BRISBANE VALLEY FLYER

March 2025

Watts Bridge Memorial Airfield, Cressbrook-Caboonbah Road, Toogoolawah, Q'ld 4313.
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Fairey Swordfish – the slow and deadly Stringbag. See page 22.

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

Greetings Members,

February is done and dusted. The monthly meeting was well attended, and we all had a great day followed by a good lunch.

There has not been a lot happening throughout the month.

Our next meeting will be on March 1st 2025. Please join us for a great day.

Best wishes

Peter Ratcliffe
President BVSAC

The down-side of Wind Sheer/Gradients –
the Evils of a Changing Wind Component

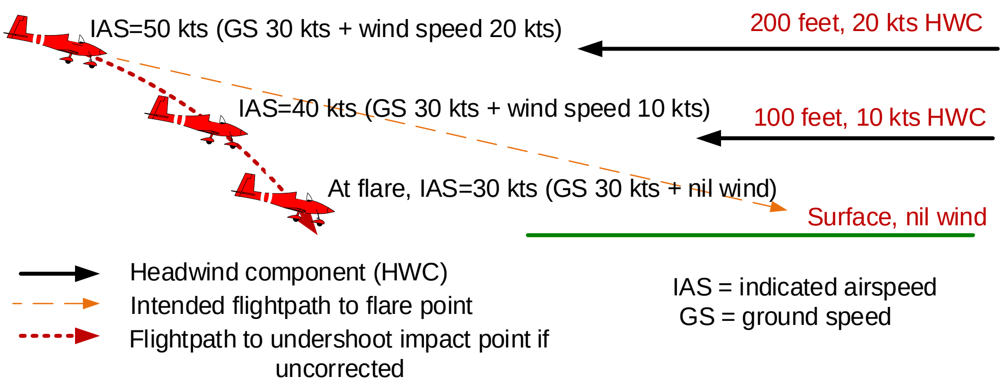
By Rob Knight

According to Janes Aerospace Dictionary, windshear and wind gradient are synonymous – a change in wind velocity with a change in position, usually in height above the runway level. Impossible to see, as air itself has no visible form, the phenomenon can have a profoundly serious effect on the approach (and climb) profiles of aeroplanes operating in their vicinity. Effectively, changes in the wind velocity (either directional, speed, *or both combined*) will quickly change airspeed, approach (or climb) path, power required and influence vital control inputs. Under severe conditions, a wind gradient can create situations that can exceed the power and controllability limits available and put an aeroplane's safety in jeopardy.

For simplicity and for starters let's use just the single term – wind gradient and consider a circumstance relating to a change in headwind component during a descent to land. In this case the headwind component is that part of the total wind velocity that is acting on the aeroplane's nose against our direction of motion.

Let's assume that we are approaching to land on runway 36. At 200 feet above the runway the wind is 360/20 so we will be experiencing a headwind of 20 knots. The wind at ground level is seldom the same as that experienced at 200 feet because of surface friction, and a change in wind speed is also likely to change the wind direction because of a force called Coriolus. Note that here we are considering the effects of the wind changes on the aeroplane rather than the cause of the change.

For the sake of this argument, let's assume headwind component varies as we descend. As stated above, we have a headwind at 200 feet above the runway of 20 knots, and on the runway (on the ground) no wind at all. In other words, a steady gradient from 200 feet down to the runway – a wind gradient. In the sketch below, the aeroplane has a normal approach speed of 50 knots.



Sir Isaac Newton said it all when he gave us his law that objects remain stationary or continue at a uniform speed unless acted upon by an outside force. In the sketch above the aeroplane has an airspeed of 50 knots which is modified by the wind speed to give us the 30 knots we have as groundspeed. Thus, in a headwind situation, the IAS comprises the groundspeed PLUS the headwind (IAS = 30 + 20 = 50 knots).

That is all good. We have the correct speed, and maintaining the correct approach angle to arrive at the selected flare point which sits just nicely in the right place on the windscreen.

However, at 100 feet above the runway in the sketch, the wind drops from 20 knots to 10 knots. The aeroplane will continue in its state of uniform motion (groundspeed) at 30 knots but now there's only 10 knots of headwind. Adding this to the ground speed will only give us 40 knots on the ASI. The pilot has done nothing wrong – it's just the way the wind affects the airspeed. With an airspeed now of just 40 knots, below the normal approach speed, the aeroplane will start to sink and the flare point will rise up the windscreen in front of you rather more quickly.

A keen pilot, always anticipating a gradient on approach, and being prepared to correct for such an event, will immediately lower the nose to correct and maintain the required 50 knots airspeed AND will ADD sufficient power to maintain/regain the desired approach path. However, let's assume that, in this case, no corrective actions are undertaken and follow this scenario to its conclusion

With now just 40 knots on the ASI the aeroplane settles on a steep descent path towards the ground. Under Sir Isaac's direction, the aeroplane maintains just 30 knots of ground speed and the airspeed will continue to decay until the aircraft arrives at the point where the flare must begin. By now its airspeed will have fallen to 30 knots (with no headwind the ground speed and airspeed are one and the same). It is far short of the original flare point, perhaps even short of the runway, and insufficient airspeed remains for adequate controllability to flare and to make a safe landing.

What did the pilot do wrong? Well, the speed loss was not of his or her making. But the failure to notice and immediately remedy the airspeed decay most certainly is. It is the pilot's duty to maintain a safe airspeed appropriate to the flight conditions at all times. It raises the two primary adages yelled by instructors for over 100 years, "Airspeed, airspeed, airspeed", and, "Thou shalt maintain thy airspeed lest the ground arise and smite thee".

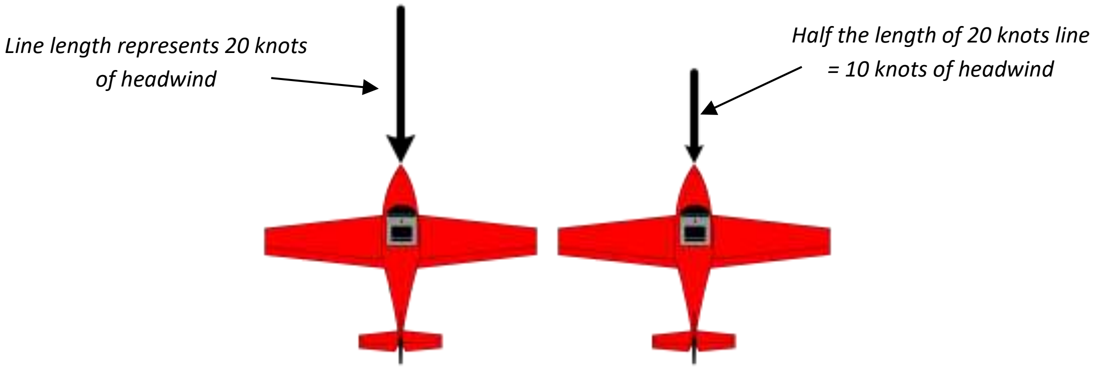
So, let's spell out what the pilot should have done. As soon as the airspeed started to decay the pilot SHOULD have moved the stick forward sufficient to lower the nose to increase the airspeed to the required 50 knots. This would raise the ground speed to ensure that the required airspeed is achieved. And every time the airspeed begins to slow, he should, again, make that remedial action. Sufficient to restore the airspeed of 50 knots airspeed. Simultaneous with every airspeed correction, the pilot should have added sufficient power to maintain/regain the approach angle to flare at the selected point. Thus, the correct restorative action is stick forward (just enough) and add power, (just enough) to reach the selected flare point. Not one action or the other, BUT BOTH!

In the continuing descent towards ground level the wind speed continues to fall ultimately to zero so more and continuing corrective action will be necessary to keep the ground speed rising as the wind speed is falling to maintain the correct, required, and necessary airspeed as well as additional power being added progressively. This will get the aeroplane to the desired flare point with the correct airspeed. Note that, as depicted by this sketch, the ground speed must have been raised by 20 knots to recover that 20 knots loss in wind speed, and considerable power may have been required to get to the flare point.

In other words, in any wind conditions, the airspeed is directly controlled on approach by the aeroplane's ground speed. The pilot doesn't see the ground speed, only its effect on the airspeed, but being attentive to the ASI, and making immediate corrections to restore any airspeed loss or change in the desired approach angle, makes an approach safe from wind gradient effects.

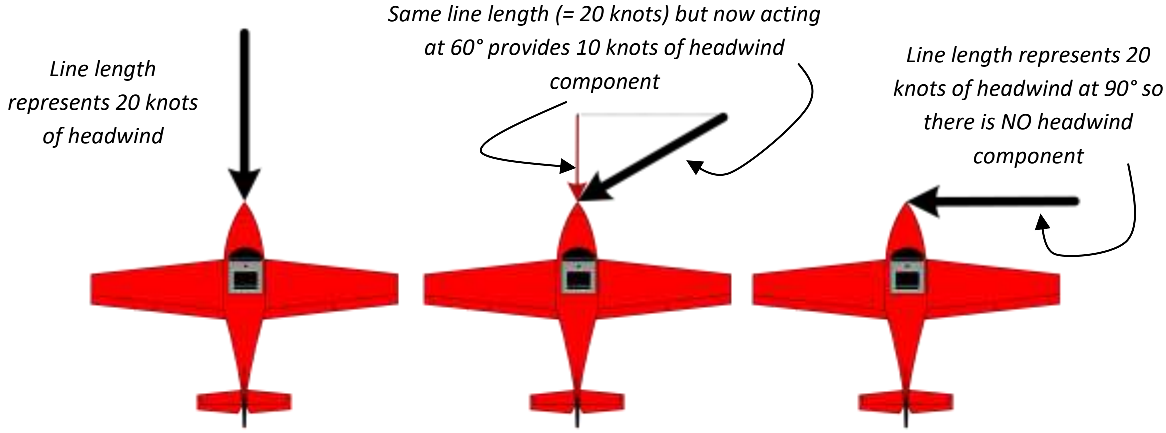
Thus far we have only been considering a loss in actual wind strength, and a situation where the wind remains a constant direction throughout the approach. This is less likely the case in reality where wind speed and wind direction changes occur simultaneously. Thus, a headwind component can vary immensely.

