BRISBANE VALLEY FLYER

June 2024

BRISBANE VALLEY SPORT AVIATION CLUB INC

Watts Bridge Memorial Airfield, Cressbrook-Caboonbah Road, Toogoolawah, Q'ld 4313.
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The Rare and Mysterious Focke-Wulf Fw-189c. See page 22.

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Contents

Our website - **bvsac.com.au**

Greetings Members,

May has come and gone and not much has been happening around the club.

We have finally received a copy of club house plans from council and now we can move ahead with getting the approvals to put the new utility room on club house.

Our next meeting will be on 1st June at 10.30 am. at YWSG Clubrooms, so come and join us for a great day with friends.

Best wishes

Peter Ratcliffe
President BVSAC

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The Ultimate Turn – The Max Rate

By Rob Knight

How are your turns? Most pilots reckon they're fine, no problems. But are they really up to scratch in handling an emergency, when a quick change in direction is obligatory? When the chips are down, you'd better be good, because there won't be time to wonder about it!

A maximum rate turn.

The maximum rate turn is a manoeuvre that gets an aeroplane turned around in a confined geographical area, perhaps inside obstacles such as buildings, hills, trees, power lines etc., often when operating at low level. It can also be relevant in getting the aeroplane out of the way of another aeroplane. However, it should be noted right here that any need, in real life, to carry out either manoeuvre suggests earlier very poor alertness and/or decision making. Better pilots avoid the need for a max-rate or emergency turn rather than be forced to carry one out!

For the record - maximum rate turns are precision manoeuvres that require training to accomplish properly, and subsequent practice to maintain the developed skills.

To carry out a turn at a maximum rate turn, we must have the greatest possible horizontal component of lift to pull the aeroplane toward the centre of its turn. This can only be achieved by two things:

1. By maintaining the maximum angle of bank possible to incline the lift vector as far as possible towards the horizontal, and

2. By maintaining the highest practicable angle of attack to get the maximum amount of lift.

When the turn is occurring, the aeroplane is changing direction at the highest possible rate, i.e., maximum degrees turned through, in minimum time. For most light two-seat aeroplanes, the maximum angle of bank achievable whilst maintaining height will be about 60° and this can only be achieved with full power applied.

We all know that lift varies with both the angle of attack and airspeed. The highest useful angle of attack is about 15 degrees and at that high angle we will get both the maximum C_L (lift), and also very substantial drag. Any further angle of attack increase will precipitate a stall, which will kill about 80% of our produced lift, and increase drag exponentially.

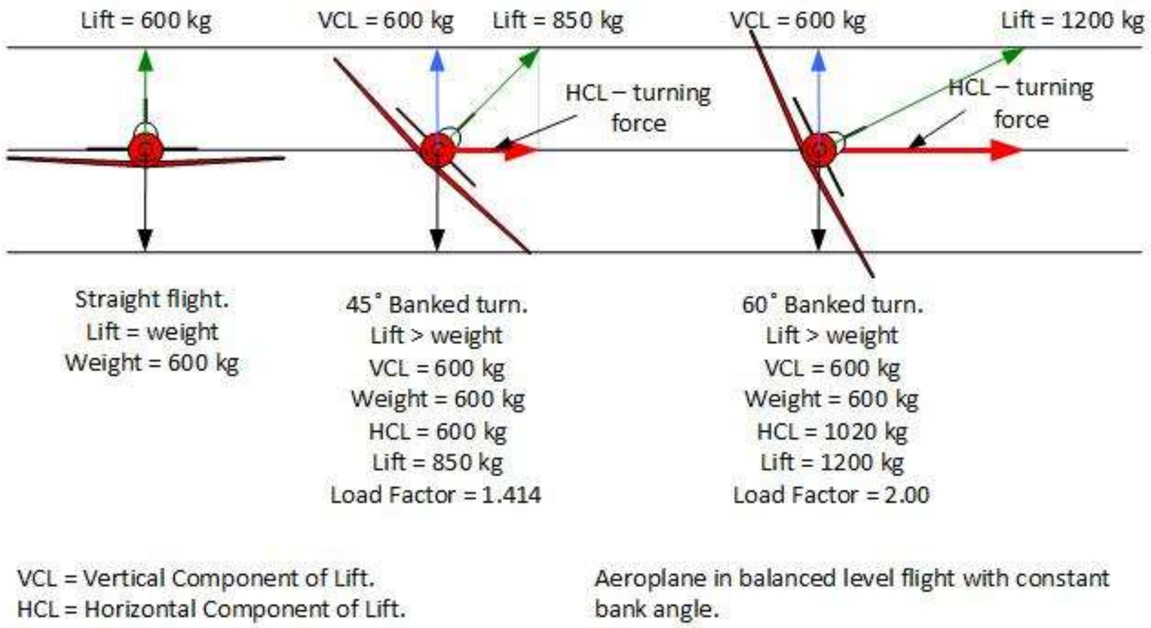
A well-executed maximum rate turn requires that the aeroplane , whilst banking, be brought quickly right up to the early edge of the stall onset, but absolutely no further. In practice, where a stall warning is available, this can be very helpful in identifying the exact amount of back pressure to hold the aeroplane on the edge of the stall onset for the maximum angle of bank achievable in that aeroplane at that weight and power.

Note that Emergency Turns and Maximum Rate/Minimum Radius turns are the SINGLE occasions where it is acceptable to continue to fly with the stall warning triggered and not carry out an immediate stall recovery. It is considered that pilots will have the necessary situational awareness required to purposely operate the aeroplane in this state.

From the following sketch, it's easy to see that the horizontal component of lift[1] (HCL) force rises substantially as the angle of bank increases. From zero when the wings are level, to 1020 kg of horizontal force in a 60° angle of banked turn. This clearly demonstrates the rising force pulling the aeroplane around in the turn as the bank angle increases; higher bank angle = higher rate of turn

[1] Also called Centripetal Force).

because the turning force is greater. Therefore, as stated, for a maximum rate of turn, we need the maximum angle of bank possible.



Forces in a 60°banked turn.

To obtain the maximum HCL force we'll need maximum lift which is only achieved at CL MAX, which, in turn, is attained at the critical angle, The high angle of attack means greatly increased drag, so full power must be used (power increase reduces airspeed decay caused by the drag increase, and also reduces the stall speed). However, once full power has been applied, the airspeed will have to reduce as the angle of bank increases.

However, we must now also note that, with the rise in the lift required to both turn and support the aircraft causing a rise in loading in the turn, we will also experience a rise in the aeroplane's stall speed which will increase as the square root of the load factor being applied. So, with a load factor of 2 being developed in a 60° banked turn, an aeroplane with a basic stall speed of 38 knots will now stall at 38 X √2[2] = 54 knots. Or, with a level flight stall speed of 50 knots, in a 60° banked turn, a new speed of 50 X √2 = 71 knots will apply. In a 75° angle of bank turn, in level flight, the load factor is 4, so an aeroplane stalling at 38 knots will experience a rise in stall speed of 38 X √4[3] = 76m knots, a value likely to be close to the level-flight-cruise speed of such an aeroplane.

