS, it is close enough to the TAS so we'll call it that. Using the formula given, 70/10 + 7 = 14° so we'll need a bank angle of around 14 degrees to make good a rate 1 turn.

Note:

I fly a side-by-side two seat recreational aircraft that cruises at 73 knots and has no instrument to indicate a rate-1 turn. So, to turn onto a desired compass heading, to simulate a rate-1, I need about 14°.bank I have found that, if I bank the aircraft left until the left-side edge of the instrument panel is about the height of my ASI (2.25 inch/57mm mount) below the horizon, this approximates a rate-1 turn left and I can use the table of errors rather well. To make a rate-1 turn right, I place the left-side edge of the instrument panel about the height of my ASI above the horizon. Turning left or right, neither is totally accurate, but close enough to need only small fixes to correct residual directional errors from my desired compass direction.

For your aircraft, you'll need to experiment.

Happy Flying

------ ooOOoo ------

A First – A Hydrogen Turboprop for Light Aircraft

Turbotech and Safran test first hydrogen turboprop for light aircraft

In France, Turbotech and Safran have successfully tested the first hydrogen-fuelled gas turbine engine for the light aviation sector. The testing was carried out at the ArianeGroup's facility in Vernon, France, and are part of the BeautHyFuel project to explore hydrogen propulsion solutions for light airplanes. The French Civil Aviation Authority (DGAC) supports BeautHyFuel as part of France's post-Covid stimulus program and is led by Turbotech and Elixir Aircraft in partnership with Safran, Air Liquide and Daher. The project leverages ArianeGroup's decades-long experience with hydrogen propulsion for the Ariane rocket.

The TP-R90 turbine engine designed for light GA aircraft

On January 11, Turbotech and Safran successfully completed the first test of a hydrogen-fuelled aero gas turbine engine with ultra-high performance regenerative cycle. The test was made possible by ArianeGroup's resources and decades of expertise in preparing and performing tests with hydrogen fuels for space applications at its Vernon test facility in France.

This initial trial was carried out using hydrogen fuel stored in gaseous form. In a second phase later this year, the engine will be coupled to a cryogenic liquid storage system developed by Air Liquide to demonstrate the end-to-end integration of a propulsion system replicating all functions on a complete aircraft.

"This first experiment carried out using a Turbotech TP-R90 regenerative turboprop engine shows we can convert previously proven internal combustion technologies to create a working zero-carbon solution for general aviation," said Damien Fauvet, CEO of Turbotech. "As we move to liquid hydrogen fuel, the aim is to offer a high energy-density propulsion system with real commercial applications. Our solution will be readily retrofittable on light airplanes and could have potential in other market segments."

"This first stage of the project has already gone beyond our expectations," said Pierre-Alain Lambert, VP Hydrogen Programs for Safran.

The TP-R90 fitted, small, light, and powerful.

"Our objective was to validate the behaviour of the engine and fuel control system at all phases, from engine start to full throttle, as well as strategies in the event of a failure.

For Safran, this kind of small-scale investigation is really valuable, because we can learn quickly and nimbly. It complements our other, larger-scale initiatives aimed at removing the barriers to hydrogen propulsion for air transport, such as our technology demonstration in partnership with CFM International as part of Airbus's ZEROe program, supported by Clean Aviation. ArianeGroup's expertise in hydrogen testing was decisive in the timely success of this crucial first step."

