BRISBANE VALLEY FLYER

May - 2022

BRISBANE VALLEY SPORT AVIATION CLUB INC

www.bvsac.com.au

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

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Home-built Supercat, airborne at Watts Bridge 2010

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From the Club

Hello all,

Easter is over for another year, and I hope that you were all able to get away for the break or be able to visit family and friends.

Our last meeting was well attended and we had a visitor from the Probus Club, Cherryl Champney is a member of this organization.

Gillian Purdy from Probus is a ex air hostess for British Air Ways, and she and Cherryl spoke about a book by Tom Brady on The Empire Air Training Scheme. This gentleman gave a talk on this book at the Probus club meeting and Cherryl though we would like to hear about it.

You are all invited to our next meeting to be held in club house on the 7th May, so please come along to the meeting and then stay for the BBQ lunch and fellowship afterwards.

Peter Ratcliffe

President BVSAC

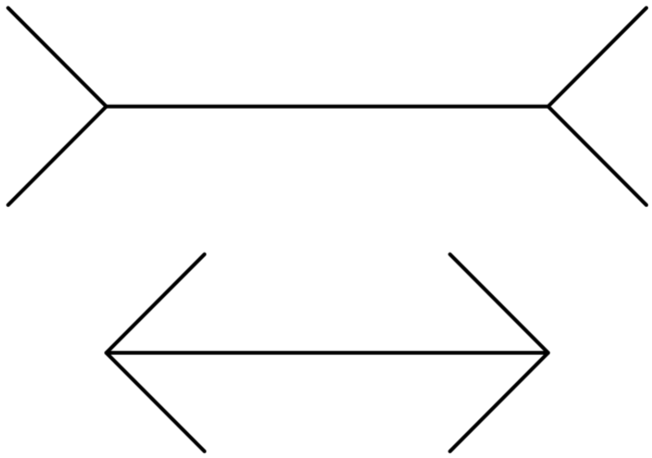
Illusions, When What you see is Maybe Not For Real!

By Rob Knight

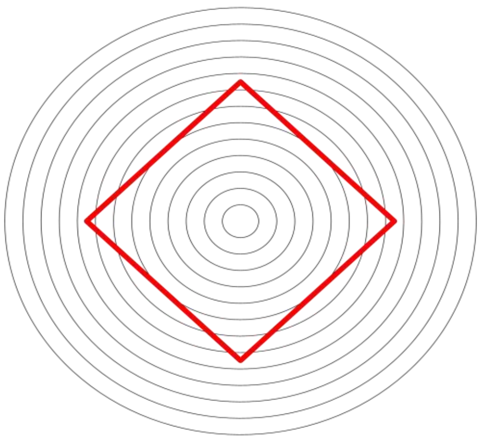
Everyone is familiar with visual illusions, with things that aren't as they appear. As young children, people learn that railway tracks don't come to a point at the horizon even though their eyes claim that they do.

Linear perspective illusions:

The two illusions below are typical of this type of illusion and demonstrate the ways in which the brain modifies what the eyes actually see and comes up with the wrong answer.



The two horizontal lines above are actually the same length.



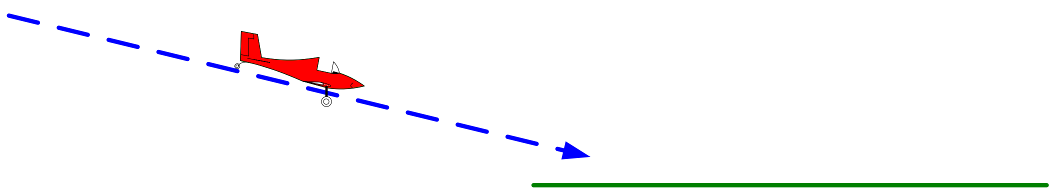
The sides of the red diamond are actually straight lines.
Go on – put a ruler over them.