To illustrate this point, see the explanatory sketches below. These are drawn as vector diagrams and the length of the thick black line represents the wind speed. The first set of two aeroplanes illustrates a halving of the headwind wind speed; a drop in headwind from 20 to 10 knots. In the second set of aeroplanes, the wind speed line is drawn the same length representing the same wind speed in all three cases, but the direction relative to the direction of flight is changed and thus is the headwind component (that part of the wind velocity that is acting against the direction of flight).



Half the headwind speed = half the headwind component.

Now let's look at the effect of a change in direction. This, too, will vary the headwind component.



A 20-knot wind acting at varying angle to the aircraft changes the headwind component

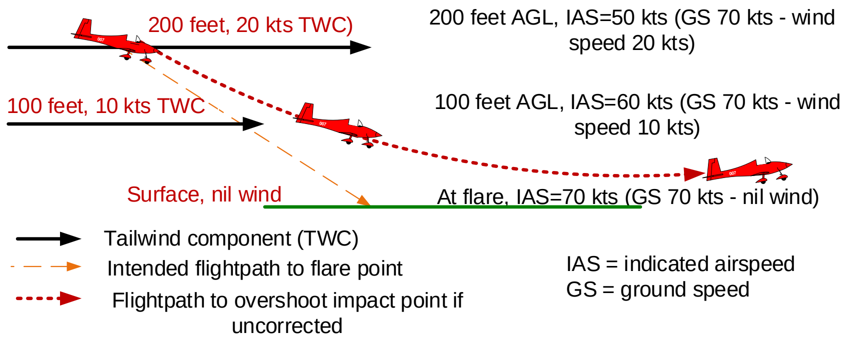
In other words, if one was on approach at 50 knots into a 20 knot headwind, a sudden wind direction change of 90 degrees would see one suffering an instant 20 knot reduction in airspeed. In the same way, should the 20 knot wind as suddenly revert back to a headwind – the airspeed would rise again, just as quickly.

So far, we have discussed headwinds, and seen the falling headwind component in a headwind gradient drag down the airspeed. But what happens if it's a tailwind?

Exactly the same - only in reverse. A tailwind gradient will cause a rise in airspeed. I have more difficulty getting people to accept this than the headwind gradient situation but it's no joke – it really happens this way.

To see the situation for what it is, let's look again at a diagram, this time for an aeroplane doing 50 knots IAS, on approach for a runway, and suffering a 20-knot tailwind at 200 feet and a 10 knot tailwind at 100 feet. In keeping with the previous sketch relating to this, again, there is no wind on the runway.

In the next sketch, the IAS is equal to the ground speed MINUS the wind speed. So, at 200 feet the IAS is 70 - 20 = 50 knots. Remember, when the wind speed changes so will the airspeed. So, at 100 feet above the runway, the groundspeed will still be 70 knots, but 70 - 10 will provide an IAS of 60 knots – the aeroplane has gained 10 unwanted knots. Also, the selected flare point will be fast moving down the windscreen; perhaps disappearing below the aircraft as its approach profile rapidly becomes too shallow to make that point on the runway.



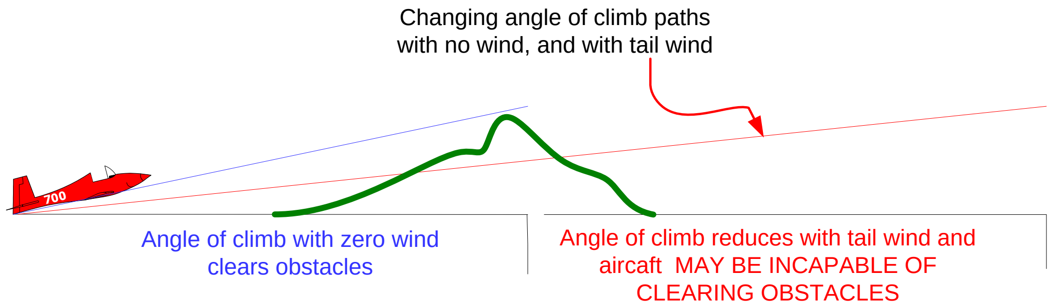
Continuing this approach will see the aircraft descend onto the runway, further down its length than the original flare point, with 70 knots written accusingly on the airspeed indicator. With no tailwind the airspeed will be the same as the ground speed.

A headwind condition allows a pilot to make corrections to the approach path using power but a tailwind has no such remedy. Once the throttle is closed, a change in approach profile cannot safely be modified from its state of being too high. Some have argued that pulling the nose up to reduce speed to accommodate the increase at the flare would work but there is no safety in this. What mortal pilot will actually be able to ensure the airspeed will rise to the required value – they place their destiny into the hands of fate, they play Russian roulette with two chambers loaded.

We have covered the required response to a headwind gradient, but what about a tailwind gradient? There is really no response once the throttle is closed and all power is removed. The pilot must go around, or overshoot, as soon as possible, before the second effect of a tailwind gradient can become overpowering in the climb out.

This second effect relates to the effect the tailwind gradient will have on the aeroplane's ability to climb. Not in terms of rate of climb, that is simply a matter of surplus horsepower, but the angle of climb that specific aeroplane can achieve at its maximum thrust, at that load, and in the prevailing pressure and temperature conditions and with that tailwind gradient even if Vx, the airspeed for the best angle of climb, is maintained.

Note that the angle of climb will be adversely affected in ANY tailwind climb out, but remember that a tailwind gradient is likely to exacerbate the loss in angle of climb performance substantially.



In the sketch above (not to scale) I have provided the same height climbed, but doubled the distance travelled to climb to that height in a tailwind situation. It can be impossible to remain clear of terrain in a severe tailwind gradient situation and accident statistic archives contain many such calamitous records. The best answer as to how best to handle this situation is not to get into it in the first place.

Conversely, a headwind gradient in a climb, or an overshoot situation, will see the airspeed tending to rise, often very substantially, causing the angle of climb to be increased dramatically. This is caused by the headwind component increasing. A potential hazard in this situation is holding a very high nose attitude to gain the advantage of the headwind gradient and suffering an engine failure.

There is a large arc indeed to get the nose attitude reduced to maintain an adequate airspeed. A stall is possible in this case.

How can we calculate the headwind component?

The table on the right is a common means of ascertaining the two components of any wind direction. If the angle between the runway and the wind direction is known, the components can be read off. For example, given runway 28 and a wind 240/20 (note, it will need to be a magnetic wind direction for the comparison) the angular difference is 270-230 = 40 degrees and 20 knots. From the table read down the 40 degree column until you reach the 20 knot row. Read 15 knots headwind and 13 knots of crosswind. Naturally, this table can be used for any comparison of directions to get the head and cross wind components. If, on flying a track (for Americans among us, “course”) of 140° with a W/V of 090/30, the offset is 50° so the components are headwind 19 knots and cross wind 23 knots. Warning – the directional units must be same, either true or magnetic.

Crosswind Correction
Angle Between Wind Direction and True Course

Wind Speed Knots	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°
10	10 / 0	10 / 2	9 / 3	9 / 5	8 / 6	6 / 8	5 / 9	3 / 9	2 / 10	0 / 10
20	20 / 0	20 / 3	19 / 7	17 / 10	15 / 13	13 / 15	10 / 17	7 / 19	3 / 20	0 / 20
30	30 / 0	30 / 5	28 / 10	26 / 15	23 / 19	19 / 23	15 / 26	10 / 28	5 / 30	0 / 30
40	40 / 0	39 / 7	38 / 14	35 / 20	31 / 26	26 / 31	20 / 35	14 / 38	7 / 39	0 / 40
50	50 / 0	49 / 9	47 / 17	43 / 25	38 / 32	32 / 38	25 / 43	17 / 47	9 / 49	0 / 50
60	60 / 0	59 / 10	56 / 21	52 / 30	46 / 39	39 / 46	30 / 52	21 / 56	10 / 59	0 / 60
70	70 / 0	69 / 12	66 / 24	61 / 35	54 / 45	45 / 54	35 / 61	24 / 66	12 / 69	0 / 70

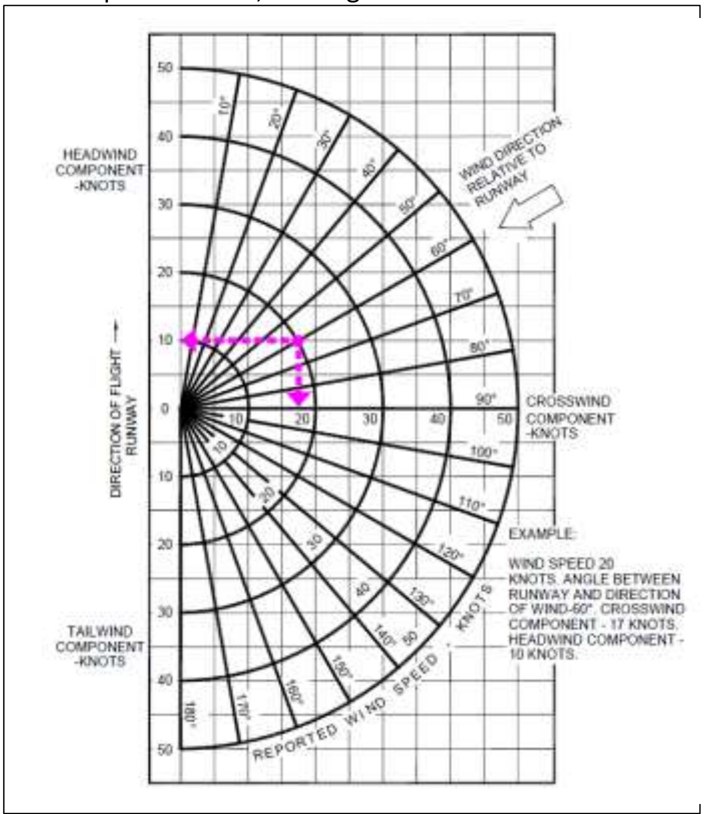
Headwind 0 / 0 Crosswind

Headwind/crosswind table

For practical purposes, for angles exceeding 70 degrees, consider wind components to be entirely cross wind and zero headwind.