As stated earlier, this is an emergency. Obviously, we'd want to enter the turn without delay, but to use a full application of control to enter might well bring its own issues.

As discussed elsewhere, and in previous articles, aeroplanes have a maximum manoeuvring speed (VA). This serious limitation on the airframe is the highest indicated airspeed at which a full or harsh application of aeroplane controls can be made. If, whilst the aeroplane is flying above this specifically nominated airspeed, a full application of controls, OR a sudden and substantial (harsh) control movement is made, the load imposed of the airframe may exceed the limits and a failure ensue, perhaps of a wing attachment or a tail section, either of which is likely to ruin your whole day.

Pilots should always be fully aware of their airspeed, and know whether their current IAS is above or below the VA for their aeroplane - it is, after all, a structural limitation of some note. If a maximum

[2] *√2 = 1.414.*
[3] *√4 = 2.00.*

rate turn is required, and the IAS is above the relevant V_A, a full application of aileron to enter the turn cannot be applied even though it's an emergency. Pulling your wings off entering an emergency turn is self-defeating and hardly good airmanship. Better to merely apply half the available control input and endure a slightly reduced roll rate to get the required bank. However, a pilot knowing the current airspeed relationship to his/her V_A will have an obvious advantage in knowing whether they can apply full control input. Note that the full control to which I refer is the aileron. In regard to rudder, note that only sufficient rudder to balance the adverse yaw from the aileron input will be necessary.

Warning: Some aeroplanes, such as home-builts, may be vague in regard to their specific V_A. An easy way to calculate this limiting IAS value is as follows:

> *Manoeuvring speed is stall speed multiplied by the square root of the limit load factor. E.g., given a PA38-112 Flight Manual limit load factor of 3.8G, and a flaps-up stalling speed of 48 knots, the manoeuvring speed would be 48 X √3.8[4] = 94 knots. For a GR Lightwing, which has a limit load factor of 4G and an observed stall speed flaps up of 38 knots, the V_A calculates out to 38 X √4 = 76 knots. And guess what? This is exactly what the POH advises.*
>
> *As the load factor is given for the aeroplane's MTOW, when operating at a lower take-off weight, the V_A can be adjusted for the lower weight by reducing the V_A by 1% for each 2% of take-off weight reduction.*

So why all the fuss about V_A? Here it is!

1. If the airspeed is above V_A **<u>for the weight</u>**, ***<u>and you don't want to risk pulling your wings off</u>***, the entry must employ both a smooth roll in (no harsh yanking on the control) ***<u>and</u>*** use less than full aileron deflection. Generally, in this case, the application of full power is delayed until the aeroplane has decelerated to V_A.

2. If the entry IAS is below V_A **<u>for the weight</u>**, the application of full aileron (with appropriate coordinated rudder to balance) can be used (smoothly) with a simultaneous rapid (but also smooth) advancement of throttle to full power.

The last limitation in achieving the maximum rate of turn is the pilot. Here, two issues arise - disorientation and G Loading.

Disorientation issues can be diminished by practice. Select a prominent reference point at the entry and use it to maintain orientation during the turn. In addition, regular practice at conducting the turn and rolling out after 360 and 180 degrees will assist in general orientation.

With increasing G loading, one's heart has more difficulty pumping blood to the brain. Because human eyes are acutely sensitive to blood flow, the effect on human vision of increasing G loadings is that spots are likely to form before the eyes from about +3G, with grey-out beginning at about +5G. A complete vision blackout will begin at around +6G. Note also that these effects vary between individuals and are heavily influenced by smoking tobacco, physical fitness, regular exposure to hi G forces, and anti-G manoeuvres or devices. As stated earlier, executing a maximum rate turn in most light aeroplanes will provide a maximum of 2G so these issues are unlikely to occur.

The following is a basic air exercise based on a general-purpose light training type aeroplane with a fixed pitch propeller and no ability to shed load as agricultural aeroplanes can do when the dump is operated.

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[4] *√3.8 = 1.96.*

Of note to a pilot flying this manoeuvre, will be the rapid rate of turn requiring a constant and accurate lookout as the aeroplane will be entering a new sector of sky every few seconds, especially in a high-winged aeroplane, and the need to retain their reference point orientation.

A. Air Exercise **(aeroplane IAS in excess of VA)**

Entry

1. Note reference point and roll in with a smooth application of aileron (not exceeding half available aileron application), balancing adverse yaw with smoothly applied rudder.
2. Stop the bank at 60°.
3. Apply sufficient back pressure to maintain height (the stall warning should be indicating the onset to the stall, or the stall onset buffet should be felt in the stick).
4. Simultaneous with the application of back pressure, check IAS and apply full power when IAS <VA.
5. Lookout.

What 60° left bank looks like

What 60° right bank looks like

In the turn

6. Check bank angle about 60° and maintain <u>constant</u>.
7. Check ball in the middle.
8. Check maintaining height. Note, if a descent indicates on the VSI, with minimum application of aileron[5][6], take a few degrees of bank off. If climbing, again with minimum application of aileron, increase bank a little.
9. Stall warning/buffet should be still heard/seen/felt.
10. Lookout.
11. Repeat from 6 until exit is initiated.

Exit the Turn

Prior to the nose reaching the desired exit point (for either 180 or 360 degrees of turn).

12. Judge approaching reference point and roll OUT with aileron whilst balancing with rudder.
13. Stop the roll-out at wings level.
14. Releasing back pressure to maintain height as the bank angle decreases.
15. Check ball in the middle.
16. Check maintaining height.
17. Check nose on reference point.
18. As airspeed rises back to desired level, reduce power to suit.
19. Lookout.

B. Air Exercise **(aeroplane IAS below VA)**

Entry

1. Note reference point and roll in with a full application of smoothly applied aileron, balancing adverse yaw with appropriate and smoothly applied rudder.
2. Simultaneously with the aileron application, apply full power with a smooth but brisk application of throttle.

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[5] *With the aeroplane very close to the critical angle, excessive aileron WILL precipitate a stall.*

[6] *This functions best on aeroplanes fitted with differential ailerons.*

3. Stop the bank at 60° and apply sufficient back pressure to maintain height (the stall warning should be indicating the onset to the stall, or the stall onset buffet should be felt in the stick).
4. Lookout.

In the turn

5. Check bank angle about 60° and maintain constant.
6. Check ball in the middle.
7. Check maintaining height. Note, if a descent indicates on the VSI, with minimum application of aileron[7][8], take a few degrees of bank off. If climbing, again with minimum application of aileron, increase bank a little.
8. Stall warning/buffet should be still just be heard/seen/felt.
9. Lookout.
10. Repeat from 5 until exit is initiated.

Exit the Turn

Prior to the nose reaching the desired exit point (for either 180 or 360 degrees of turn).

1. Judge approaching reference point and roll OUT with aileron whilst balancing with rudder.
2. Stop the roll-out at wings level.
3. Releasing back pressure to maintain height as the bank angle decreases.
4. Check ball in the middle.
5. Check maintaining height.
6. Check nose on reference point.
7. As airspeed rises back to desired level, reduce power to suit.
8. Lookout.