The TP-R90 has also ben fitted into a light helicopter

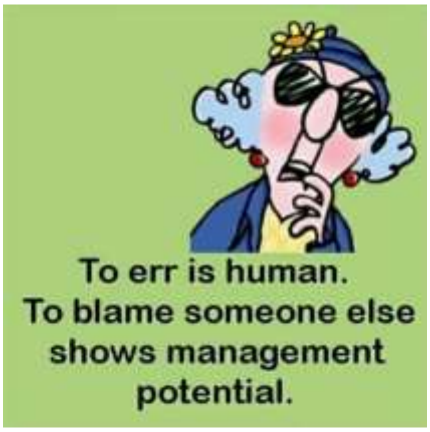
Turbotech, Elixir Aviation, Safran, Air Liquide and Daher formed the BeautHyFuel joint research project in June 2022 to design and ground test a hydrogen propulsion system rated for light aviation and develop a methodology so it can be certified for retrofit. BeautHyFuel benefits from the unique combination of Turbotech's ultra-efficient light turbine technologies, Safran's expertise as an aeroengine manufacturer and fuel system designer, Air Liquide's cryogenic hydrogen storage technologies for aerospace, Elixir's role as a manufacturer of innovative fourth-generation light planes, and Daher's experience in aircraft development, certification, production and maintenance.

------ ooOOoo ------

FLY-IN Invites Looming

WHERE	EVENT	WHEN
Murgon (Angelfield) (YMRG)	Burnett Flyers Breakfast Fly-in	**See website for next planned event". Confirm details at: http://www.burnettflyers.org/?p=508**


The sad demise of the sole prototype of the VW-190



The Days of Our Lives (From a Flying Instructor's perspective).

By Rob Knight

It was about 1978 when Graham M. came into Waitemata Aero Club. He was a bit of a misfit and found it difficult to make friends. However, his propensity for making statements to the disadvantage of other people caused great disquiet amongst other members.

For example, one evening in the Club bar, he began chatting up the girlfriend of another member - one of my ex-students. There was a brief spat and the ex-student went to the bar to refresh his and his GFs drinks. Whilst away, Graham, in my hearing, told the girl the ex-student was involved in drugs and that she needed to be very careful lest she become tarred with splashings from his brush. She mentioned this on the ex-student's return and there was an explosion of anger and the two had to be drawn apart.

I had as little to do with Graham as possible. Any time our paths crossed I was polite and used soft words I really had to search for because his manner and actions kept them from the front of my mind. We clashed when he started to advise my students about their theory and contradicted some official versions of briefings. The CFI did tell him to stop but he was also not keen to pick a fight until something more serious gave reason. I felt that we'd already passed that point.

I left and went to Hamilton, initially to the Waikato Aero Club. Whilst there, Graham also moved to Hamilton and started frequenting the Club bar there. He became so obnoxious that, one Saturday night, some vexed Club members there got him drunk and used his wallet to purchase a rail ticket to Paekakariki, hours down the line, just north of Wellington. They tucked him up in the sleeper bed minus his clothes so when he got to the station at Paekakariki, he had an enormous hangover, but no clothes, no explanation, only his depleted wallet lying on the floor of the carriage. I believe that he was awarded some attire from the lost clothing locker and spent a day hitch-hiking back to Hamilton.

Over the next six months or so, somewhere, Graham did an instructor rating. I had left the Waikato Aero Club and was the CFI at the Rukuhia Flying Club. He approached me for work but I had a full-hours of casual instructors so declined. He then asked if he could do trial flight for people that he brought along. Much as I didn't like him, business was business so I agreed to sign his supervision papers to validate his instructor rating for this purpose only.

Graham was active, he seemed to be doing a couple of TIF[5]s a week. Then one day I got caught away on a cross-county with aeroplane problems. I had two TIFs booked in, but wasn't there, so Graham offered to do them in my stead. The Office staff accepted his offer and he did the two flights.

In keeping with my usual policy, I did a follow-up call on the two people with whom Graham had flown. They both said they had not really enjoyed the flights after they had been demonstrated the spin. Furious, I called several of the people that Gerry had brough along himself and they expressed the same problem. I called and challenged Graham because I knew that he was not spin rated, plus my Cessna 150 was placarded against any intentional spins.

He told me that, as the pilot in command and instructor, it was both his decision and, indeed, his duty to show the full gamut of aeroplane manoeuvres. I reminded him his actions were illegal as neither he nor the Cessna could carry out intentional spins. He argued, so I continued that I was the CFI and that I was morally correct and legally entitled to dispense with his services forthwith. He was fired!