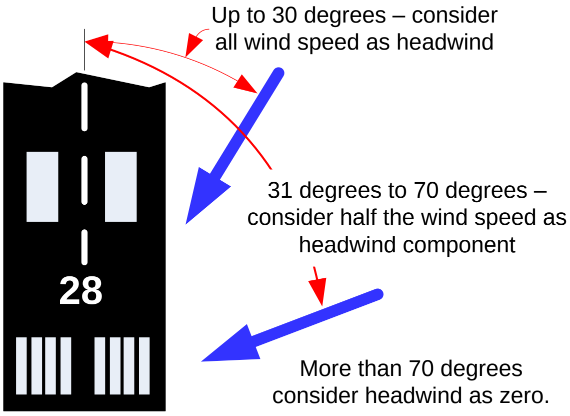
Another means of obtaining the wind components is using a graphical presentation as shown on the left.

In this presentation, the angle between the nose and the direction from which the wind is blowing is graphically displayed.



From this graphically displayed angle, both the headwind and the crosswind components can be visually seen as the pink lines indicate., If calculating these components from a weather forecast, remember the wind is degrees true, whereas ATC will provide it verbally as degrees magnetic. Therefore ensure both the heading AND the wind are in the same units, true OR magnetic and NOT a mix of the two.

These are all for the calculation of a headwind component. But only aeroplanes carrying two pilots can do these calculations whilst being on approach so we can look to some rules of thumb to assist. Be very clear that any rule of thumb is not as good as actual figure values, but merely serves as being better than nothing in the situation.



Generalised Rule of Thumb

So, let's summarise the issue. Wind gradients occur on most approaches but, because their speed change is usually over an extended height band, their effects are relatively easy to avoid using constant small adjustments to nose attitude and power applied to maintain airspeed and the desired approach path. However, a pilot cannot be complacent and their first defence against wind gradient issues is to be always aware of their potential presence and ever watchful for the sudden onset of their early symptoms of falling airspeed with no attitude change. The second line of defence is to act decisively on recognising their symptoms appearing, and being prepared to go around without hesitation. Remember, if the decision to go around is left too late, in severe cases a safe go-around may no longer be an option.

If you are concerned about your own performance when experiencing this phenomenon, see your CFI and get some advice or even some practical experience.

Happy Flying

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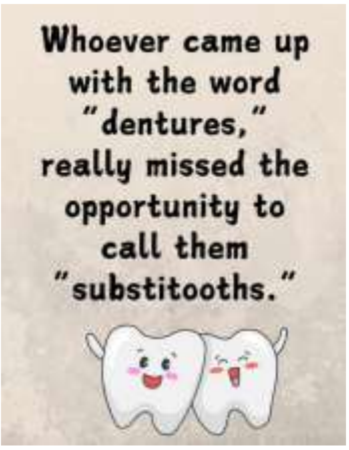

The story of the Grumman AA-1B Trainer

By Rob Knight

The story of the AA1B started with its design in the 1960s by the notorious Jim Bede. The prototype first flying on 11 July 1963, he intended it to be a kit aircraft. However, after he completed the design, designated as BD-1, he decided to produce it as a certified aircraft and manufacturer them in his own company. For this purpose, he formed Bede Aviation and submitted the design to the FAA for certification. Amongst his other quirky ideas for the design, he included folding wings to allow it to be trailered and to reduce hangarage costs, but the FAA were reluctant to certify it with folding wings and the certification process stalled. Bede was insistent that the folding wings remained but his shareholders disagreed and ousted him from the company, renaming it American Aviation – the AA part of the aircraft's name. The Company reworked the wing design to remove the fold issues, extended its wing tips to improve its rate-of-climb, an anti-servo tab on the elevator to improve pilot's "feel", and added a spring system to self-centre the elevators and increase longitudinal stability. They also added inboard stall strips to improve handling during stalls. They named this revised design the AA-1 Yankee Clipper.

The BD-1, its wings unfolded.

The AA-1 was certified under FAR Part 23 on August 29, 1967, with the first production AA-1 flying on May 30, 1968. The first 1969 models were delivered in late 1968 at a base price of US$6495, a cost notably lower than that of competitive aircraft at that time. American Aviation built 459 examples of the AA-1 Yankee Clipper between 1969 and 1971 at their factory in Cleveland, Ohio.

In 1971, Grumman bought American Aviation, renaming it Grumman American Aviation, and beginning in late 1972 sold the 1973 model year design as the Grumman American AA-1B Trainer for School and Aero Club training use. A variant was produced for the personal-use market and called the TR-2 featuring a standard radio and trim package. The AA-1B was produced until 1976. 680 AA-1Bs were produced.

All the AA-1s, AA-1As and AA-1Bs were powered by the Lycoming O-235-C2C low-compression engine designed for 80/87 avgas, which produced 108 hp. The base 0235 engine also powered the Piper PA-22 Colt, the Piper PA-38 Tomahawk, and the Cessna 152.

The Grumman light aircraft line was subsequently acquired by Gulfstream Aerospace in 1977 who developed it into their own light aircraft division, Gulfstream American, in Savannah, Georgia. They then completed a major redesign of the AA-1B, resulting in the AA-1C which was again marketed in two versions, differentiated by the avionics fitted and the external trim package. The AA-1C Lynx targeted private owners while the AA-1C T-Cat was the flying school/Aero Club trainer. These names were chosen to position the aircraft in the Gulfstream American line which, at that time featured the Cheetah, Tiger, and the Cougar.

The AA-1C received a new larger horizontal tail and other significant improvements, including a 115 hp Lycoming O-235-L2C high-compression engine designed for 100LL fuel, which brought the cruise speed back up to that of the original 108 hp Yankee. 211 AA-1Cs were produced in 1977 and 1978.

The last AA-1C was produced by Gulfstream American in 1978. Overall, 1820 AA-1 family aircraft were built between 1969 and 1978.

All models of the AA-1 accommodate two people in side-by-side seating under a sliding canopy and are noted for their exceptionally light handling. The Yankee and its four-seater siblings, the AA-5 series, feature a unique bonded aluminium honeycomb fuselage and bonded wings that eliminated the need for rivets without sacrificing strength. The wide-track main landing gear struts are laminated fibreglass for shock absorption, marketed as the "Face Saver" design by American Aviation.

The Yankee was originally designed to minimize the number of airframe parts used, with the aim of simplifying production and saving money. As a result of this philosophy, many parts were interchangeable. Due to the use of a non-tapered (constant diameter) tubular spar, which doubled as the fuel tank, and the lack of wing washout, the wings could be exchanged left and right. The fin and horizontal stabilizers were interchangeable, as were the rudder and the elevators. The ailerons and flaps were similarly the same part. While it did succeed in making production easier, this design philosophy produced many aerodynamic compromises in the design. For instance, because the flaps were the same part as the ailerons they were too small to be effective as flaps. The lack of wing washout, necessitated by the wing interchangeability requirement, meant that stall strips had to be fitted to produce acceptable stall characteristics for certification. Over time this philosophy of compromising the aerodynamics in favour of a minimized parts count was abandoned. For example, the redesign of the AA-1B into the AA-1C by Gulfstream involved wider-span elevators and horizontal stabilizers that produced better longitudinal stability, but were no longer interchangeable with the rudder and fin.

Powered by the same 108 hp Lycoming O-235 engine as the Cessna 152, the original Yankee cruises twenty percent faster thanks to the cleaner wing and better aerodynamics.

While the original American Aviation AA-1 Yankee was designed to fill the role of a personal transportation and touring aircraft, many of the early production models were purchased by flying schools and Aero Clubs for flight training. The appeal of the AA-1 to schools was obvious – compared to the competition, the AA-1 was faster, cost less to purchase and maintain and, most importantly, had more student-appeal with its sliding canopy and fighter-like looks.

Many of the early school accidents were related to spin-training. Once the AA-1 entered a fully developed spin and exceeded three turns, it was usually not recoverable. The AA-1 had been spin-tested as part of its certification, but in 1973 the FAA issued an Airworthiness Directive ordering the aircraft placarded against spins.

The remaining accidents were generally attributed to three things: the AA-1's short endurance (a mere 3 hours and 20 minutes (with 45 minutes reserve) if flown with care), it’s inability to use short grass strips, and its relatively higher approach speeds (74–78 knots). These were quite different to the other training aircraft in use in that era and took some adaptation by instructors and students alike.

Today most of the AA-1s, AA-1As, Bs and Cs are in private hands. If the pilot is properly trained on the aircraft and stays within its limitations, data show that it is as safe as any other light aircraft.

Some AA-1s have had their original engines replaced with larger 150 or 160 hp engines that further increase performance. Other popular modifications include the addition of a dorsal strake on earlier model AA-1s to improve yaw stability or the addition of a transparent red rudder cap to fair the flashing beacon for reduced drag. Some AA-1s have been converted to taildragger configuration.

AA-1B ZK-DKY, in the same livery I flew it

My personal experience with the AA-1B was as a line instructor with the Waitemata Aero Club at Ardmore in New Zealand. In the mid-1070s, the Club began looking for a replacement for its three Airtourer trainers and comments were made to the Piper, Cessna, and the new Grumman American agents. Cessna 152s were already plentiful on the airfield and their handling performance were already well known. Piper was only advertising their soon-to-be produced PA-38 112 Tomahawk Is and no examples were available, only advertising pamphlets. Grumman, however, jumped in and made a brand new, bright and shiny example of the AA-1B available at a peppercorn hire to the club.

ZK-DKY (aka Dinky) was flown by students and members alike. It looked good and flew even better as far as a hire aircraft was concerned. For training, though, it proved not as good in its characteristics as the Airtourers we already had for that purpose. DKY cruised 15 knots faster than the 100 hp T1s, and 5 knots quicker than the T3, with its 130 hp engine. It climbed quicker than the T1s, but only matched that of the T3.