Happy Flying

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[7] *With the aeroplane very close to the critical angle, excessive aileron WILL precipitate a stall.*
[8] *This functions best on aeroplanes fitted with differential ailerons.*

The DHC-4 Caribou, Beasts of Burden with a Difference

By Rob Knight

In the mid to late 1950s the United States military opened submission for a specialised cargo aircraft that could operate on and off short unprepared airstrips, and with the fuselage egress sized and located to suit large and bulky freight items. The response from the de Havilland Canada Company, famous for its DHC-2-Beaver and DHC-3 Otter single engined aircraft, was the DHC-4 Caribou. This was the first multi-engined STOL design from the company.

An RAAF DHC-4 Caribou – a cost-effective and versatile flying workhorse.

Designated initially by the United States military as the CV-2, and later as the C-7 Caribou, the aircraft made its first flight on 30 July 1958, and went on to see service with both military and civil operators around the world, although now retired from all military operators, is still in use in small numbers as a rugged bush aeroplane by civil operators in 2021.

The Caribou design concepts mirrored those of the preceding Beaver and Otter – in both construction materials and design simplicity for field maintenance and the finished aircraft was both rugged in design and STOL in operations. The United States Army ordered 173 in 1959 and took delivery in 1961.

The STOL capabilities were excellent, and the design requiring runway lengths of only 1200 feet (365 metres) for normal operations and these figures quickly aroused the interest of civil commercial operators. U.S. certification was given in December 1960.

The iconic high gull wing design of the Caribou made it very distinctive in flight, reduced the length required for the undercarriage legs, and aided lateral stability.

The Australian Air Force (RAAF), in 1963, initially ordered 18 but added 7 more to that number in 1964. And it didn't stop there – four more were ordered as "one-off" orders over the years between 1968 and 71, to give a total number of Caribous purchased and operated by the RAAF as 29 aircraft.

Operated by No. 35 Squadron RAAF until 2000, 7 of these aircraft became the RAAF Transport Flight Vietnam in 1964 where they remained until 1971. These aircraft returned to Australia in 1972. All Caribous were transferred to No. 38 Squadron RAAF in 2000.

In the RAAF, a Caribou crew typically comprised four men, the Captain, Co-pilot, a Flight Engineer (who doubled as the Loadmaster), and an Aircraft Technician. Every Flight Engineer was required to be experienced on the DHC-4 to ensure a modicum of engineering expertise to fix issues and failures during operations. However, on long trips it was usual to carry additional "techos" for the ever-likely breakdowns that would occur away from base!

In flight, the Caribou cockpit afforded excellent visibility for both pilots, and the engine controls were located in the overhead console similar to a Twin Otter. Flying around with your hands up to hang them on the throttles sounds strange but in practice it worked very well and was surprisingly comfortable and intuitive. Also, mounting the engine controls on the overhead console allowed less-complex cables and wiring arrangements to manage and operate the engines. The space this freed up, central, and in front of the pilots, was then used to house a slide out console. To the Left of the Captain's leg on the sidewall was a vertically mounted hydraulic nose wheel steering tiller/wheel which is used for taxiing and steering on take-off and landing when the rudder was too ineffective, below about 40 knots.

The Flight Engineer stood between the elevated pilot seats for take-off and landing and sat in the cargo area for the majority of flight.

The 3 engine start toggle switches were mounted in front of the captain's left knee in a vertical arrangement and were labelled START, VIB and PRIME. In light of the radial engines' inclination for hydraulic locking on start, a Caribou's starter motors had "slip release" mechanisms to release the starter drive if it felt any resistance other than normal compressions. This meant that no engine damage could ensue from hydraulic locking so releasing the crew from the tedious task of pulling the blades through by hand prior to engine start.

The Caribou flight deck – note the throttles and other controls in the roof.

In the event, the right engine was started first, by pushing the start toggle switch to the right and after turning through 15 blades (or 6 on a warm engine) the captain called "contact". at this point, and pressed the VIB and Prime switches to their right: the co-pilot simultaneously moving the right engine ignition switch to the BOTH position. After the engine started and the RPM rose to about 600 RPM the Starter and VIB switches could be released and 1000 RPM was maintained using the using the primer only. Once all parameters and no fire lights are illuminated the co-pilot moves the Mixture to Auto Rich and the primer can be released. Sounds easy, eh? On a cold start, maybe, but on a HOT start…….?

As soon as both Pratt and Whitney R2000s are rumbling happily with the temperatures in the green we're ready for engine run ups. Brakes are checked when taxiing out and the propeller reverse is checked for correct operation (unusual to be fitted on a piston aircraft). This is accomplished by pushing the throttles up in to the roof and then pulling backwards. Two blue lights illuminate on the instrument panel to confirm that both propellers have moved in to reverse pitch.

Run ups are fairly conventional but like any radial engine all movements with the throttle adjustment should be gentle and slow. Props are checked and the pitches cycled through full fine and full coarse at 1900 RPM. The ignition check is carried out at static manifold pressure (roughly 30" at sea level). Because the propellers are not governing at this power it is not only a check of the magnetos but also general engine health. The RPM should be within 50 RPM of that placarded (around 2200 RPM), obtained from initial test flight data.

After engine run ups, the pre-take-off checklist calls for flaps to be set anywhere from 0 to 25 deg. Look, again, overhead in the overhead console behind the engine controls for the flap lever and the flap setting indicator on the instrument panel for the current setting (one of 4). A short field, minimum length take-off flap setting is 25 degrees, with a rotate speed of 63 knots, at a MTOW of

28500 lbs. The aircraft can get airborne well below 60 knots but 63 knots is used as it coincides with the minimum VMCA[9] speed.

As the take-off roll only takes around 8 seconds, this is phase of flight must be thoroughly prepared for. 30" of MP[10] is set, and, whilst the aircraft is held stationary on the brakes, power advanced slowly to 50" giving 2700 RPM before the brakes are released. Care has to be taken to limit throttle movement as the supercharged engines can be over-boosted at sea level beyond their 50" maximum. After brake release, acceleration is brisk and directional control is by the nose wheel steering through the little tiller until reaching 40 knots when the rudder becomes effective. Until now, the pilot non-flying has held the yoke, and the pilot flying has been controlling the aircraft's direction with the little tiller. At 40 knots the pilot flying calls "my controls" and transfers their left hand from the nose wheel tiller to the control column to give them full control.

At rotation speed it takes a reasonable amount of back pressure to lift the nose to the climb attitude. Once airborne the captain selects the gear up using a lever just to the left of the throttles (in the roof) and requests flaps 15. As the aircraft accelerates above 74 knots, flaps are selected up by the co-pilot. At 300 ft power is reduced to METO[11] (42.5" MP and 2550 RPM) and at 500 ft CLIMB power is selected (35" and 2250 RPM) and the aircraft is settled in to the climb at 105 knots, achieving a leisurely 700-800 fpm depending on the aircraft weight. Note that all throttle work is controlled by the pilot flying, and prop and mixture changes adjustments by the pilot monitoring. As altitude increases, throttles must be advanced to counter the diminishing efficiency of the single-stage superchargers, and maintain 35" MP. Typical cruise altitude is 9000-10000 ft using a power setting from the flight manual that equates to 700 brake hp, usually around 31" MP and 1900 RPM. Below 750 hp, an auto lean mixture can be selected. This gives a cruise speed of around 120 KIAS (Indicated Airspeed) or 140 KTAS (True Airspeed) burning 600 lbs (1964 litres) per hour of fuel. This gives good endurance with a max fuel capacity of just over 4800 lbs.