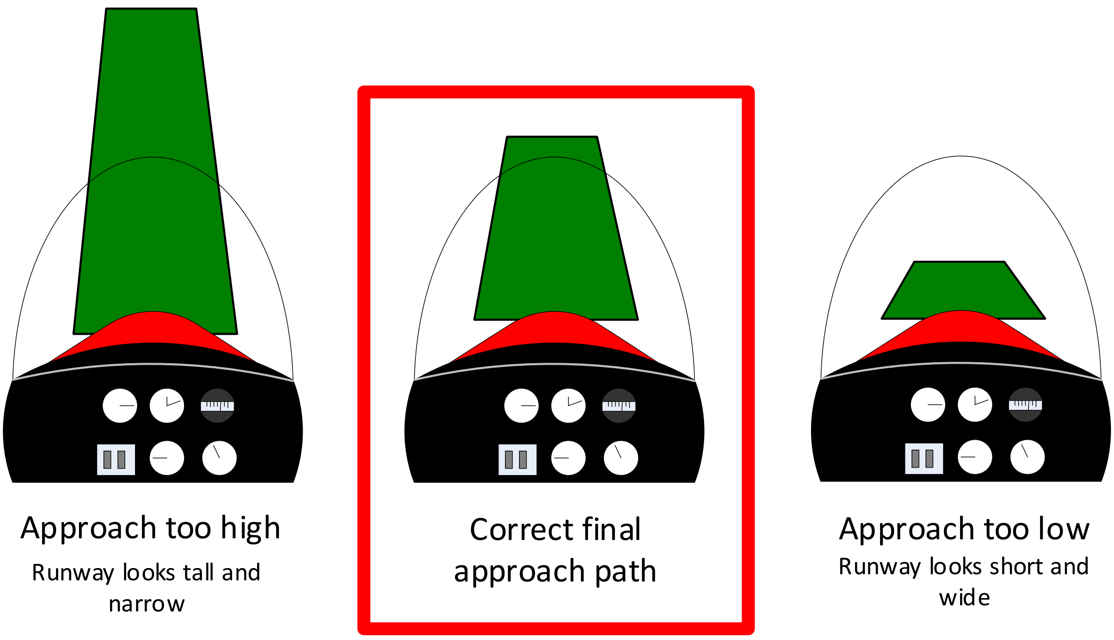
Linear Perspective Illusions in Flight:

This type of illusion can occur on final approach and may encourage a pilot to change his/her approach slope path when it is already, in fact, quite correct. The conflict lies between what a pilot sees when on approach, and what runways have looked like from this position in the past.

Different runways have different ratios of widths to lengths and, while most are level others have upslope or downslope. Pilots learn to recognize the appearance of a normal final approach by developing and recalling a mental image of the expected relationship between the length and the width of the runway they trained on, or runways they have experienced in the past. When faced with new runway dimensions and/or new or unexpected runway slope, the appearance of a *correct* final approach may be quite different from what they recollect and subconsciously use as a standard.

A *Normal* Approach into a Level Flat Runway.