The AA-1Bs training failings were several. Probably the worst was its stall characteristics. There were frightening placards around the cockpit forbidding spinning and mentions of non-recovery if entered. This caused much angst with students and I personally had several students that refused to fly the type because of this. I found the AA-1Bs stall quite benign, but too vague in its natural warnings of the stall's approach. Contrary to the published flight manual, there was very little aerodynamic buffet prior to the stall break, and the controls were already light so there was little change in elevator control weight. Its audible stall warning was often the first the student knew of a stall's approach because the induced drag of the rectangular and constant thickness wing form produced copious quantities of induced drag, causing a rapid airspeed decay if power wasn't added when turns got steep and height was being maintained. This was also significant in power-and-flap stall exits, where even a light hauling back on the yoke after adding full power in the recovery immediately killed all acceleration and precipitated an abrupt secondary stall.


AA-1B instrument panel.

This aircraft had a freely castoring nosewheel so all directional control during taxi was with individual wheel braking. On take-off, brakes were used individually at the beginning of the roll until the rudder took over above about 40 knots. Cross wind take-offs required dragging the windward wheel brake into about 50 knots was achieved before sufficient rudder authority could be achieved. Cross wind landing in gusty conditions, could require some nifty one-legged footwork to keep straight on the rollout.

The type had another unique characteristic. When loading was increased as in a steep turn or when pulling out of a dive, there came a sound in the cockpit, loud enough to be heard whilst wearing headsets, of cellophane crumpling. Like screwing up a cigarette packet, it was sharp and clearly audible and was caused by the honeycomb construction taking the loads and distorting minutely.

This sound also upset students and also a couple of other instructors who ultimately preferred to fly something else other than DKY.

I found the type very unsuited to air strip operations; it had two major flaws. Its induced drag produced at high angles of attack when carrying out over-shoots/go arounds from low-speed short landing approaches on up-sloping strips meant an unwary pilot could find its drag curve could be exceedingly rapidly exceeded. This is a definite NO-NO when operating into up-sloping strips and would result in serious accidents if encountered. The second issue lay with the type’s rather small wheels, which meant that grass length was a major consideration before choosing to land on grass surfaces.

Ignoring these personal dislikes, the AA-1B type was over-all a perfectly acceptable aircraft. Whilst I felt that other types were better trainers, as a hire or private owner’s aircraft, it was cheap to operate with a good performance for local flying. Cross country flights, although quick, tended to be short between refueling stops but this is not a serious issue. All in all – with adequate conversion training it was a perfectly safe, easy to fly, and good-looking aircraft.

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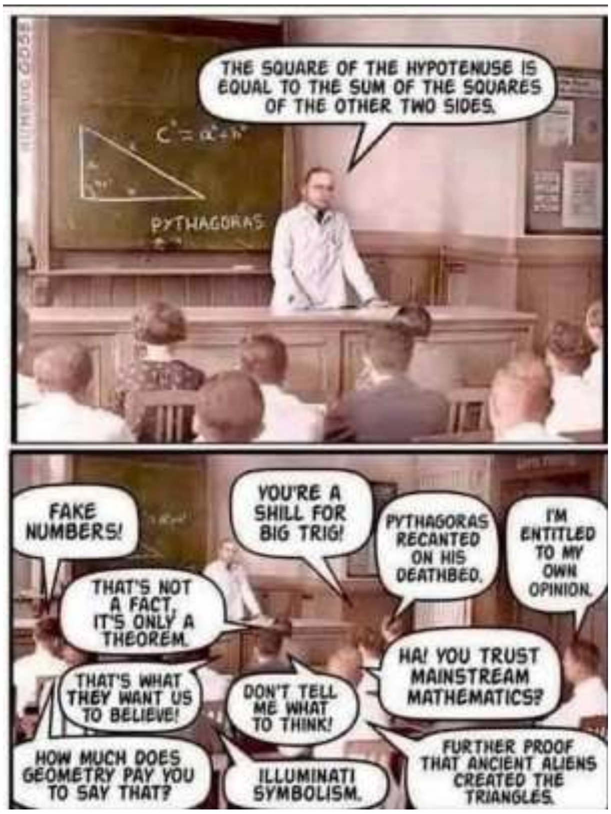


I intend to post telepathically today, So, if something strikes you as funny, that’ll be me!

The Consolidated PBY Catalina.

By Rob Knight

Initially designated as Model 28 by Consolidated, the PBY was originally designed for a role as a patrol bomber, an aircraft designed with a long operational range intended to locate and attack enemy transport ships at sea. In 1933, with a potential conflict in the Pacific Ocean, in mind, where troops would require resupply over great distances, the U.S. Navy approached Consolidated and two potential suppliers of such a flying boat, offering contracts to each to supply a prototype. Consolidated provided their company Model 28 as their entry.

The Consolidated Model 28 that became the PBY series.

The Model 28 looked startlingly different to the other entrants with its parasol wing and external bracing struts, mounted on a pylon over the fuselage. The design also differed in having wingtip stabilizing floats that retractable in flight to become streamlined wingtips, which had to be licensed from the Saunders-Roe company in the UK. The Model 28 was of all-metal construction stressed skin construction using aluminium sheet, except for the ailerons and wing trailing edges, which were aluminium frames covered with fabric. Powered by two 825 hp Pratt & Whitney R-1830-54 Twin Wasp radial engines mounted on the wing's leading edge. Its defensive armament comprised four .30 in Browning machine guns, and offensively, up to 2,000 lb (900 kg) of bombs.

Its maiden flight on 21 March 1935 was eminently successful and it was transferred to the U.S. Navy for service trials. The XP3Y-1, while providing a significant performance improvement over previous patrol flying boats, was still not exactly what the US Navy wanted and it requested further development in order to bring the aircraft into the category of patrol bomber. To carry out the changes, in October 1935 the prototype was returned to Consolidated. The changes also included a re-designation of type to XPBY-1 and the installation of 900 hp R-1830-64 engines. In the redesign, Consolidated also introduced revised vertical tail surfaces which resolved a problem with the tail becoming submerged on take-off, which had made lift-off impossible under some conditions. After the modifications were completed, the now XPBY-1 had its maiden flight on 19 May 1936. The flight uniquely recorded a record non-stop distance flight of 2,992 nm was achieved.

The XPBY-1 was initially delivered to a squadron in October 1936, while the second squadron to be equipped received the first of its aircraft in early 1937. The second production order was placed on 25 July 1936. Over the next three years, the design was gradually developed further and successive models introduced.

The aircraft was eventually awarded the name Catalina, after Santa Catalina Island in California in November 1941, as Great Britain ordered their first 30 aircraft.

The PBY was the most numerous aircraft of its kind, with around 3,300 aircraft built. During World War II, PBYs were used in anti-submarine warfare, patrol bombing, convoy escort, search and rescue missions (especially air-sea rescue), and cargo transport. The type operated in nearly all operational theatres of World War II. The Catalina served with distinction and played a prominent and invaluable role in the war against Japan. While several different flying boats were adopted by the Navy, the PBY was the most widely used and produced.

Although relatively slow and awkward, Allied forces used the PBY in a wide variety of roles for which it was never intended. In particular, PBYs are remembered for their rescue role, in which they saved the lives of hundreds of aircrew members downed over water.

Accredited to a Catalina was the U.S. Navy's first credited air-to-air "kill" of a Japanese airplane in the Pacific War. On 10 December 1941, the Japanese attacked the Cavite Navy Yard in the Philippines where numerous U.S. ships and submarines were damaged or destroyed by bombs and bomb fragments. However, while flying to safety during the raid on Cavite, Lieutenant Harmon T. Utter's PBY was attacked by three Japanese A6M2 Zero carrier fighters. Chief Boatswain Earl D. Payne, Utter's bow gunner, shot down one, thus scoring the U.S. Navy's first kill. Of note, Utter, as a commander, later coordinated the carrier air strikes that led to the destruction of the Japanese battleship Yamato.

The Catalina performed one of the first offensive operations against the Japanese by the US. On 27 December 1941, six Catalinas of Patrol Squadron 101 bombed Japanese shipping at Jolo Island against heavy fighter opposition. Alas, only 2 Catalinas returned, the other four were shot down and lost.

An RAF PB5 approaches Europa Point, Gibraltar during WWII..

Catalinas were the most extensively used anti-submarine warfare (ASW) aircraft in both the Atlantic and Pacific theatres of World War II, and were also used in the Indian Ocean, flying from the Seychelles and from Ceylon. Their duties included escorting the Arctic convoys to Murmansk, seeking and destroying submarines in the Atlantic and Pacific and searching for and rescuing downed airmen in both oceans as well as the North Sea. By 1943, U-boats were well-armed with anti-aircraft guns and two Victoria Crosses were won by Catalina pilots pressing home their attacks on U-boats in the face of heavy fire: In 1944, Flying Officer John Cruickshank of the RAF received the award for sinking the *U-361,* and in the same year RCAF Flight Lieutenant David Hornell received the decoration posthumously for the sinking of the *U-1225*. Hornell's aircraft was damaged in the exchange of fire before it sunk the U-boat and Hornell (with two other crew) died from exposure. In all, Catalinas destroyed 40 U-boats, but not without losses of their own. A Brazilian Catalina attacked and sank *U-199* in Brazilian waters on 31 July 1943. Later, the aircraft was baptized as "Arará", in memory of the merchant ship of that name which was sunk by another U-boat.

In their role as patrol aircraft, Catalinas participated in some of the most notable naval engagements of World War II. The aircraft's parasol wing and large waist blisters provided excellent visibility and combined with its long range and endurance, made it well suited for the task.

An RAF Coastal Command Catalina, flying from Castle Archdale Flying boat base at Lower Lough Erne, in Northern Ireland, located the German battleship *Bismarck* on 26 May 1941, some 690 nm northwest of Brest. Bismarck was attempting to evade Royal Navy forces as she sought to join other Kriegsmarine forces in Brest. This sighting eventually led to the destruction of the German battleship, after being delayed by Bristol Swordfish biplane torpedo bomber attacks until a naval force completed the task.