In flight, rudder forces are relatively light and its effectiveness is high at low air speeds, which enables such a low VMCA. However, there is a down side - because of the high positioning of the rudder relative to the aircraft centre of gravity, a rapid application of full rudder at low airspeed can result in an initial roll OPPOSITE to the direction of rudder application. what one would normally expect. Aileron forces are also comparatively light and thus easily manageable below about 120 knots: above this speed, their heaviness increases rapidly.

Given its cumbersome size, the Caribou is a very manoeuvrable aircraft. When operating at low level or in restrictive terrain, a special precautionary configuration of 15 degrees flap lowered, and power reduced to give 80 KIAS in level flight could be used. This provided a lower nose attitude to improve flight visibility for the pilots and enabling smaller radius turns in confined spaces. Large wing overs could also be flown which were not only fun but also an effective means of losing altitude after dispatching paratroopers from the rear ramp. Cargoed packages, ranging from light cardboard "heliboxes" to "A22" palleted loads up to 2200 lb in weight, could be airdropped from various altitudes. Being pushed along the rollers in the cargo area to the rear door, after exiting, their parachutes would be static line opened. Using LAPES[12], the Caribou could deliver loads up to 4000 lbs flying at a height of 3-6 feet off the ground with the landing gear extended, Google it for a quick search – there are plenty of examples. Using LAPES, developed by the U.S. during the Vietnam War delivering aircraft could fly accurately in to a cleared area and precisely deliver loads and avoid their exposure to ground fire by eliminating being stationary whilst discharging their loads. The exercise was still not without risk, the load could get hung-up in the cargo bay with the parachute still

[9] *VMCA - Minimum Control Speed Air. (Google "V speeds".)*

[10] *MP – Manifold pressure – the pressure of the air/fuel mixture in the inlet manifold of an engine.*

[11] *METO – Maximum continuous power.*

[12] *LAPES - Low Altitude Parachute Extraction System.*

attached and create a monstrous drag issue but this was considered to be a much lower risk than elimination by ground fire whilst stopped.

Cruise descents were flown with a at a power of 28-30" applied, and 1900 RPM. This gave 140 knots and a unhurried 500 fpm rate of descent to minimise shock cooling in the Prat and Whitney's and for passenger ear pressure balancing comfort in the unpressurised cabin. As under boosting a radial engine can be just as damaging as over boosting, pilots always planned, where possible, to use at least 1" MP per 100 RPM for descents (i.e. when at 1900 RPM, have MP at 19" or more.

RAAF Caribou overseas – a visitor to Omaka (NZOM).

The compulsory re-join checklist covered important items such as selecting Auto Rich mixture. The same rejoin practice as civil aircraft joining a civil circuit was used. The aircraft descended to circuit height normally not below 1000 feet and on downwind the airspeed was reduced to below 120 knots and then further reduced to 105 knots to allow 15° of flap to be extended. As a standard procedural turn was used to get around onto final approach, abeam the landing threshold the stopwatch was started and, in nil wind, at +30 secs the turn onto base leg was commenced. Power on the base turn was set to about 15" to 17" MP and an attitude to give 80-85 knots with a 15-20° angle of bank.

Turning onto finals for a short field landing should occur at 500-600 ft AGL on an approach slope considered much steeper than normal for larger aircraft. Flaps were lowered further, to 30°, below 85 knots, causing a severe nose up trim change (as expected in a high winged aircraft as the flap application raises the drag line). This has the pilot flying franticly applying forward trim to relieve the now quite high elevator stick pressure to counteract the ballooning effect and hold the nose at the desired approach angle. Finals checks were then carried out, selecting props to full fine pitch which then pulled the speed back to achieve and maintain the desired threshold speed of 66 knots at typical weights. Full flap extension of 40° was infrequently applied for landing, as it only reduced the approach speed by a couple of knots and made the ailerons much heavier due to the ailerons drooping with flap extension.

Aileron authority on finals at such a slow speed was quite poor and required substantial control applications in turbulence. With so much extra drag from the flaps, large power changes were required to remedy airspeed issues quickly. Even a few knots too fast over the fence on a 350-metre strip in a 12-tonne aeroplane can quickly ruin one's day!

Another side effect of the blown wing was that all large power increases resulted in a lot more lift so one had to be ready to lower the nose as power was increased otherwise you also end up quite steep on profile. Being fast over the fence would also require the aircraft to fly nose low and potentially land the nosewheel before any other part of the aircraft. If the pilot flying nailed the airspeed correctly, the flare was commenced at approximately 30 ft (judged visually) and the big Pratts pulled back to idle to achieve full back elevator just as the stick shaker comes on, with both mains kissing the hard stuff gently. Absolutely satisfying when you nail it! Once the nose wheel is on the runway both throttles are pushed up into the roof to engage reverse pitch confirming with the 2 blue lights mentioned earlier. The captain then verbalises "two blues, your controls". The co-pilot now has control of the yoke and the captain transitions to the nose wheel steering tiller, and pulls back on the throttles to increase the RPM with reverse pitch. At 30 knots reverse thrust is cancelled to avoid ingesting too much debris. These actions all happen rather quickly, and the brakes must be used as well to ensure a minimum stopping distance. Parking and shut down was conventional and required the observing of a maximum cylinder head temperature of 180 degrees prior to moving the mixtures to Idle Cut-Off.

With either engine out, single engine performance in the Caribou was adequate but not startling. Because there was no simulator all practice was carried out in the aircraft using "zero thrust" of 15" MP and 1500 RPM. The large rudder provided ample control in the event of a failure (providing you were above VMCA) and full power on the live engine would give about 300 fpm rate of ascent at MTOW at sea level. Like any radial engine however it did not like to be run at high power for extended periods, and sometimes even after 5 mins the oil temp on the good engine would be reaching the maximum limit during training, requiring the "good" engine to be throttled back. I would not have liked to have had to rely on one engine for 30 mins at METO climbing out of a valley in PNG on a hot day! Conducting STOL approaches required a committal height of 400 ft single engine to allow for the height loss in the event of cleaning up for a go around.

The Caribou was a very versatile and practical aircraft in the RAAF roles for which it was purchased. It was economic to operate and very functional in its various applications and locations it serviced.

The Caribou – Short Take-off in PNG.

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Disasters in Design - The Christmas Bullet 1918

By Rob Knight

The Christmas Bullet was an American single-seat cantilever wing biplane, considered by many to be among the worst aircraft ever constructed for its time.


The first Christmas Bullet.