I contacted the NZCAA and removed him from my supervision, and advised them of the circumstances. I have not seen or heard of the man since.

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[5] TIF – Trial/introductory flight.

Disasters in Design – The Curtis XP-55 Ascender 1943

By Rob Knight

The XP-55 resulted, like the Vultee XP-54 and the Northrop XP-56, from a 1940 competition for unconventional fighter aircraft designs. The XP-55 ticked all the boxes for unconventionality – it was a pusher design, with canard longitudinal control surfaces, rudders and vertical fins mounted on its outer mainplanes, and a highly swept wing. With so much back-to front in its appearance, it quickly developed the secondary title of Ass-ender, instead if its given name.

Ultimately powered by an Allison V-1710 piston engine, this radical design was a flying wing with fuselage added and only vestigial control surfaces fitted to the rear fuselage and outer wing locations. This arrangement inevitable led to stability problems and, over its testing period, each of its unusual flying control surfaces were enlarged to try and give the pilot adequate control over the aeroplane for it to be safe, if not useful. In all, four ascenders were built, two crashed, one killing its pilot and an unfortunate passerby.

The XP-55 Flight Office.

When testing began on the first prototype, the aircraft could scarcely be tempted to leave the ground, – its canard elevator equivalent providing such inadequate pitch control. With an additional added surface area, controllability improved and testing continued.

Both crashes were direct results of the XP-55's extremely poor stalling characteristics. Pilots considered the design to be extremely dangerous in this respect, with the sudden onset and savage results of any exceeding of the critical angle of attack and the resulting height loss to recover totally unacceptable. To reduce their concerns, Curtis fitted a primitive stall warning device, but such an addition was not rated highly as the aircraft was considered so dangerous and unpredictable in its handling.

To add to the pilots' concerns were the ongoing issues with inadequate engine cooling. All flights undertaken saw the engine temperature instrument needles almost always indicating in the red danger zones.

XP-55 CS at the National Air and Space Museum.

Its demise was inevitable. The official performance and development reports deemed the aircraft to not be desirable as a combat aircraft.

------ oooOoo ------

The Mitsubishi Type 96 (Claude) Fighter

By Rob Knight

Mitsubishi A5M (Type 96) Claude fighter with Jettisonable belly tank carrier arrester hook.

Suburo Sakai, the top-scoring Japanese fighter pilot for WWII, records in his book, Samurai, that he entered combat in the Sino Japanese war, in 1938, after being posted from Formosa (Taiwan) to Kuikiang, in South-Eastern China. His operational aircraft was a Type 96 Claude (Mitsubishi A5M), a single seat, radial engined, low-winged monoplane, that first flew in 1935. Its significance was that it was the world's first monoplane shipboard fighter aircraft, although Sakai was using his aircraft from a land base.

The Type 96 designer was Jiro Horikoshi, who was later famed for his design of the Mitsubishi A6M Zero, the best-known Japanese fighter of the war, but the Claude was a far more primitive design. Its engine was either a Nakajima Kotobuki 41 or 41 KAI 9-cylinder air-cooled radial piston engine, developing 710 hp. The wings were thin (for their day) and un-gulled, unlike the initial prototype. A retractable undercarriage system was considered during the design work but calculations showed only a small improvement is operating parameters so the added weight and complexity was avoided and the final design sported a fixed tail-wheeled undercarriage system.

A5M/Type 96 Instrument panel

The aircraft entered service in early 1937, and its first aerial battles were at the beginning of the Second Sino-Japanese War, including air-to-air battles with the Republic of China Air Force's Boeing P-26C Model 281 "Peashooters". Noteworthy is the fact that these were the world's first aerial dogfighting battles, and kills between monoplane fighters built primarily of metal.