On 7 December 1941, before the Japanese amphibious landings on Kota Bharu, Malaya, their invasion force was approached by a Catalina flying boat of No. 205 Squadron RAF. The aircraft was shot down by five Nakajima Ki-27 fighters (nicknamed "Nate" by the allied forces) before it could radio its report to air headquarters in Singapore. Flying Officer Patrick Bedell, commanding the Catalina, and his seven crew members became the first Allied casualties in the war with Japan. Patrol

Wing 10 of the U.S. Asiatic Fleet had 44 Catalinas under its command but lost 41 within 90 days. Patrol Wing 10 also lost its main seaplane tender, USS *Langley*, to Japanese aircraft during the Dutch East Indies Campaign while it was transporting 32 Curtiss P-40 Warhawk fighter planes.

A RCAF Canso (Canadian name for PBY) flown by Squadron Leader L.J. Birchall foiled Japanese plans to destroy the Royal Navy's Indian Ocean fleet on 4 April 1942 when it detected the Japanese carrier fleet approaching Ceylon.

No only did a flight of Catalinas spot the Japanese fleet approaching Midway Island, beginning the Battle of Midway a major hinge point of the Pacific war, but during the Battle of Midway, four U.S. Navy PBYs of Patrol Squadrons 24 and 51 made a night torpedo attack on the Japanese fleet on the night of 3–4 June 1942. They scored one hit which damaged the fleet oiler *Akebono Maru*, the only successful American torpedo attack in the entire battle of Midway.

During the Guadalcanal campaign, some U.S. Navy PBYs were painted matte black and sent on night bombing, torpedoing, and strafing missions against Japanese supply vessels and warships, including conducting interdiction raids on the Tokyo Express. These PBYs were later called "Black Cats". Subsequently, special squadrons of Black Cats were formed, commencing in December 1942. Flying slowly at night, dipping to ship mast height, the Black Cats bombed, strafed, and torpedoed all kinds of Japanese vessels, sinking or damaging thousands of tons of shipping. The Black Cats also performed bombing, strafing and harassment regarding land based Japanese installations, as well as conducting reconnaissance and search and rescue operations. The Black Cat squadrons continued to be active into 1944 with the improved model, the PB4Y-2, beginning to come in service in greater numbers and replacing the PBYs. The last Black Cat squadrons returned to the U.S. in early 1945.

The Royal Australian Air Force (RAAF) also operated Catalinas as night raiders, with four squadrons Nos. 11, 20, 42, and 43 laying mines from 23 April 1943 until July 1945 in the southwest Pacific, deep in Japanese-held waters. This action bottled up ports and shipping routes and forced ships into deeper waters to become targets for U.S. submarines. They also tied up the major strategic ports such as Balikpapan which shipped 80% of Japanese oil supplies.

In late 1944, their mining missions sometimes exceeded 20 hours in duration and were carried out from as low as 200 ft in the dark. Operations included trapping the Japanese fleet in Manila Bay in assistance of General Douglas MacArthur's landing at Mindoro in the Philippines. Australian Catalinas also operated out of Jinamoc in the Leyte Gulf, and mined ports on the Chinese coast from Hong Kong to as far north as Wenzhou. Both USN and RAAF Catalinas regularly mounted nuisance night bombing raids on Japanese bases, with the RAAF claiming the slogan "The First and the Furthest". Targets of these raids included a major base at Rabaul. RAAF aircrews, like their U.S. Navy counterparts, employed "terror bombs", ranging from scrap metal and rocks to empty beer bottles with razor blades inserted into the necks, to produce high-pitched screams as they fell, keeping Japanese soldiers awake and scrambling for cover. There was a Catalina base on Drimmie Head on the Gove Peninsula in the Northern Territory.


A USAF PB5.

Catalinas were employed by every branch of the U.S. military as rescue aircraft. A PBY, piloted by LCDR Adrian Marks (USN), rescued 56 sailors in high seas from the heavy cruiser Indianapolis after the ship was sunk during World War II. When there was no more room inside, the crew tied sailors to the wings. The aircraft could not fly in this state; instead, it acted as a lifeboat, protecting the sailors from exposure and the risk of shark attack, until rescue ships arrived. Catalinas continued to function in the search-and-rescue role for decades after the end of the war.

Catalinas were also used for commercial air travel. For example, Qantas Empire Airways flew commercial passengers from Suva to Sydney, a journey of 2,060 nm, which in 1949 took two days. The longest commercial flights (in terms of time aloft) ever made in aviation history were the Qantas flights flown weekly from 29 June 1943 through July 1945 over the Indian Ocean, dubbed the Double Sunrise. Qantas offered non-stop service between Perth and Colombo, a distance of 3,592 nm. As the Catalina typically cruised at 110 knots, this took from 28 to 32 hours and was called the "flight of the double sunrise", since the passengers saw two sunrises during their non-stop journey. The flight was made in radio silence because of the possibility of Japanese attack and had a maximum payload of 1,000 lb (450 kg) or three passengers plus 143 lb (65 kg) of military and diplomatic mail.[

An Australian PBY named "Frigate Bird II", an ex RAAF aircraft, registered VH-ASA, made the first trans-Pacific flight across the South Pacific between Australia and Chile in 1951 piloted by (Sir) Gordon Taylor, making numerous stops at islands along the way for refuelling, meals, and overnight sleep of its crew. It route was from Sydney to Quintero in Chile after making initial landfall at Valparaiso via Tahiti and Easter Island. One of six ordered by the RAAF VH-ASA was used as part of the air route across the Pacific from Sydney to Valparaiso and now resides in the collection of the Museum of Applied Arts and Sciences in Sydney.

With the end of the war, all of the flying boat versions of the Catalina were quickly retired from the U.S. Navy, but the amphibious versions remained in service for some years. The last Catalina in U.S. service was a PBY-6A operating with a Naval Reserve squadron, which was retired from use on 3 January 1957. The U.S. Air Force's Strategic Air Command used Catalinas (designated OA-10s) in service as scout aircraft from 1946 through 1947.

The retired Catalina subsequently equipped the world's smaller armed services into the late 1960s in fairly substantial numbers.

The Brazilian Air Force had flown Catalinas and gained maritime operational experience in naval air patrol missions against German submarines from 1943. After the war, the flying boats operations continued, now carrying out air mail deliveries. In 1948, a transport squadron was formed and equipped with PBY-5As converted to the role of amphibious transports. The 1st Air Transport Squadron (ETA-1) was based in the port city of Belem and flew Catalinas and C-47s until 1982. Catalinas were convenient for supplying military detachments scattered along the Amazon. They reached places that were otherwise accessible only by helicopters. The ETA-1 insignia was a winged turtle with the motto "Though slowly, I always get there". Today, the last Brazilian Catalina (a former RCAF one) is displayed at the Airspace Museum (MUSAL) in Rio de Janeiro.


Cockpit of a PB5A.

Jacques-Yves Cousteau used a PBY-6A (ex N101CS) to support his diving expeditions. His second son, Philippe, was killed in an accident in this aircraft that occurred on the Tagus River near Lisbon. The Catalina nosed over during a high-speed taxi run undertaken to check the hull for leakage following a water landing. The aircraft turned upside down, causing the fuselage to break behind the cockpit. The wing separated from the fuselage and the left engine broke off, penetrating the captain's side of the cockpit.

Steward-Davis converted several Catalinas to their Super Catalina standard (later known as Super Cat), which replaced the usual 1,200 hp Pratt & Whitney R-1830 Twin Wasp engines with Wright R-2600 Cyclone 14 engines producing 1,700 hp. This modification required a larger, squared-off rudder to be installed to counter the increased yaw which the more powerful engines could generate. The Super Catalina also had extra cabin windows and other alterations.

Of the few dozen remaining airworthy Catalinas, the majority are in use as aerial firefighting aircraft. China Airlines, the official airline of the Republic of China (Taiwan) was founded with two Catalina amphibians.

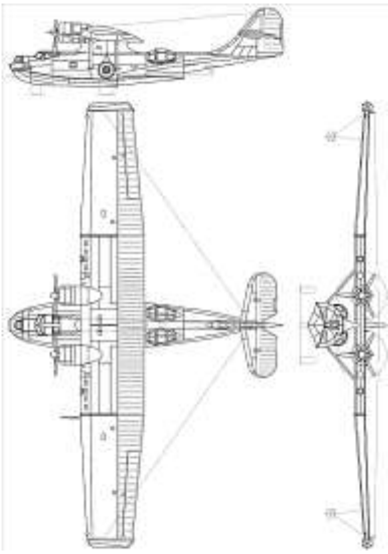
In July 2023 a company called Catalina Aircraft, current holder of the Type Certificates for the Catalina, announced an intent to build the Catalina II, a new aircraft on the basic design principles of the original Catalina but using turboprop engines and other modern aviation tools. Deliveries are planned to commence by 2029.

A PBY, modified for fire-fighting, at NAS Whidbey Island, Oak Harbor, Washington, USA, in 2009

Over-all, an estimated 4,051 Catalinas, Cansos, and GSTs of all versions were produced between June 1937 and May 1945 for the U.S. Navy, the United States Army Air Forces, the United States Coast Guard, Allied nations and civilian customers.

General characteristics

- **Crew:** 8 — pilot, co-pilot, bow turret gunner, flight mechanic, radioman, navigator and two waist gunners
- **Length:** 19.47 m
- **Wingspan:** 32 m
- **Height:** (6.43 m)
- **Wing area:** 130 m^2
- **Empty weight:** 9,485 kg
- **Max take-off weight:** 16,066 kg
- **Powerplant:** 2 × Pratt & Whitney R-1830-92 Twin Wasp 14-cylinder air-cooled radial piston engines, 1,200 hp each
- **Propellers:** 3-bladed constant-speed propellers



Performance

- **Maximum speed:** 170 knots
- **Cruise speed:** 109 knots
- **Range:** 2,190 nm
- **Service ceiling:** 15,800 ft
- **Rate of climb:** 1,000 ft/min
- **Wing loading:** 124 kg/m^2

Armament

- **Guns:** 3 x .30 cal machine guns (two in nose turret, one in ventral hatch at tail)
- 2 x .50 cal machine guns (one in each waist blister)
- **Bombs:** 1,814 kgs of bombs or depth charges; torpedo racks were also available

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Sir Frank Whittle – Father of the Jet Engine

By Rob Knight

Frank Whittle was born on June 1, 1907, in Coventry, Warwickshire, England. He died August 8, 1996, in Columbia, Maryland, in the U.S.A.) Sir Frank was an English aviation engineer and pilot, the one who invented the jet engine.