Doctor William Whitney Christmas, born September 1st, 1865, in Warrenton, North Carolina, was educated via St. John's Military Academy, the University of Virginia and George Washington University. He earned Bachelor, and Master of Arts degrees, and later became a medical doctor, but eventually quit his medical practice to devote himself to aviation, ignoring the fact that he had absolutely no background in aircraft design or aeronautics.

Christmas claimed to be one of the first aeroplane pilots and insisting that he'd made his first flight in March 1908 in his custom designed plane, but had torched the aircraft to protect his design secrets. This has never been confirmed but he surely patented, built and flew a biplane of his own design in 1909. It was known as the Red Bird.

After the Red Bird he built the Red Bird 2 and founded the Christmas Aeroplane Company in 1910 and, under this Company name, produced his most famous, controversial and "revolutionary" design, the Christmas Bullet. It was a prototype biplane fighter which had no interplane struts or flying wires to brace or support the wings. In his promotional material, Christmas described the aircraft as being capable of flying to Germany on a mission to kidnap Kaiser Wilhelm II.

His Bullet was ready for test flying in the Autumn of 1918, but Christmas couldn't get a pilot prepared to risk his life even to do test hops on the runway. Pilots would come to look, then depart - but no one was prepared to take aloft an aircraft with wings designed to flap like a bird during flight. Finally, Cuthbert Mills accepted the challenge. It is not known how much Christmas paid him, but Mills took the Christmas Bullet up for a maiden flight and soon after take-off, at a very low altitude, the top wings failed and tore from the fuselage. The aircraft dived steeply into the ground at speed and Mills was killed instantly

But Christmas, not to be discouraged by the first Bullet fatality, constructed a second aircraft identical to the failed first. Christmas advertised this second plane as "the safest, easiest plane in the world".


The second Christmas Bullet, before its flight.

The test flight of the second plane also resulted in a fatal crash when the uncontrollable aircraft flew itself into a barn, killing the pilot, Lt. Allington Joyce Jolly, and destroying itself.

The Christmas Bullet is generally acknowledged as the worst aeroplane ever built and some aviation historians have called Dr. Christmas "the greatest charlatan whose name has been associated with aircraft". It is one of the only multi-example aircraft types in the world with a 100% casualty rate.

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See and be Heard – Dodging a Mid-Air Collision.

By Rob Knight

The recent rash of mid-air collisions reminds us it's not enough to assume that other pilots will always join a circuit correctly, fly that circuit correctly, use their radio as they should, or even keep a lookout for us.

Perhaps it's the seemingly uncontrolled nature of mid-air collisions, both before and after colliding, that makes them one of a pilot's greatest fears and most discussions regarding collision avoidance centre on the rules for flying a safe visual circuit. While following the rules is vital, the range of midair accidents demonstrates that it's not enough just to review them and consider best practices. We all must raise our defences and improve our techniques, not only to see and avoid compliant pilots, but also to see, avoid, and de-conflict from those who don't comply, intentionally or otherwise. To this end, let's look and see some accrued details from statistics.

What we DON'T want to see….

As one might imagine, the time of day, flight direction, location, and other factors can each have a sizeable effect on the timing of midair encounters and tragedies. Some reported specifics about mid-air collisions are:

- Fifty-six percent occur between 1200 and 1600 hours—32 percent between 0800 and 1200, and only two percent at each of night, dusk, or dawn.
- Most mid-airs are between two aircraft going in the same direction in good visibility.
- Pilots in mid-air collisions typically are not on a flight plan.
- Almost all occur at or near non-towered airfields, below 1000 feet, and involve pilots of all experience levels.

The above reinforces the notion that the closer aircraft fly in proximity to each other, the more numerous the opportunities for a midair collision. Obvious, perhaps, but a vital clue to our personal behaviour – the closer we get to an airfield, the more vital good lookout skills and good practices become.

Over my years flying I have had such an ample sufficiency of "close calls" to be sated for the balance of what life I have left. Here, I will mention just two incidents. Both occurred whilst I was instructing, and both had a clear potential of fatality. And flying skills were not any advantage in extricating myself or my aircraft from the incidents I relate.

A seriously close encounter of the first kind with another aircraft occurred in 1977. I was with a student new to circuit training, and had just turned onto the downwind leg for runway 21 at Ardmore in South Auckland, New Zealand. Julia worked as a cashier for a Bank in Papakura and was doing her training after she finished work for the day. It was about 1600 hours NZST, on a day that had been perfect for flying. Even though the day was drawing in, there were no visibility issues except, to the south, a little smoke haze hung low. We were the only aircraft in the circuit.

I called downwind and was given number one which I acknowledged. The radio crackled again - incoming. A Piper PA30 Twin Comanche ZK-DOK reported at Drury (a local VFR reporting point) for rejoin instructions. Also based at Ardmore, DOK, was cleared to join downwind for 21, and to make number two to the Victa (ME) downwind ahead.

The Victa 100s cruise speed, not being in the same speed class as an SR71, put us mid downwind when the Comanche called again. “DOK downwind for a full-stop, 21”.

The tower responded, giving them “number two”, and instructed them to report when they had us in sight. Immediately DOK replied that we were in sight, and acknowledged they were making number two. Then, maybe a minute later, even over the noise of the Victa (we didn’t wear headsets in those days) I could hear a noise with rising volume. Then the afternoon went dark.

I looked up into the starboard wheel well of the descending undercarriage of the Comanche about a metre above us. I remember seeing the tire, slowly begin to rotate in the airflow, and the pin in the centre of the tire valve shining in the afternoon sun.

I yanked the throttle closed and let the Victa sink. I couldn’t push the stick forward – the tail would have struck the aircraft above. For once, drag was on my side and we began to slow. The Comanche drew ahead and we were rolled violently left in its wake.

DOK’s pilot was reported by ATC, and had to face an NZCAA enquiry where he was reprimanded. He explained that he had lost sight of us under his nose and assumed that we’d not maintained the circuit height accurately. His lack of concern nearly killed us.

The second encounter of the first kind was at a flying competition day at Hobsonville airfield on the northern edge of the Waitemata Harbour. I had been allocated the role of air judge for the forced landing competition and, by lunch time, had finished my list of competitors. It was a private airfield and the arrangement was that, in light of the dangers of collision the competition provided, there were to be no other aircraft operating in the circuit for its duration. After I landed with my last competitor and had shut down, the OC for the competitions approached me with yet one more, a late entrant, and asked if I’d do one more flight. I agreed and we walked out to the Piper Tomahawk the entrant was using.

The take-off and climb to 2500 feet overhead was uneventful. I set up his engine failure and marked his score- as he descended. The radio had been silent for the duration, and I had been looking out as normal and had seen no signs of other aircraft. The checks completed, we turned onto finals at about 400 feet. With no other aircraft seen, and no radio calls, all the indications led me to believe that we were still alone. The marking sheet was full except for the last boxes for his use of side slip/flap and his final landing-on-the-mark score. We sank through about 150 feet AGL and I noticed the mass of observers along the sides of the runway streaming away, a dark mass of running people. I wondered why?