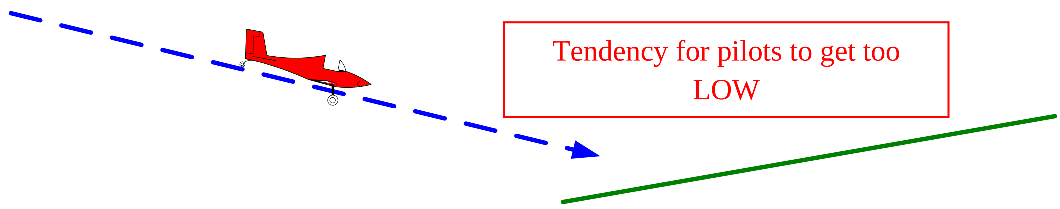


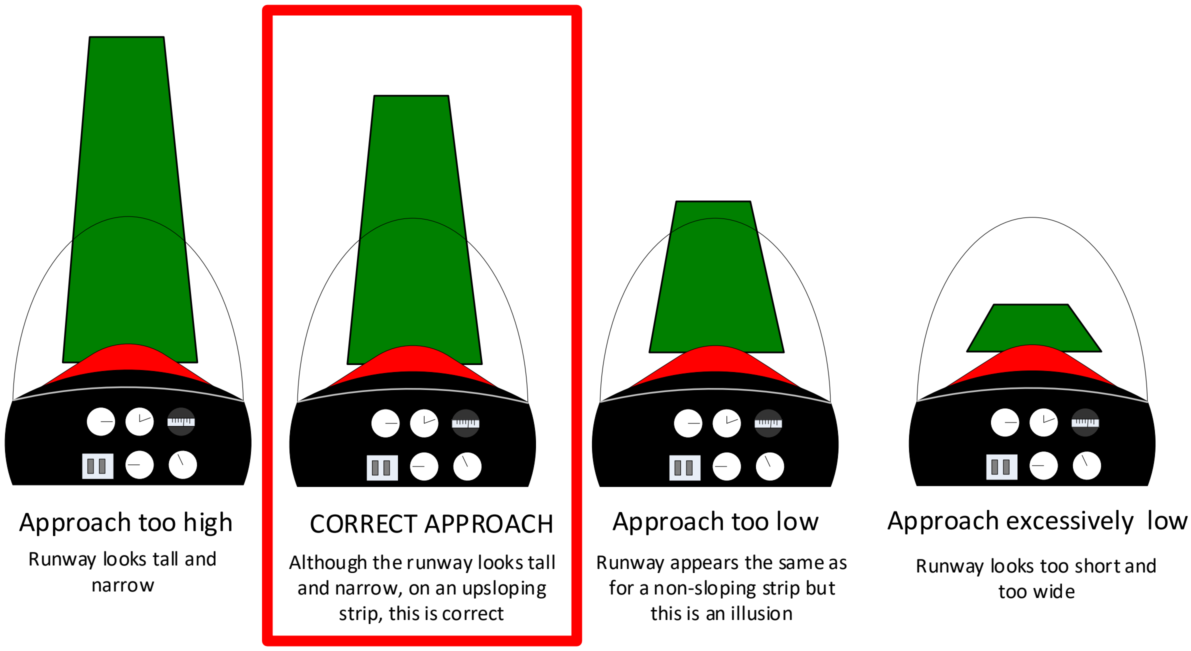
The accustomed appearance on final approach of a level, flat runway according to the pilot's memory.

The images above are a sample representation of the shape and extensions of a runway when a *normal* approach is made. Obviously, this can only be an approximation but consider these to be a standard that we can compare other representations against, over the following pages.

Now let's look at a descending *normal* approach into a Runway that slopes up-hill. The slope we see in this case appears to our eyes and thus our brain as a change in the shape perspective of the runway when viewed from the cockpit.

To a pilot, mentally comparing a sloping UP runway ahead to past level runways, the slope provides an illusion that makes it look as if the approach is TOO HIGH.





Up-hill sloping runway:

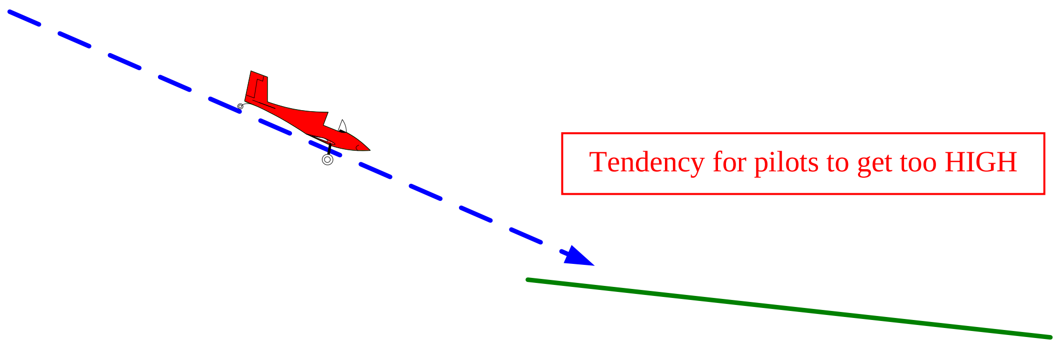
Note that the same illusion will occur on final approach for an unusually narrow runway.