Chinese Nationalist pilots, primarily flying Curtiss Hawk IIIs, fought against the Japanese, but the Type 96 with its better trained pilots, appeared to better most opponent fighter aircraft it encountered. Though only moderately armed with only a pair of 303 machine-guns, the new fighter proved effective and damage-tolerant, with excellent performance, maneuverability, and robust construction. Later, Type 96s s also provided vital escort services for the then-modern but vulnerable Mitsubishi G3M bombers.

Some A5Ms still remained in service at the end of 1941 when the United States entered World War II in the Pacific. While US intelligence sources believed the A5M still served as Japan's primary Navy fighter, in fact the A6M Zero had replaced it on first-line aircraft carriers and with the Tainan Kōkūtai in Taiwan. Other Japanese carriers and Kōkūtai (air groups) continued to use the A5M until the Zero production numbers caught up with demand. On 1 February 1942, the US carrier USS Enterprise launched air strikes at Japanese air and naval bases on Roi and Kwajalein Atolls in the Marshall Islands. During these actions, Mitsubishi A5Ms shot down three Douglas SBD dive bombers, including the aircraft of LtCdr. Halstead Hopping, commanding officer of VS-6 Squadron.

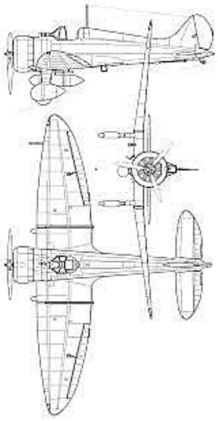
Suburo Sakai in his Type 96 cockpi.t

The last combat actions with the A5M as a fighter took place at the Battle of the Coral Sea, on 7 May 1942, when two A5Ms and four A6Ms of the Japanese carrier Shōhō fought against US aircraft that sank their carrier.[17]

In the closing months of the war most remaining A5M airframes were used for kamikaze attacks.

Mitsubishi A5M Specifications:

Length (m)	7.565
Wing span (m)	11.00
Height (m)	3.27
Wing area (m^2)	17.8
Gross weight (kg)	1671
Powerplant (hp)	710
Max Speed (knots)	235
Max range (nm)	648
Service ceiling (ft)	32,200



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Keeping up with the Play (Test yourself – how good are you, really?)

1. What causes an aeroplane to descend so steeply when in a sideslip whilst maintaining its correct airspeed?
   A. Because the lift is reduced when the airspeed is reduced.
   B. Because of the drag created by the deflected rudder.
   C. Because the drag created by the fuselage progressing partly sideways through the air reduces the lift/drag ratio.
   D. Because the upper wing has provided a lateral force increasing the effective weight.

2. From the list below select the only option that contains only heap-type clouds?
   A. Ac Ns Cb Cs Cu.
   B. Ac Cb Cu, Cu mam, Tcu.
   C. Ci, St, Fc, Ac, Cu.
   D. Ci, As, Cu, Fs, Ac mam.

3. An application of full aileron in level flight when the airspeed is very low can cause the control effect to be reversed i.e. left full aileron will cause a roll to the right. Why is this so?
   A. The angle of attack on the down-going aileron will exceed the critical angle and a stall will be induced.
   B. The control surfaces require airflow to be reliable and effective, so low airspeed means low aileron reliability.
   C. Propeller torque will automatically roll the aeroplane.
   D. The aeroplane requires a rigging check.

4. How does roll promote yaw, these axes are 90° apart?
   A. Roll promotes slip, and slip promotes yaw.
   B. Aileron drag promoted by the use of aileron provides yaw.
   C. The downwash behind the rising wing strikes the side of the rudder.
   D. The upwash behind the down-going wing strikes the side of the rudder.

5. Why can't a pilot make a compass turn whilst levelling out from a climb?
   A. Because of the compass turning errors.
   B. Because the change in G loading from climb to level flight will create erroneous errors due to pivot friction.
   C. Because the change in nose attitude will modify the dip angle.
   D. Because the aeroplane will be accelerating.