With full flap, the pilot dropped the Tomahawk just over the boundary fence and pulled firmly on the brakes, when a Cessna 152 over flew over, missing us by about ten feet. He landed about forty feet in front of us, slowed, and cleared the runway to taxi back to the aircraft parking area – completely oblivious to our presence.

To say there was a rather tense de-brief afterwards is a vast understatement. The pilot apologised; he had never seen us at any stage of his flight. The OC also apologised. It appeared that, after we took off, the 152 pilot, A L.A.M.E., told the OC that he needed to fly one circuit to check a rough running engine. The OC had authorised it, instructing him to make all the normal radio calls and to ensure that he kept me in sight. However, the pilot set the wrong radio frequency on the dial and none of his transmissions were readable by us. Also, on the climb - crosswind - his engine was again running so rough he feared he’d not make it around a normal circuit so he made a tight, low-level dash around the patch and, in the process, lost visual contact with us.

When we looked at his flight path, he was either under our port wing, or behind us, so we never had any opportunity to see him. And we were mostly hidden above his high wing. Back in the day there were no hand-held radios, and no time for the OC to run and get into an aircraft to advise us of the

152s predicament and position. Above us and behind, we couldn't see him, and, on finals, he couldn't see us because we were ahead and below his nose, in the blind spot. Far too close for comfort! What really got me wound up, though, was why he had to carry out his test flight whilst we were airborne. We would have been back in less than 10 minutes. His rush and the rank stupidity of the OC for authorising it nearly ended everything for all three of us.

My providing these two insights into the issue, serves to illustrate that such disastrous conflicts can develop at any time, in spite of good lookouts being exercised, and good procedures being followed by one of the involved aircraft.

So, what can we do to mitigate these dangers. I can only answer by advising – to carry on doing what we do. Plus, as an instructor, I also encouraged my students always do the following:

- Absolutely verify the radio frequency set is that for the airfield before entering the manoeuvring area of the airfield, its circuit, and/or its wider traffic area. Always monitor same.
- Always report position at 10 miles and 5 miles out when inbound, and listen and verify reports from other inbound traffic or airfield traffic.
- Report overhead and/or joining downwind, turning base, and turning finals. I make the calls turning because there is more aeroplane to see when banked so I am easier to identify and locate by other aircraft – airborne or on the ground.
- Maintain a constant and intense visual scan for other aircraft. Remember—there may be dissimilar aircraft in the pattern without radios.
- Use exterior lights (where available) to improve the chances of being seen by others.
- Always assume that there's someone else out there who is not informing me of his/her presence, or location, or intentions. I must see them – they're not looking for me!

In the circuit pattern we all tend to fixate on the runway, it's perfectly natural in the circumstances. But this passion must not be allowed to overwhelm the need for a continuous lookout, especially after a lookout has been done and nothing was sighted, and the radio remains silent. However, the runway in sight, one look, and a silence in the headset is not enough, and the lookout rate must be upgraded. It's also important to look all around the airfield, not just along the circuit legs ahead. Look with the sides of your eyes, trying to discern movement, and when you see it IDENTIFY IT! This last point is vital if helicopters are operating at the field where you are operating.

Over the years I have developed my own, personal, strategies to protect myself against pattern-compliant and non-compliant pilots:

See And Be Seen: Turn on all lights and strobes (where fitted) when in the vicinity of an airfield. Flashing lights in particular attract attention. Lights may not be easily visible on bright days, but, once in the habit, it's less likely I'll forget when its cloudy, and it might make a difference.

Hear And Be Heard: I make all calls according to the standard phraseology to simplify it for other listeners. I ensure that all received calls are understood, and I am always precise with my given positions and altitudes. I make my calls concise; I don't ramble and take up radio time but ensure that receivers listening can understand where I am and what my intentions are.

I remember, Always AND also, there may be aircraft operating perfectly legally without a radio. And it's far from "unheard" of for a pilot to have set the wrong frequency and inadvertently removed him/herself from all radio participation (been there-got the T shirt). So, although I actively listen as well as broadcast, I don't assume that not hearing someone on the radio definitely confirms there no other aircraft are nearby. My only defence to that is to keep a sharp eye outside.

Do What's Expected: I naturally look for other airplanes where I'd expect to see them in the circuit pattern, and I protect myself by doing what others expect me to do. I fly the normal pattern at the normal heights and speeds for my aircraft, and I make the normal radio calls. Even if someone suffering from ID-10-T disease (IDIOT) is screaming through the circuit pattern loaded with other traffic, he/she'll be looking for me in the usual places. I try not to surprise them, surprise is bad. I protect myself by being in the right place.

Don't Argue Over the Radio: Regulations and standard circuit pattern practices define who has the right-of-way in the airfield circuit. I don't ever argue the point on the radio if I see a conflict or am conflicted with. It's not a contest—but even if it was, I have to survive first, before I can claim a win.

Too close to home. YCAB, Friday, 28 July, 2023. Fatal midair between a Piper Pawnee glider tug landing on one runway, and a Jabiru taking off on another.

We'd all like to think that everyone follows the rules for airfield circuit patterns and right-of-way rules. Most training, written articles, and discussion about mid-air collisions focuses on these rules, assuming that everyone complies when faced with a critical review. Unfortunately, there are some "unreachable" pilots around that won't get the message, or will ignore if they are. Many others may create an inadvertent conflict so it's always important to assume that not everyone will follow the required rules – some by design, others by error, or even incompetence. In those cases, you'll need your superior competence to make up for the lack thereof in others. When that happens, only you can protect yourself and your passengers.

Obviously, there are far fewer chances for a mid-air collision at controlled airports because someone is employed in a glass tower just to watch out and stop aircraft banging into each other. However, that should not necessarily make non-towered airfields dangerous. It's all a game of see and be heard, keep your wits about you, and don't EVER take anything for granted. "*Hope*", is pretty thin armour to protect you from a midair; "*knowing"* provides much thicker protection.

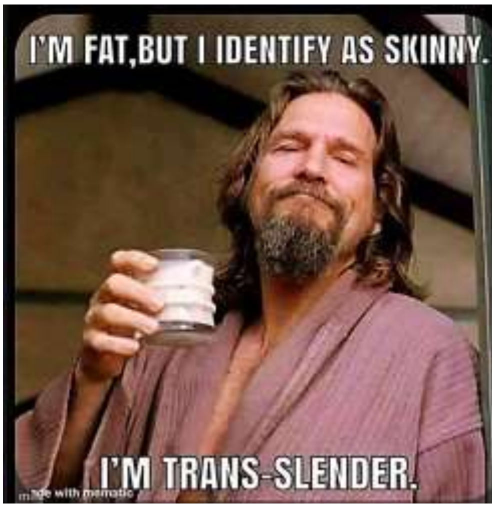
Know what and where your traffic is – ALWAYS.

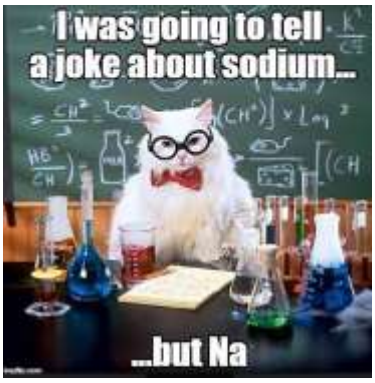
Happy flying

------ 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 Days of Our Lives (Feedback from a Flying Instructor).