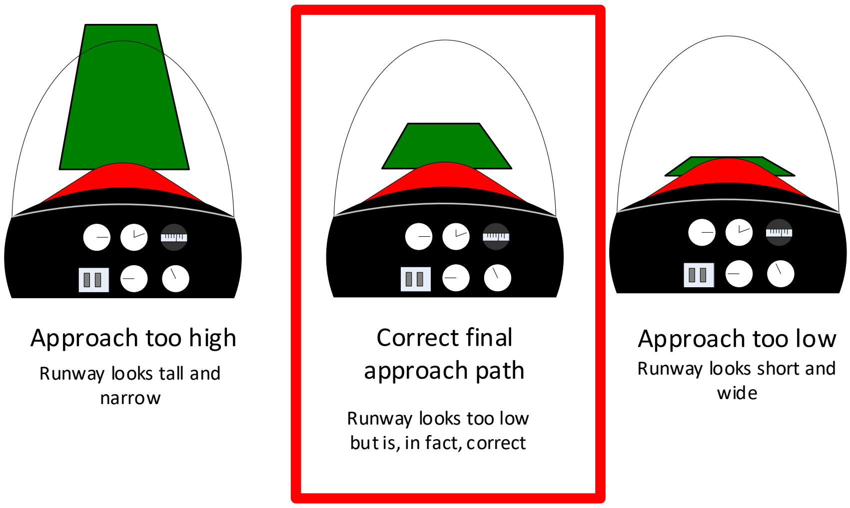
Making a descending approach to an up-hill sloping runway or to an unusually narrow or long one, can produce the visual illusion of being too high on finals. The pilot must ignore the illusion and not adjust the approach slope. The common pilot-error is to reduce power to steepen the approach and this is likely to result in a undershoot and a ground impact short of the runway. This tends to ruin one's day somewhat!

An alternative used by experienced low-level pilots is to make the approach from either a straight and level flight attitude, with appropriate flap extended, pitch set, and at an adequate approach speed, or to descend to a level below the strip and climb up to the landing. However, the judgement required for either of these techniques only comes after substantial training and practice to develop adequate accuracy. ***DON'T TRY THIS AT HOME!***

Making a *normal* approach into a Runway that Slopes Down-Hill:

To a pilot mentally comparing it to past level runways, this approach provides the illusion of being TOO LOW when it is actually correct. You can’t fix this one by adding power!





Down-hill sloping Strips

Note that the same illusion will occur on finals for an unusually wide runway.

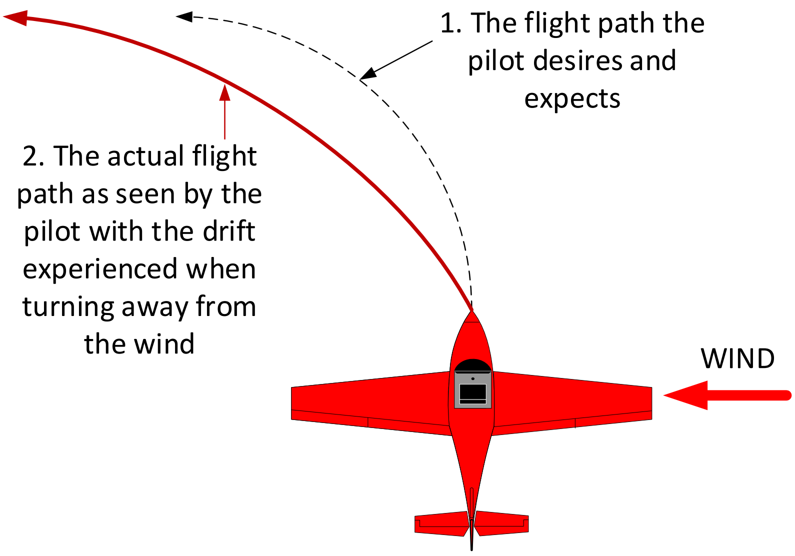
A *Normal* final approach to a down-sloping runway may produce the visual illusion of being too low on final approach. The appearance of the landing area in these circumstances is likely to encourage an inexperienced pilot to add power to make the approach slope appear normal but this will result in the aircraft being too high. The only safe option is then to overshoot.