See answers and explanations overleaf.

If you have any problems with these questions, see notes below, or call me (in the evening) and let's discuss them. Rob Knight: 0400 89 3632 (International +61 4 0089 3632), or email me at kni.rob@bigpond.com.

1. C is correct.

With the controls crossed, the fuselage presents a larger keel surface to the oncoming airflow increasing the form drag. With greater drag, the lift/drag ratio diminishes and the aeroplane descends along a steeper path to maintain airspeed.

2. B is correct.

See: https://en.wikipedia.org/wiki/List_of_cloud_types

3. A is correct.

Level flight at low airspeed will necessitate a higher-than-normal angle of attack. To roll an aeroplane with aileron, one aileron (on the upgoing wing) is deflected down which increases the angle of attack on that portion of the wing. Such a deflection down, with the wing already holding a higher-than-normal angle of attack, may see the aileron cause that part of the wing to exceed its critical angle of attack and so create a stall condition. As the stall is on one wing only, being induced by that down-going aileron, the aircraft will roll towards it, the exact opposite to the direction of intended roll.

4. A is correct.

When an aeroplane's wings are not level, the lift force is inclined sideways, and this non-vertical lift force has a horizontal component which induces slip. As the aeroplane slips, the keel surface will cause it to weathercock and yaw.
See *Further effects of controls.*

5. D is correct.

Because the aeroplane will be accelerating, so acceleration errors will be encountered.

------ ooOOoo ------

Aircraft Books, Parts, and Tools etc.

Contact Rob on mobile – 0400 89 3632

Tow Bars

Item	Condition	Price
Tailwheel tow bar.	Good condition	**$50.00**

Aircraft Magnetic Compass (Selling on behalf)

Item		Price
Magnetic compass: Top panel mount, needs topping up with baby oil.		**$45.00**

Propeller Parts

Item	Condition	Price
Propeller spacers, Assorted depths, all to fit Rotax 912 UL/ULS propeller flanges	Excellent	**$100.00 each**
Spinner and propeller backing plate to suit a Kiev, 3 blade propeller, on a Rotax 912 engine flange.	Excellent	**100.00**

For all items, Contact me - on mobile – 0400 89 3632

Or email me at: kni.rob@bigpond.com

Aircraft for Sale

Kitset - Build it Yourself

$1,780.00 neg

DESCRIPTION

All of the major components needed to build your own aircraft similar to a Thruster, Cricket or MW5.

- Basic plans are included, also
- Hard to obtain 4" x 3" box section, 2 @ 4.5 metres long.
- Wing spar & lift strut material - 6 tubes of 28 dia. x 2 wall.
- 20 fibreglass ribs plus the moulds,
- 16 spar webs plus the moulds,
- 2 fibreglass flat sheets for the leading edges - 4 metres long x 1.1 metres wide.
- All instruments including,
- A Navman flow meter,
- A Powermate rectifier regulator,
- A ballistic parachute,
- A 4-point harness,
- Set fibreglass wheel pants, and
- More.

Box sections and tubes

Flow Meter, Navman, Ballistic Chute, etc

A very comprehensive kit of materials

Colin Thorpe. Tel: LL **(07) 3200 1442**,

Or Mob: 0419 758 125

Ribs, tubes, spats, etc

Thruster T85 Single Seater for sale.

$9,750.00 NEG

Beautiful classic ultralight single seater taildragger Thruster for sale; to good Pilot. Built in 1984, this is a reluctant sale as I inherited Skyranger V Max and two aeroplanes are too many for me.