His father a mechanic, Whittle entered the RAF as a boy apprentice and soon qualified as a pilot at the RAF College in Cranwell. Early in his career he recognized the potential demand for an aircraft that would be able to fly at great speed and height, and he first put forth his vision of jet propulsion in 1928, in his senior thesis at the RAF College. However, his ideas met only with ridicule by the Air Ministry, who claimed they were impractical. In that same year he was posted to a fighter squadron where he served as a test pilot through 1931 and 32, before then pursuing further studies at the RAF engineering school, and at the University of Cambridge between 1934 and 1937.

Whittle's first patent for a turbo-jet engine was obtained in 1930, and in 1936 he joined with associates to found a company called Power Jets Ltd. which led to his first jet engine ground-testing in 1937. While this ground-testing event is customarily regarded as the invention of the jet engine, the first operational jet engine was designed in Germany by Hans Pabst von Ohain, and powered the first jet-engined aircraft flight on August 27, 1939.

It was only the outbreak of World War II that spurred the British government to pull-finger and begin supporting Whittle's development work. So, in 1941, a jet engine of his invention was fitted to a specially built but un-flown design – a Gloster E.28/39 airframe. The plane's maiden flight took place on May 15, 1941. The British government took over Power Jets Ltd. in 1944, by which time Britain's Gloster Meteor jet aircraft were in service with the RAF, intercepting German V-1 ram-jet powered drones.


Sir Frank Whittle's test-bed aircraft – a Gloster E.28/39

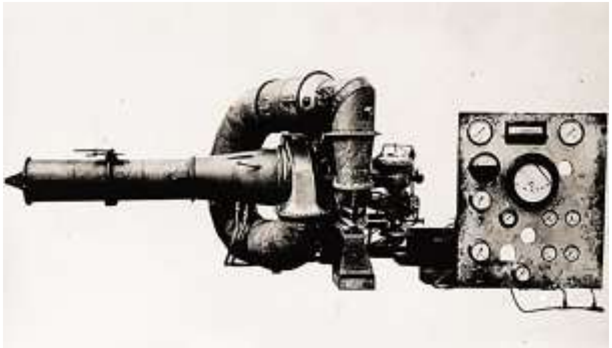
Whittle retired from the RAF in 1948 with the rank of air commodore, and that same year he was knighted. The British government eventually atoned for their earlier neglect by granting him a tax-free gift of £100,000. He was awarded the Order of Merit in 1986. In 1977 he became a research professor at the U.S. Naval Academy in Annapolis, Maryland. His book *Jet: The Story of a Pioneer* was published in 1953.

The definition of a jet engine is a type of any of a class of internal-combustion engines that propels an aircraft by means of the rearward discharge of a jet of fluid, usually hot exhaust gases generated by burning fuel with air drawn in from the atmosphere.

Internally, the prime mover of virtually all jet engines is a gas turbine. Variously called the core, gas producer, gasifier, or gas generator, the gas turbine converts the energy derived from the combustion of a liquid hydrocarbon fuel to mechanical energy in the form of a high-pressure, high-temperature airstream. This energy is then used to provide forward thrust, or is harnessed by a propulsor such as an aeroplane propeller to generate a thrust with which to propel the aircraft or a helicopter's rotor.

On 12 April 1937, at his laboratory at the British Thompson-Houston Works in Rugby, Warwickshire, RAF Flight Lieutenant Frank Whittle prepared the first test of his prototype aircraft engine, the Power Jet W.U. ("Whittle Unit"), which he called a "supercharger."

Using an electric motor, Whittle spun the engine up to 1,000 RPM before switching on the pilot jet, to spray atomized diesel fuel into the engine's combustion chamber. A hand-cranked magneto supplied a high-tensioned electrical current to fire a spark plug to ignite the fuel. Whittle continued to increase the RPM to 3,000, at which speed the combustion cycle became self-sustaining. The Whittle Unit continued to accelerate uncontrolled to about 8,500 RPM.



Rank Whittle's first test-bed jet engine.

This was the very first successful test of a turbojet engine.

By definition, the Power Jet W.U. was a single-shaft turbojet engine with a single-stage, centrifugal-flow compressor, a single combustion chamber, and a single-stage, axial-flow turbine. The engine had two air intakes, one for each side of the compressor impeller. The impeller was double-sided with a diameter of 19 inches (48.26 centimetres). It had 30 blades and was constructed of Hiduminium R.R. 56, a high strength, high-temperature, aluminium alloy produced by High Duty Alloys, Ltd., at Slough, Berkshire, England. The compressor blade tips had a width of 2 inches (5.08 centimetres). The inner diameter of the compressor scroll was 31 inches (78.74 centimetres). The turbine was 14 inches (35.56 centimetres) in diameter with 66 individual blades. Each blade was 2.4 inches (6.096 centimeters) long, with a chord of 0.8 inches (2.032 centimetres). The turbine was constructed of Firth-Vickers Stayblade, a chrome-nickel stainless steel alloy produced by Firth Brown Steels of Sheffield, South Yorkshire, England. The turbine bearing housing was water-cooled.

In functioning, air entered the compressor where it was heated and pressurized by the spinning impeller to about 4 times normal atmospheric pressure. This caused the air temperature to increase substantially. The pressurized air was passed on to the combustion chamber where the fuel spray was ignited by the spark plug. Burning gas passed through the turbine blades, causing them to spin at very high speeds. The turbine turned a shaft which led forward to turn the compressor impeller. Exhaust expelled through the tailpipe provides thrust.

Testing of the Whittle Unit continued until 23 August 1937. For reasons of safety, British Thompson-Houston would not allow Whittle to test the engine above 12,000 RPM., and recommended that he move his laboratory to a BTH-owned foundry at the Ladywood Works, Lutterworth, Leicestershire, England.

After analysing test data, Whittle concluded that the Power Jet W.U. had poor compressor efficiency; that there was excessive preheating of air entering the rear intake because of combustion chamber heat; the combustion of the air/fuel mixture was unsatisfactory; and there was excessive frictional loss in the turbine.

The W.U. eventually reached 17,750 RPM. and produced approximately 1,390 pounds of thrust (6.18 kilonewtons). Whittle continued testing a series of improved W.U. turbojets until 1941, when he built the Whittle W.1X engine based on data gleaned from the W.U. engine.

On 15 May 1941, a Whittle W.1 powered the Gloster E.28/39 prototype jet fighter on its first flight.

The test being eminently successful, development of the W.1X continued. Issues were slowly designed out and the performance of the engine improved. Subsequently, Whittle, by now a Wing Commander, developed the Whittle W.2, which powered the Gloster Meteor on its first flight, 5 March 1943. When he was promoted to Group Captain (temporary), 1 July 1943.

Whittle's W.1X engine

The Gloster E28/39, in flight

The Whittle W2/700 was the ultimate aircraft gas turbine engine development of Frank Whittle's company Power Jets Limited. The company was established to develop Whittle's patent for a gas turbine aero engine and it had successfully done that. The first flying engine, designated the 'W1' had flown in the Gloster E28/39, becoming the first English turbine-powered aircraft to fly.

The Whittle engine was licensed for development to several English companies, notably Rolls Royce, who took over the licence from Rover, and De Havilland. The Whittle engine was also the basis for the development of gas turbines in America by the General Electric Company (GE). In October 1941, General Henry Harley ("Hap") Arnold, U.S. Army Air Forces, arranged to have the W.1X flown to the United States so that the U.S. could develop its own jet engine, the General Electric Type I.

Gloster Meteor DD206/G was the first Meteor to fly, on 5th March 1943. It used the Whittle W.2 engine.

Air Commodore Sir Frank Whittle, OM, KBE, CB, FRS, FRAeS.

During WWII the Whittle 'W1-X' engine and design drawings for the up-rated 'W2' engine were sent to GE in the US for engine development there. Subsequently GE became one of the world's major manufacturers of aircraft gas turbine engines. A Rolls Royce version of the Whittle, called the 'Nene', found its way to Russia and then China, to Hispano-Suiza in France, Pratt & Whitney in the US, Rolls Royce Canada and Commonwealth Aircraft in Australia. Another Australian connection with the Whittle engine came with Richard Joseph (Dick) Ifield, an Australian engineer and inventor who worked for Joseph Lucas Ltd and invented the fuel pump and governor for the Whittle engine. His system was also used on the engines developed by Rolls Royce and De Havilland.

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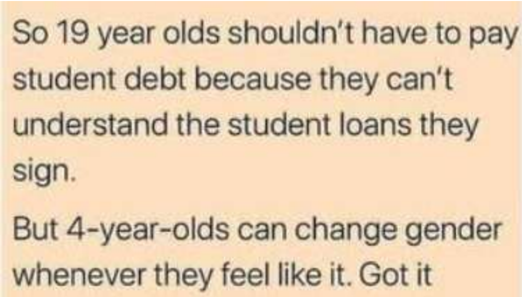
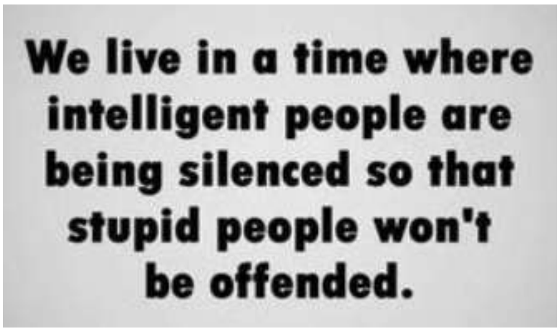
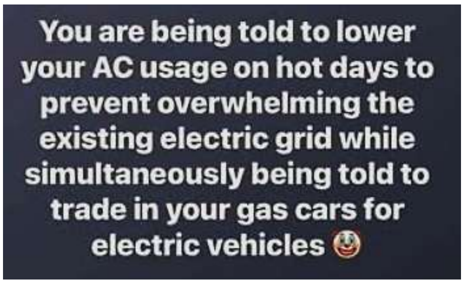
FLY-INS Looming

WHERE	EVENT	WHEN
Murgon (Angelfield) (YMRG)	Burnett Flyers Breakfast Fly-in	**Find Next Planned EVENT AT** **http://www.burnettflyers.org/?p=508**







Dr: Madam, I'm sorr…….