By Rob Knight

The day was great for flying and the Aero Club was intensely busy. There were Tomahawks and Victas with students and instructors criss-crossing the apron, and Cherokees and Cessnas on hire chasing them. The Flight office counter was 3 deep in people reporting in for their next bookings or passing the details and cheques for their last flights. It warmed my heart as these were the days when the Club made my wages.

One man at the back stood apart. Tall and distinguished, he wore a trilby hat over a dark suit, and carried a tooled leather briefcase. As my previous student was writing out their cheque, he stepped up to the counter and spoke to Maurice, a colleague instructor standing beside me, and said that he was taking DGJ to Hamilton and could he have the keys, please. Maurice looked at him – a total stranger, and asked for his license and logbook.

The stranger drew up to his full height of about 6-foot 1-inch (185.5cm), and said, unapologetically, that that he didn't have either his license or his logbook with him.

That was a real red flag! Everyone needed to produce these on demand when hiring an aircraft, even if they were a member of the Club. Both Maurice and I looked at him, and Maurice said that without them he couldn't fly as PinC. It was the Club's rules, even for members.

The response from the man in the suit was intended to intimidate. He glared at Maurice and replied, "Do you have any idea who I am?"

"No", said Maurice, "Do you know who I am?" The man stayed silent and Maurice continued. "I'm your authorising instructor and you'll have to either show me your logbook and license for inspection or you can't fly without an instructor."

The man's glare deepened. He threw his briefcase up onto the counter and said, I am Doctor Ian Walsh. You'll have heard of me? I have to get to Hamilton urgently, I have a medical conference to attend."

"Na, Mate, never heard of you. Why should I know who you are?"

The suit snorted and said angrily that he was not accustomed to being spoken to in such a manner and that the Club Committee would be advised of his offhand attitude and insolence.

Maurice, somewhat aggrieved, added that without his license we had no way of knowing who he really was, and, without a log book it couldn't be ascertained that he was current – both being requirements of our insurer.

The suit grabbed his briefcase and holding his hat, stormed out of the Clubrooms vowing never to grace us with his presence again. He'd give his business to another organisation.

Maurice called and advised the other hire organisations at Ardmore and I understand that he did try others but no-one would give him a hire aircraft.

Our caution was justified. Sometime later we were told that the man had been charged with aviation offenses. He was not a doctor of anything let alone medicine, and his name was not Ian Walsh. We were told that he suffered from mental health issues and that he'd tried the patience and professionalism of various other Aero Clubs and Flying Schools in New Zealand's South Island. Although he had once held a PPL, it had been taken from him by NZCAA on mental instability grounds several years before his appearance at the Club.

Had we allowed him to hire DGJ, he'd have been likely to have had an accident, and it's unlikely we'd have had a sympathetic response from our insurer.

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

WTF - The World's Worst Aircraft – the Fairey Rotodyne 1957

By Rob Knight M24-149

The concept of a vertical take-off airliner has captured the imagination of designers and airlines virtually since passengers were first taken aloft in a balloon, 200 odd years ago.

The Rotodyne was a compound aircraft with wings, tractor engines and a tip-driven rotor system. Unfortunately, it was use of the tip jets at and near the airport that was the problem. The Rotodyne put out a painful 106 decibels of shrieking noise. Much work was done on silencers, but it was never reduced to the 96 decibels that the authorities demanded. Budgetary problems of the time saw the RAF and British Army withdraw their interest and the Rotodyne became a wholly civil project. Fairey talked up expressions of interest from BEA in the UK, New York Airways and the US Army, but the crucial launch order never came. British government policy to rationalize the industry saw the end of the Rotodyne and Fairey as an airframe maker in 1962.

The Fairey Rotodyne in flight

The Rotodyne display at the 1958 Farnborough Air Show was eye catching, with its impressive operating airspeed of up to 156 knots being demonstrated. This was almost 20 knots faster than the official rotorcraft world speed record of the time.

SPECIFICATIONS:

Crew and Passengers:	3 and 48 respectively.
Powerplants:	2 X 2800 hp Eland NEL7 Turboprops.
Cruise speed:	160 knots.
Rotor diameter:	27.43 m.
Length:	17.95 m
Height:	6.8 m
Weight:	14,969 kg

The Rotodyne operational concept was for it to take-off and climb vertically to 1000 feet and then transition to level flight/climb using the two turboprops to provide forward thrust to accelerate the aircraft. As the turboprops also provided air pressure through the rotor tip jets to spin the rotor, as the props took over and provided thrust, so the engines supplied less rotor spinning pressure at the tip jets and the rotor auto rotated as an autogyro to assist with lift in normal flight.

The downfall of the Rotodyne was primarily twofold. Its noise factor was one, with its rotor tip jets providing a pain-filling 108 decibel shriek on take-off. The second was the heavy cost of development. With no like-concept aircraft designs to follow, Fairey found the development costs prohibitive and, in light of the ever-increasing foreseeable financial load, the British Government withdrew its support and the project was cancelled in 1962.

Another notable factor was the serious over-weight issues Fairey were experiencing in the rotor head design. Even before the first flight trials began, the weight of the operating rotor head had increased two-fold over the first estimates.

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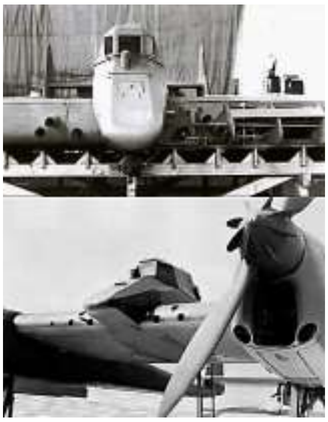
The Mysterious Focke-Wulf Fw-189C

By Rob Knight M24-163

The cramped Focke-Wulf Fw 189C cockpit was home to a crew of two, seated back-to-back - the pilot facing forward and the gunner, aft.

The Focke-Wulf Fw 189C was a unique descendant as a development variant of the FW 189, a 3 seat, army co-operation and reconnaissance aircraft for the German Luftwaffe in WWII. While not as numerous or renowned as some of its contemporaries, the development of the FW-189C offers an insight into the novelty and trialling of German wartime aircraft design to broaden the offensive capabilities of the Luftwaffe aircraft when development and manufacturing resources were so stretched.

Based on the successful Fw 189, a reconnaissance aircraft, the Fw 189C was developed as a resource-poor response to the evolving needs of the Luftwaffe for a heavily armed ground support and attack aircraft. The characteristics that were intended to retain were the original Fw 189 distinctive twin-boom design and centrally mounted cockpit/fuselage as the manufacturing tooling and jigs were already established and thus the less expense and time would be expended to change the role of the new design.



A major modification in the Fw-189C was the replacement of the large glazed, hi-viz cockpit with a heavily armoured central nacelle for protection from ground fire.

The original FW-189 design.