If the approach is continued, the only result can be a late flare, a touchdown too far into the field with reduced braking ability because of the down-hill slope, and an over-run through the far fence at best.

These last endeavours do not endear a pilot to their insurer but may well bring a smile of anticipation to the face of an undertaker!

Other visual illusions that can have serious consequences for pilots at low level:

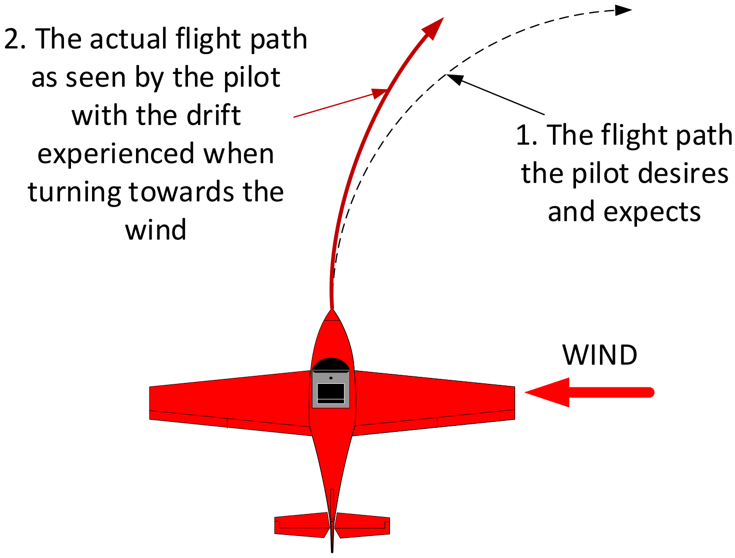
The drift of an aeroplane can cause a disconcerting illusion when turning at low level, it's the illusion of non-existent slip or skid in the turn, caused by drift.



The aeroplane appears to slip inwards, into the turn

Take a pilot flying across the wind and experiencing port drift. If he/she turn to port the drift will cause a sensation on of a turn with a higher yaw rate than should occur for the angle of bank used. In other words, it looks as if the aeroplane is slipping when it is not. This results in inexperienced pilots applying right rudder to decrease the yaw rate to what seems more appropriate for the bank angle. However, the pilot is now holding out-of-turn rudder and the ball will be on the left showing a skid. **THE CONTROLS ARE CROSSED BY THE PILOT.**

In the sketch below the same circumstances exist but the pilot is turning to the right – into the wind direction.



The aeroplane appears to skid outwards, away from the turn

To an inexperienced plot, the aeroplane will appear to be skidding out of the turn and they (perhaps even subconsciously) may add right (into the turn) rudder to counter the apparent skid out of the turn. However, with the added rudder the aeroplane is now slipping and the controls are, again, crossed. The ball will be again out to the left. **THE CONTROLS ARE CROSSED BY THE PILOT.**

The instant the pilot checks the slip/skid ball and steps on it if it is out of position, the aeroplane will be flying correctly again even though the apparent flight path will not confirm or agree with that.

For low level pilots this is one of the first illusions that must be trained OUT of the pilot when they begin their training. They must learn that, if the aircraft appears to be slipping or skidding in the turn, they check the ball and correct that ball position if it is out of place. After that they must ignore the illusion for that's all it is. Note that for port drift it is the right ruder that is misused and if the drift is to starboard, the left rudder will be misused.

In other words, pilots must ignore the illusions. They must anticipate drift and allow for it in terms of lateral distances when operating around obstacles.