Patient: STOP right there. I'll have you know that I identify as a man.

Dr: Apologies Sir. I just wanted to advise you that your tests have come back and show you have ovarian cancer.

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

By Rob Knight

In the late 1970s my booking sheet gave my next student as a John G., booked to start a type rating in ZK-DON, a Maule M4-210C. At that time, it was the most powerful taildragger available for dual training and hire on any Ardmore flight-line.

John, a wealthy business owner, had joined the Club solely to get rated in the Maule. He intended to buy shares in a Harvard and get into flying warbirds. John had limited flight-time totals and I suggested that, as all he wanted was a type rating, and the Maule was vastly more expensive than the 150 hp Piper Cub, it would be cheaper to do the tail-wheel training in that, and checkout on the Maule afterwards. That resulted in the first incandescent melt-down I saw from John. He had told me what he wanted and I was to get on with it (expletives removed). His explosive outburst was seen by other instructors and the Office Manager, some of whom later reported it to the CFI. I told John that, as I was the pilot/instructor in command for his training, his attitude would have to change or there'd be no flying in any club aircraft and he quietened down.

John was no natural pilot. With the tact of a meat axe and the manner of a charging rhinoceros, his aircraft handling followed suit and our sessions were usually tense and I had to make it clear that, until John demonstrated the skills I wanted, there would be no signing off. However, he couldn't accept critique without felling belittled. And thus, we continued until eventually he gave me what I needed to see and I signed his paperwork.

Over the next period, John hired the Maule several times for local flights and one Saturday he planned to take some friends to Great Barrier Island on a hunting trip. I saw him load the rear luggage locker with rifles, ammunition, boxes of food, and several cartons of beer. Having already done weight and balance calcs with him as part of the type rating, I was surprised, as the M4 was very easy to load and with the centre of gravity aft of the rear limit. He tried to get a junior instructor to authorise his trip but, lacking a type rating himself, the instructor declined and John was forced to come to me. Whilst checking his flight legs and times, I idly asked for his load sheet showing his weight and balance calcs and he reverted to the old explosive rage he used to get his own way. He hadn't done a load sheet but was obliged to do one if I asked. I asked!

He stormed out to the aircraft, blank load sheet form in hand, and after a few minutes exploded again. The aircraft was well outside the rear limit. Enraged, he threw the flight manual and the fuel dipstick he held in his hand onto the tarmac. The wooden dipstick smashed, splitting into pieces, and the flight manual burst open leaving loose sheets blowing across the apron. I walked out and, while other Club members rushed around trying to do a Humpty Dumpty and put the flight manual together again, I grounded him indefinitely, on the spot, for inappropriate behaviour and damaging club property. Subsequently he paid the replacement costs for the damaged items after the Club lawyer wrote to him but he never flew with the Club again whilst I was there.

In early 1990 he had his Harvard shares and was in the Warbirds formation aerobatics team. It was "practice day" and he was booked for the team briefing at 1630 hours. However, he had had an earlier drama to deal with resulting in one of his rages. After assuring the team leader twice that he was OK to fly, the formation team took-off and commenced their practice. Ten minutes later, his AT6 Mk2A Harvard, No. 4 in formation, collided with another AT6, in no 3. position, in a bomb burst manoeuvre. John was killed when his aircraft dived vertically into a grassy area on the Ardmore airfield with its elevator cables severed, right rudder cable severed, and minus its starboard tailplane and elevator.

The pilot of the other AT6 was able to carry out a successful emergency landing on the runway at Ardmore – he was uninjured (See NZCAA TAI report, 90-039, dated 25 February 1990. A lack of anger management and flying aircraft don't mix.

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The Stringbag That Carried a Punch – The Fairey Swordfish

By Rob Knight

Many wartime aircraft types have become legends in their own right. There's the immortal Spitfire, the Hurricane, The P51 Mustang, and the P47 Thunderbolt, affectionately known as "the Jug". And what about the Lancaster, the Mosquito, and the B17s and B26s. All these types were martial aircraft, with testosterone producing guns, screaming engines, high speeds, massive bombs, and other displays of military might. Yet there's another aircraft, almost a little old lady, that sported four wings, flew at speeds akin to a Bristol F2 Fighter from WWI, operated off short airfields and aircraft carriers, carried but a single rear-facing machine gun for defence, that is also most certainly deserving of a place on this list of legends. I speak of the Fairey Swordfish, born of the Fairey Aircraft Company in 1936.

Founded by Charles Richard Fairey in the turmoils of WWI in 1915, the Fairey Aviation Company Limited was a British aircraft manufacturer for the first half of the 20th century. Based in Hayes in Middlesex as well as Heaton Chapel and RAF Ringway in Cheshire, the company produced the Swordfish in 1936.

T.S.R. II, Swordfish, aka "Stringbag".

Even at the time of its first flight, the Swordfish design was outdated and teetering on the edge of obsolescence in comparison to some alternatives. Considering that the Supermarine spitfire did its first flight only 18 days later, the Swordfish one could be forgiven for wondering what the advantages could be in such an outdated design. Time, and the type's successes would surely provide the explanation.

Being given the internal designation of T.S.R. I, standing for Torpedo-Spotter-Reconnaissance I, the proposed design was a biplane configured aircraft powered by a 645 hp Bristol Pegasus IIM radial engine. Not even having official sanction for development work, it was a self-financed private venture while both customers and applicable requirements for the type were sought by the Fairey management team.

On 21 March 1933, the prototype T.S.R. I flew its maiden flight from Great West Aerodrome, Heathrow. Subsequently, it performed various flights to explore its flight envelope, and to investigate the aircraft's flight characteristics. However, on 11 September 1933, the prototype was lost during a series of spinning tests during which it refused to recover. With great fortune, the pilot survived the incident. Prior to this, the prototype had exhibited favourable performance, which contributed to the subsequent decision to proceed with a more advanced T.S.R II prototype, which had been specifically developed to conform with a newly issued Specification S.15/33.

On 17 April 1934, the new prototype, the T.S.R II, performed its maiden flight. In comparison with the T.S.R. I, the new version was equipped with a more powerful model of the Pegasus engine, an additional bay within the rear fuselage to counteract spin tendencies, the upper wing was slightly swept back to accommodate the increased length of the fuselage, and other less significant aerodynamic-related tweaks to the rear of the aircraft. During the ensuing flight test programme, the T.S.R II was transferred to Fairey's factory in Hamble-le-Rice, Hampshire, where it wheels were replaced with a twin-float undercarriage. On 10 November 1934, the first flight of the T.S.R II in this new configuration was performed. Following successful water-handling trials, the T.S.R II conducted a series of aircraft catapult and recovery tests aboard the battlecruiser HMS Repulse. The T.S.R II was later restored to its wheeled undercarriage prior to an extensive evaluation process by the Aeroplane and Armament Experimental Establishment at RAF Martlesham Heath.

Testing at Martlesham was completed in 1935, and was followed by an initial pre-production order for three aircraft placed by the Air Ministry. It was at this point that the T.S.R II received the name Swordfish. All three pre-production aircraft were powered by the Pegasus IIIM3 engine, but were fitted with three-bladed Fairey-Reed propellers in place of the two-bladed counterpart used on the earlier prototype. On 31 December 1935, the first pre-production Swordfish made its maiden flight. On 19 February 1936, the second pre-production aircraft became the first to be delivered while the last pre-production aircraft was fitted with floats and underwent water-based service trials at the Marine Aircraft Experimental Establishment at Felixstowe in Suffolk.

In early 1936, an initial production contract for 68 Swordfish aircraft was received, as the Swordfish I and the type entered service with the Fleet Air Arm (FAA) in July 1936. By early 1940, Fairey was at its manufacturing capacity, busy with the Swordfish and other types such as the new Fairey Albacore torpedo bomber. The Admiralty approached the Blackburn Aircraft Company with a proposal that manufacturing activity for the Swordfish be transferred to it and Blackburn immediately set about establishing a brand-new fabrication and assembly facility in Sherburn-in-Elmet, North Yorkshire. Less than a year later, the first Blackburn-built Swordfish conducted its first flight. During 1941, the Sherburn factory assumed primary responsibility for the fuselage, along with final assembly and testing of finished aircraft.

Efforts were made to disperse production and to employ the use of shadow factories to minimise the damage caused by Luftwaffe bombing raids. Major sub-assemblies for the Swordfish were produced by four subcontractors based in neighbouring Leeds, these were transported by land to Sherburn for final assembly. Initial deliveries from Sherburn were completed to the Swordfish I standard; from 1943 onwards, the improved Swordfish II and Swordfish III marks came into production and superseded the original model. The Swordfish II carried ASV Mk. II radar and featured metal undersurfaces to the lower wings to allow the carriage of 3-inch rockets, later-built models also adopted the more powerful Pegasus XXX engine. The Swordfish III was fitted with centimetric ASV Mk.XI radar between the undercarriage legs which prevented the use of torpedoes. It retained the Pegasus XXX powerplant which produced 1065 hp.

On 18 August 1944, production of the Swordfish was ended; the last aircraft to be delivered, a Swordfish III being delivered on that day. Almost 2,400 aircraft had been built, 692 constructed by Fairey and a further 1,699 by Blackburn at their Sherburn facility. The most numerous version of the Swordfish was the Mark II, of which 1,080 were completed.