The ability of the original Fw-189 to withstand significant damage was a major factor in the selection of this design to modify in light of the potential disastrous damage inflicted on such low-level strike aircraft. The Fw 189 had proven its worth in aerial reconnaissance and light bombing roles the primary aim now was to transform the reconnaissance aircraft into a more robust, armoured ground-attack plane capable of withstanding intense hostile fire, especially during low-altitude operations.

However, the re-engineered design that culminated in the Fw 189C faced several great challenges during its development. The additional armaments and armour significantly increased the aircraft's weight, substantially reducing its performance and manoeuvrability.

The rear section of the nacelle, was fitted with defensive armaments to protect against enemy aircraft attack: the twin-tailed layout maximizing efficiency and defensive capabilities within the confines of the modified nacelle.

The attack armament of the Fw 189C also bore very significant changes. Here, the aircraft was equipped with an array of weapons suited for its ground-attack role. Included here was the potential to fit machine guns, large calibre, rapid-fire canon and attachment points for rockets and several different sized anti-personnel bombs, and heavier explosives for tank and ground establishment attacks. It is noteworthy that the two Argus As 410, 460 hp, V12 engines from the original FW-189 V1 design, were retained.

A major and serious limitation lay in the re-designed and now armoured cockpit. The armour that provided the crew safety, necessitated the fitting of very small armoured glass windows which then savagely restricted their visibility. For the pilot, this limited field of view made it difficult to navigate, identify targets accurately, and assess situational threats during combat. For the gunner, the reduced visibility impeded defensive capabilities, crucial for defence against enemy fighters.

Furthermore, the modifications to the FW_189c's central nacelle resulted in a major shift in the aircraft's centre of gravity, which, in addition to the weight changes relating the new big-gun armament and bombs, result in near insurmountable challenges in handling and stability.

Initially, only two prototypes of the Fw 189C were constructed, a reflection of both the experimental nature of the project and the constraints of wartime resource allocation.

The first prototype was a direct modification of the original prototype designated as the Fw 189 V1, repurposed and redesigned to emerge as the V1b. This prototype underwent a series of tests to evaluate its ground-attack capabilities, including its manoeuvrability, armament effectiveness, and the practicality of the armoured nacelle design.

During these tests, the Fw 189C was pitted against other ground-attack aircraft of the era, such as the Henschel Hs 129. This comparative evaluation was central to the determining of the Fw 189C's viability and potential superiority over current ground-attack aviation asserts. The Luftwaffe was particularly interested in assessing whether the Fw 189C's adaptations offer ed any significant tactical advantages on the battlefield

Responding to these findings, yet more modifications were undertaken, including enlarging the pilot's windows to improve visibility and redesigning the rear section of the aircraft for better performance. Despite these efforts, the Fw 189C's evaluation phase displayed inherent design limitations that could not be fully alleviated and it was decided that further modifications were not likely to be cost-effective.

The conclusion of the Fw 189C's testing phase was marred by an unfortunate incident – the prototype was written off following a crash during landing. This accident not only halted further direct evaluation of the prototype but also symbolized the broader challenges faced by the project.

Ultimately, the Fw 189C did not enter production, an inevitable decision driven by the results of the design's extensive testing and evaluation, and the evolving priorities of the Luftwaffe.

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

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

1. What force opposes weight when an aeroplane is in a steady climb?
   A. Lift.
   B. Thrust.
   C. The total reaction of Lift and thrust.
   D. Drag.

2. An aeroplane in in equilibrium in a steady glide. What opposes the aircraft's weight?
   A. Drag.
   B. Thrust
   C. Lift.
   D. The total reaction of lift and drag.

3. A pilot, sitting in the cockpit, is looking forward at a stationary propeller blade. Is the pilot viewing the back of the blade or the face of the blade?
   A. Face.
   B. Back.
   C. Neither, these terms don't apply to propellers, only turbines.
   D. It could be either back or face, depending on the direction of propeller rotation.

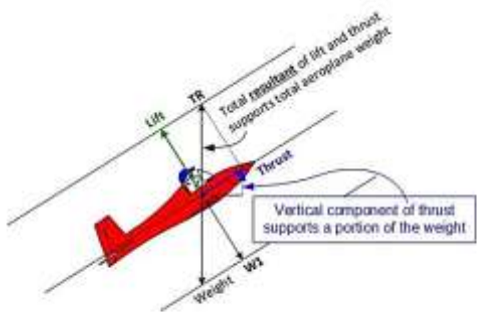
4. What causes the trim change that occurs in most aeroplanes when flaps are lowered?
   A. The pilot leaning forward in their seat to apply flap moves the Centre of Gravity.
   B. As flaps are lowered, the drag line is either raised (high wing) or lowered (low wing) which changes the arm of the thrust/drag couple.
   C. The general increase in form drag change the trim.
   D. The change in profile drag causes the trim change.

5. A pilot notices that, as he rotates and raises the nose to take off, there is a tendency for the nose to yaw to the right. What is the most likely to cause of this if there is no crosswind?
   A. Washout on the wings becoming effective at the higher airspeed.
   B. Slipstream effect from the airflow blast back from the propeller.
   C. Gyroscopic forces generated by the anti-clockwise (from the cockpit) rotating propeller
   D. Gyroscopic forces generated by the clockwise (from the cockpit) rotating propeller.

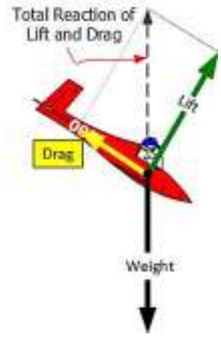
See answers and explanations overleaf.

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.

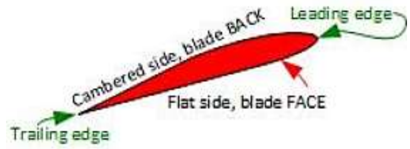


As the engine and therefore the thrust is inclined with the higher nose attitude in the climb, the thrust has a vertical component that supports some of the weight so relieving the aerodynamic lift required. The sketch to the right displays this on a vector diagram. See the weight is supported by the Total Resultant (TR) of lift AND the vertical com ponent of thrust.



2. D is correct.

An aeroplane in a glide is supported by the Total Resultant (TR) of the Lift and the Drag vectors. See sketch



3. A is correct.

The pilot is seeing the face of the propeller blade from the cockpit.

Pilot's view

4. B is correct.

As flaps are lowered, the dragline will rise in a high winged aircraft because the flaps are above the centre of gravity, or descend in a low wing because they are below the centre of gravity, respectively. Thus, lowering flaps say in a Cessna 172, will cause a nose up trim change and in a PA28, a nose down change in trim.

5. D is correct.

Rotating nose up on take-off with a clockwise spinning propeller will cause the resulting gyroscopic effect to yaw the nose to yaw right.

------ 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**
Panel mount Magnetic compass. Needs fluid top up but functions fine.		**$35.00**

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:

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

Ribs, tubes, spats, etc

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

Or Mob: 0419 758 125

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 hangered. It has been set up for stock control or mustering, and is not fitted with doors.

Registered until 13 October 2025, 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 of that issue and the pilot report it contains 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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