One last but not least deception – The false visual reference illusion:

A "bat & ball" slip/skid instrument

A false visual reference illusion may cause a pilot to attempt to orient the aircraft in relation to a false horizon. This illusion is caused by flying over a sloping cloudbank. Pilots spend their lives levelling their wings to the visible horizon and when a sloping cloudbank is beneath and ahead of them, this illusion is extremely hard to ignore. An artificial horizon (when fitted) is very helpful here, otherwise the limited panel "bat & ball", or a turn coordinator is helpful. For ultralight aircraft that fly without a slip/skid indicator ("bat & ball", or turn coordinator), this illusion will remain very disconcerting until the pilot descends to a level beneath the sloping cloud layer.

Happy flying

Rebuilding 'Mriya' – Antonov Plans To Resurrect World's Biggest Aircraft – AN-225; Seeks Donation On Facebook Page

Antonov CEO Sergii Bychkov has launched a campaign to resurrect the world's largest plane, the AN-225 Mriya (Dream), which was destroyed by Russian troops in the early days of the Ukraine invasion.

On March 24, Bychkov posted an appeal on Antonov's Facebook page for donations, saying he wished to restore the Soviet-era plane as "a symbol of the world's highest scientific and technical achievements in modern transport aircraft construction." Antonov claims the company would do it themselves, but it is short on cash due to the ongoing war.

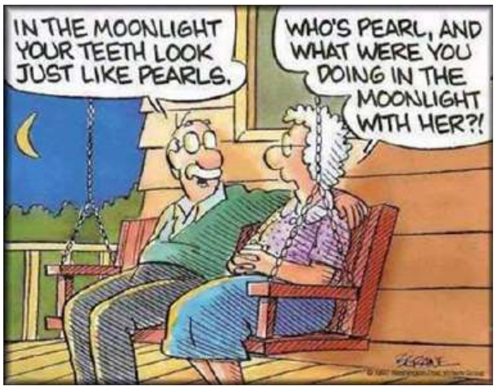
The remains of the An-225, which was destroyed by Russian troops (via Twitter)

The AN-225 was undeniably a powerful aircraft. It has six ZMKB Progress Lotarev D-18T turbofan engines that enable a maximum take-off weight of 640 tonnes. It has a wingspan of 290 feet, a length of 275 feet, and a height of 59 feet.

The gigantic freighter was the heaviest plane ever built and has set 240 world records, including two Guinness World Records for the aircraft with the heaviest take-off weight, as well as the largest wingspan of any aircraft.

Building a new An-225 is likely to cost more than $3 billion.

May 25, 2022



The Angle of Attack Deception

By Rob Knight

My logbook[#1] shows that I took my initial training flight on January 15th 1962, as a 13-year-old. All I had to offer myself was youthful enthusiasm, a burning desire to fly aeroplanes, and an insatiable craving to read every book about flying and aviation in general that I could lay my hands on. My father was also a student pilot at that time – when he could get away from the farm, and the local Aero Club Piper Cub and instructor were both available. I could already recite sections from his Fenwick Flight Training Manual including the bits about the stall occurring at an angle of attack, but I was also exposed to the Club's over-weight and over-bearing blowhard talk-abouts, slurping beer at the bar and reciting slurred adages such as, "Maintain thy airspeed lest the world arise and smite thee," as relating to a stall on approach. The text books were stating one thing but my peers were telling another story entirely.

Three years later I went solo, at 16, after school finished for the day and still wearing the grey and black school uniform of the Whangarei Boy's High School. Still confused about the real cause of a stall but too afraid of self-embarrassment to ask, I figured that so long as I didn't "poke the tiger" and I maintained the 80mph approach speed required by Ian Butchart, my instructor in the Piper Colt that replaced the Cub, I'd be OK. I was: it did: and I continued flying: everyone was happy. The following year, at 17, I was awarded my PPL – in the same aircraft and holding the same beliefs and concerns in regard to stalling.