The aircraft at Kentville

New Engine Rotax 503 Dual Ignition has only 10

Fuel tank

Instrument panel

Details

Built - 1991	Serial Number - 312
Model - Thruster 85 SG	Rego Number – 10-1312
TTIS Airframe - 638	Original logbooks - YES
Engine - *NEW* Rotax 503 DIUL	Next Annuals due – 05/11/2023
TTIS Engine – 10 hours	Propeller – Sweetapple, Wood, 2 Blades (as new)

Instruments - RPM, IAS, VSI, ALT, Hobbs meter, New Compass, CHTs, EGTs, Voltmeter & fuel pressure gauge

Avionics - Dittel Radio 720C and new David Clark H10-30

Aircraft is fitted with Hydraulic Brakes. Elevator Trim. Landing Light. Strobe Beacon. Auxiliary Electric Fuel Pump.is in excellent mechanical condition and the skins are “as new”.

Offers considered. Call Tony on 0412 784 01

Sky Dart Single Seat Ultralight for Sale.

$4,500.00 NEG

A single seat, ultralight, Taildragger. Built in 1987, this aircraft has had a single owner for the past 18 years, and is only now I am regretfully releasing it again for sale. I also have a Teenie II and am building another ultralight so I need the space.

The landed Sky Dart III rolling through at YFRH Forest Hill

TTIS airframe is 311 hours, and the engine, TTIS 312 – is just 1 hour more. Up-to-date logbooks available. 2 X 20 litres tank capacity. To be sold with new annuals completed.

It is easy to fly (for a taildragger), and a great way to accumulate cheap flying hours.

Call me to view, Bob Hyam, Telephone mobile 0418 786 496 or Landline – 07 5426 8983, or Email: bobhyam@gmail.com

Landed at McMaster Field after my flight back from Cooma just West of Canberra. In the cockpit with me is GeeBee, my dog

Single Seat T84 Thruster, disassembled and ready for rebuild.

I have a T84 single seat Thruster project in my hanger at Watts bridge.

The fuselage is on its undercarriage, the wing assemblies are folded up and the skins are with them.

Included is a fully rebuilt Rotax 503 dual ignition engine and propeller.

And, most importantly – the aircraft logbook!

Asking price $5000.00

Contact John Innes on **0417 643 610**

Slipstream Genesis for Sale

Slipstream Genesis. Built 2001. Two seats side by side, powered by 80 hp 912UL Rotax, driving a Warp Drive 3 bladed prop. Cruise 70-75 knots. Empty weight 304kg, MTOW 544 kg, Payload 240 kg. Fuel tanks hold 78 litres. With fuel burn averaging 16 litres/hr, still air endurance (nil reserve) is theoretically 5 hours, or 350 nm. Aircraft always hangared. It has been set up for stock control or mustering, and is not fitted with doors.

Registered until 13 October 2024, currently flying, and ready to fly away

Total Hours Airframe: 149.7. Current, up-to-date, logbook. Aircraft flying so these figures will change

Total Hours Engine: 1673.9. Annuals/100 hourly inspection due 07/06/2024. Sprag clutch replaced January 2020, gearbox overhauled January 2020. Just undergone ignition system overhaul. One CDI Ignition unit replaced PLUS brand-new spare unit included in sale. Easy aircraft to maintain - everything is in the open. Comes with spare main undercarriage legs, spare main wheel, and nosewheel with other assorted spare parts included. Sale also includes spare engine ready to fit (logbook available).

Fabric good, seats are good, interior is tidy. Fitted with XCOM radio/intercom. Basic VFR panel with appropriate engine instruments, and compass.

An article on this aircraft was published in Sport Pilot, June 2019 issue. See front cover and pilot report within.

Must sell: two aeroplanes are one too many. Quick sale - Fly it away for $10,000 including spare engine.

Contact **Rob Knight tel. +61 4 0089 3632**, **or email** kni.rob@bigpond.com for details and POH.

$10,000

Aircraft Engines for Sale

Continental O200 D1B aircraft engine

Currently inhibited but complete with all accessories including,

- Magneto's,
- Carburettor,
- Alternator,
- Starter motor,
- Baffles and Exhaust system, and
- Engine mounting bolts and rubbers.

$POA

Total time 944.8 hours. Continental log book and engine log are included.

Phone John on 0417 643 610

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