T.S.R. II, dropping its torpedo.

The primary weapon of the Swordfish was the torpedo, but the low speed of the biplane and the need for a long straight approach made it hazardous against well-defended targets. Swordfish torpedo doctrine called for an approach at 5,000 feet followed by a dive to torpedo release altitude of 18 feet, a mere 5,5 metres. The maximum range of the early Mark XII torpedo was 1,500 yards (1,400 m) at 40 knots, and 3,500 yards (3,200 m) at 27 knots. As the torpedo travelled 200 feet (61 m) forward from release to water impact, and required another 300 yards (270 m) to stabilise at preset depth and arm itself, the ideal release distance was 1,000 yards (910 m) from target. Considering the enemy defence gunnery, it was a big ask for the Swordfish to survive that distance.

The Swordfish was also capable of operating as a dive-bomber. During 1939, Swordfish on board HMS Glorious participated in a series of dive-bombing trials, during which 439 practice bombs were successfully dropped at dive angles of 60, 67 and 70 degrees, against the target ship.

After more modern torpedo attack aircraft were developed, the Swordfish was very effectively redeployed in an anti-submarine role. Armed with depth charges or eight "60 lb" (27 kg) RP-3 rockets, and flying from the smaller escort carriers, or even merchant aircraft carriers (MACs) when equipped for rocket-assisted take-off (or RATO). Its low stall speed and inherently tough design made it ideal for operation from the MACs in the often-severe mid-Atlantic weather. Indeed, its take-off and landing speeds were so low that, unlike most carrier-based aircraft, it did not require the carrier to be steaming into the wind. On occasion, when the wind was right, Swordfish were flown from a carrier at anchor.

Swordfish formation above their carrier.

Although never considered to a be a “pilot’s aircraft” to fly, the Swordfish was nevertheless very simple and had relatively low pilot loads. Its controls were physically heavy, and its rates of roll and climb were slow compared to other service aircraft, but these points were not in its design brief. Of greater interest to the pilots and crew members was its ability to remain flying after receiving heavy airframe damage from enemy gunfire and its ability to absorb shock from carrier landings in rough seas and darkness. But the over-riding complaint from all crew members was the freezing cold all experienced in the open cockpits.

Swordfish, on approach for its carrier.

Whilst obviously very vulnerable to heavily armed attacking fighter aircraft, the Swordfish’s low speed aided its extremely manoeuvrability and making it a hard target against faster foes, but its low speed increased its vulnerable against ground or ship fire, especially during torpedo attacks. Its maximum level flight speed was only 130 mph (113 kts) when unloaded which reduced to a mere 92 mph (80 knots) when carrying a torpedo. And torpedo attacks were straight runs – no evasive action allowed.

Armed with depth charges and rockets, the aircraft were good submarine killers. In the anti-submarine role, Swordfish pioneered the naval use of air to surface vessel (ASV) radar, allowing the aircraft to effectively locate surface ships at night and through clouds. It had a ceiling of 16,500 ft and a range of 522 miles.

The remarkable achievements of the type included sinking one battleship and damaging two others of the Italian navy during the Battle of Taranto, and the famous attack on the German battleship Bismarck, which contributed to her eventual demise. Swordfish sank a greater tonnage of Axis shipping than any other Allied aircraft during the war. The Swordfish remained in front-line service until V-E Day, notably outliving some of the aircraft intended to replace it.

After World War II the company diversified into mechanical engineering and boat-building. The aircraft manufacturing arm was taken over by Westland Aircraft in 1960. Following a series of mergers and takeovers, the principal successor businesses to the company became FBM Babcock Marine Ltd, Spectris plc, and WFEL (formerly Williams Fairey Engineering Limited), the latter manufacturing portable bridges.

Rear Gunner defence in a Swordfish

Note: The nickname "Stringbag" was not due to its biplane struts, spars, and braces, but a reference to the seemingly endless variety of stores and equipment that the type was cleared to carry. Crews likened the aircraft to a housewife's string shopping bag, common at the time and which could accommodate contents of any shape, and that a Swordfish, like the shopping bag, could carry anything.

Swordfish cockpit.

General Specifications:

Crew:	3 (pilot, observer, and radio operator/ rear gunner. The (observer's position was frequently replaced with auxiliary fuel tank)	Powerplant:	1 × Bristol Pegasus IIIM.3 9-cylinder air-cooled radial piston engine, 690 hp
Length:	35 ft 8 in (10.87 m)	Propeller:	3-bladed metal fixed-pitch propeller.
Wingspan:	45 ft 6 in (13.87 m)	Wing area:	607 sq ft (56.4 m^2)
Width:	17 ft 3 in (5.26 m) wings folded	Empty weight:	4,195 lb (1,903 kg)
Height:	12 ft 4 in (3.76 m)	MTOW:	7,580 lb (3,438 kg)

Performance:

Maximum Speed:	92 mph with torpedo at 7,580 lb (3,438 kg) and 5,000 ft (1,524 m)	Range:	With normal fuel - 522nm, 454 nm carrying torpedo
Endurance:	5 hours 30 minutes	Rate of climb	870 fpm at sea level, L690 fpm at 5000 ft.
Service ceiling:	16,500 ft (5,000 m) at 7,580 lb (3,438 kg)		

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

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

1. Why does a centre of gravity located behind the stated aft limit cause a risk of spinning without recovery?
   A. In the normal disposition of forces, the weight moment pitches the nose down, with a C. of G. aft of the limit, it may be aft of the centre of pressure so now both couples are providing a nose pitch up.
   B. Because an aft C. of G, can physically interfere with the travel limit of the elevator so full-down elevator is no longer available to provide recovery.
   C. The aft C. of G. interferes with the relative airflow and forces the angle of attack to exceed the critical angle.
   D. The aft C. of G. moves the centre of pressure to a point aft of the wing training edge and creates a loss of angle of attack control.

2. What causes compass variation?
   A. Anomalies in the earth's magnetic field as indicated by isogonals on a chart.
   B. The variation between the actual positions of true north and magnetic north.
   C. Errors in the magnetic compass.
   D. Miscellaneous electrical activity in the aircraft itself, modifying the earth's real magnetic field as read by the compass magnets.

3. After considering pax and bags, a pilot has 92 kg available for fuel. How many litres if fuel RD is 0.72
   A. 66 litres.
   B. 74 litres.
   C. 127 litres.
   D. 134 litres.

4. What type of topographical chart is used mostly for VFR flight planning.
   A. A conformal Mercator projection.
   B. A transverse Mercator projection.
   C. A sectional global projection
   D. A Lambert's conic conformal projection.

5. What are two advantages of the Lambert's Conic Conformal projection to pilots?
   A. Rhumb lines are straight lines and provide the shortest distances between points
   B. Great circle tracks are straight lines, and shapes are correctly indicated.
   C. Rhumb lines are curved lines and latitude lines are parallel.
   D. Great circle tracks are straight lines and meridians are curved.

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. A is correct.

The normal disposition of aerodynamic forces acting on an aeroplane in flight always has the weight (acting through the Centre of Gravity) ahead, on the chord line, of the Centre of Pressure, that point through which all the aerodynamic lift may be considered to act.

This provides two couples where on couple (lift and weight) pitches the nose UP, and a second couple, thrust and drag, pitching the nose down. Small residual imbalances are controlled through the tail empennage (elevator and tailplane / stabilator etc.).

However, if the centre of gravity location, that point on the chord where all the weight may be considered to act, is located too far aft, it may lie aft of the centre of pressure in which case the lift with weight couple will add to the thrust with drag couple and now all aerodynamic forces pitch the nose up.

Of significance is the fact that the centre of pressure moves forward and aft so it may be OK to get airborne, then move ahead of the centre of gravity when the angle of attack increases in flight such as after take-off resulting in an immediate loss of control, stall, and fatal spin with no possibility of recovery.

2. A is correct.

Magnetic variation is caused by anomalies in the earth's magnetic field as indicated by isogonals on a chart.

3. C is correct.

92 / 0.72 = 127 whole litres.

4. D is correct

5. B is correct.

Shapes being accurate is very helpful to visual navigation and the straight line tracks drawn by pilots approximate great circle tracks so distances are shorter.

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

I went to buy some camo pants but couldn't find any.

I failed math so many times at school, I can't even count.

I was wondering why the frisbee kept getting bigger and bigger, then it hit me.

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

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**

Morgan Cheeta Aircraft for Sale

- Registered 19-1502 and paid up until July 2025.
- Power Plant: Jabiru 2200 with the cold start kit & 1.2kw starter motor.
- Propeller: Sensenich 68" ground adjustable.
- Icom radio, 2 headsets, Sigtronics intercom.
- Flight Instruments: Airspeed indicator, altimeter, vertical speed indicator, slip/skid indicator.
- Strobe lights.
- Fat beach tyres & Matco. Brakes.
- 93 litre fuel tank.
- Leather seats.
- 100 Knots cruise.
- TTIS – 32.0 hours engine & airframe.

$38,000

Contact Colin Thorpe
Ph. 0419 758 125

Jodel D9 (Bebe) for Sale

Jodel D9, Registered 28-3503 (formerly VH-IVB)

With great reluctance I'm parting with the little Jodel as I'm simply not able to fly it often enough due to living overseas and the need to finish my Auster restoration.

Completed in 1964 by LAME Vic Bartinetti at Tumut this Jodel has around 700 hours total time on the airframe and about 300 hours on a-new-at-installation VW 1680cc Hapi conversion engine. It will be sold with a new propeller (currently in build) and current maintenance release. Currently the aircraft resides at YGYM (Gympie). Note that specific hours will be available when I return to Australia early in the New Year and can access the logbooks.

I have much history with the plane, having it bought it for the first time in 1979, then sold it, then bought it back in 2015. Email me and I will fill your inbox with stories.

I'm asking $8,000, which would include the new propeller but no radio.

Contact me by email only at kerryskyring@gmail.com

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