My point in this preamble is to highlight that we can survive in many human endeavours by merely following rules whilst ignoring the underpinning knowledge details necessary to provide on-going safety. Still slightly troubled about the topic, I continued in ignorance and was considered by the Civil Aviation Authority to be safe enough to take passengers. Now, at the other end of my flying life, I contend that this is not the way it should be, and the ever-rising number of stall/spin accidents across the world appear to support this. Pilots need to better understand the real cause of a stall and the subtle influences changing the angle of attack that can occur in flight, to better avoid blundering into the hands of an undertaker.

Even professional pilots have made the fatal statistics lists in this, along with their passengers. Take the Air France A330 crash in June, 2009. In this case, the aircraft carried a Captain and two co-pilots to comply with Air France duty-time requirements. Whilst the Captain was on a duty break and out of the cockpit, the indications are that the pitot tubes iced over and the aircraft systems automatically disengaged the auto pilot. The co-pilot in command lost control whilst hand flying and allowed the aircraft to enter a stall, a fact not recognised by either of the co-pilots seated in control positions. Under their mis-control, the aircraft subsequently achieved a 40º nose-up attitude whilst maintaining a steep descending flightpath. This invoked another adage - to make an aircraft go up you pull the stick back, and to make it come down, you pull it back a bit further. Already stalled, these dough-nut dummies attempted to stop their breakneck descent by pulling the stick back further. This complete lack of appreciation by professional pilots as to what, in reality, was happening, caused 228 people to lose their lives over the next few minutes. It was a tragedy that highlights the seriously inadequate stall recognition training given to pilots even at these exhalated levels of aviation. After all, if you think that a lack of speed causes a stall, and your ASI says that you have plenty of speed, how do you recover from a stall that you don't recognise?

The poor training continues today insofar as the authorities are concerned. I have been teaching pilot theory since 1974 and have yet to see one example of a question in a pilot theory paper at any level that asks for the cause of a stall. But every paper has questions relating to the stalling speed, and what might change it. Yet an aeroplane can and will stall at any speed, at the moment its wings exceed their critical angle of attack. Is it any wonder that there remains deep confusion amongst pilots in regard to this topic, that an aeroplane stalls at an angle of attack and NOT a speed?

> STOP! WAIT! What is this *CRITICAL ANGLE OF ATTACK*?
> *The critical angle is the last possible angle of attack that a wing or aerofoil can achieve before the airflow over the upper surface breaks away and becomes turbulent i.e., the wing stalls.*

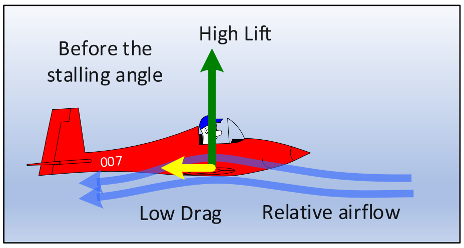
The statistics speak loudly, indeed. Across the western world the message is told in multitudes of fatal stall/spin accidents after the approach to land has commenced. If all these fatally afflicted pilots were drop-outs at school, perhaps we could believe that it was an educational issue, but that is very much not the case. The statistics tell of truck drivers, labourers, and trades people that have trained as pilots, as well as doctors, teachers, layers, and, indeed professors, that are represented on these statistics lists. It's not an educational thing per-se. In fact, more professional and intellectual individuals are listed in proportion to non-intellectuals, so it might be argued that intellectuals have an added risk. So, what the hell is really going on here?

To me the issue is only too simple. Instructors demonstrate and teach stalling as an exercise and tell the students to note the changing airspeeds as the aircraft is stalled with and without flap, with and without power applied, and in a turn etc. This lends itself to an over emphasis being placed on the stalling speed and causes of changes to it, rather than a deeper and more relevant line of training relating to how the angle of attack changes in flight (sometimes with no change in nose attitude). Even at the practical "quiz" done by flight examiners before or after a flight test, the question will be, "What can change the stall speed of an aircraft", when they should be asking, "What can change the angle of attack of an aircraft and precipitate a sudden and unanticipated stall?" The systemic (aka *officia*l) line of stall and stall recovery training, practical as well as theory, and across all nations, has become mere brainwashing, and encourages the belief that the one and only cause of a stall is a lack of airspeed. WRONG, WRONG, WRONG!

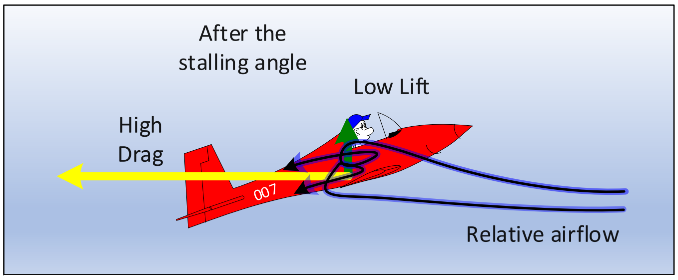
But what, in reality, is a stall? In things aviation, a stall is a breakdown in the normally smooth and streamline airflow across the upper surface of an aerofoil or wing ahead of the separation point. This airflow breaks away from the wing surface and becomes turbulent as it flows back above the wing.

Why does it break away and become turbulent? Because the angle of attack exceeds the critical angle for that aerofoil in that current state. I have not mentioned speed because speed is NOT A FACTOR.

Let's start with a little theory. In normal, unstalled flight, the aircraft requires a continued line of smooth flowing air across and under the wings to provide the lift it needs to continue flight. This smooth flow of air is called *streamline flow*.



In normal (unstalled) flight. The aerofoil is not operating in excess of its critical angle of attack. Note the lift and drag values.



A stalled airflow- the aerofoil has exceeded its critical angle in a classic, level-flight stall. Note that an aircraft will stall in ANY attitude. Also note the lift and drag values when stalled.

DEFINITION: The angle of attack is the angle made between the chord line of the aerofoil, and the relative airflow. The relative airflow is a vector quantity having both magnitude (speed) and direction relative to that aerofoil

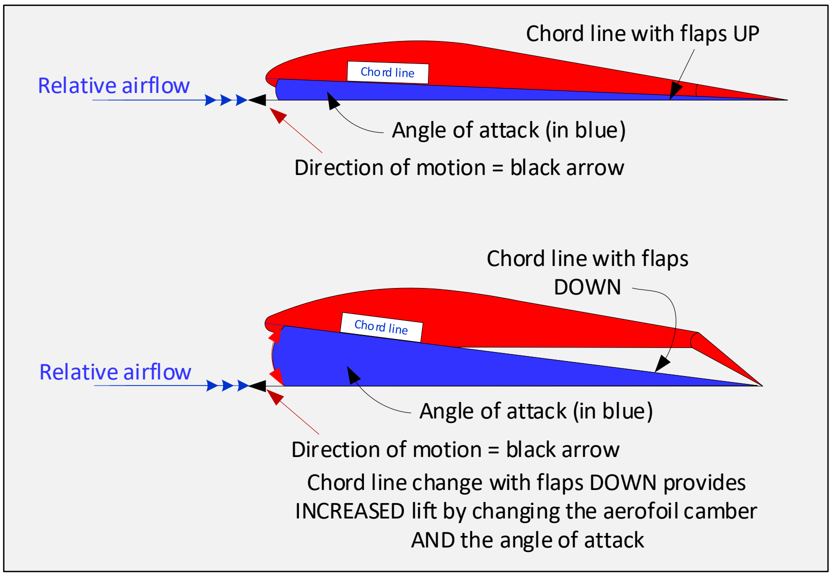
There are several things that a pilot can do in flight that will change the angle of attack at any one point in time. These are:

I. Change the aerofoil's chord line.
II. Change the aeroplane's nose attitude with no change in the aeroplane's flight path,
III. Change the aeroplane's flight path with no change in the nose attitude,
IV. Bank/turn the aeroplane whilst climbing or descending.
V. Roll the aeroplane.

Before the howls of derision reach my tender ears, let's look at these statements, one at a time, before we make statements that we might regret. Let's see how pilots change the aerofoil's chord line.

We do this every time we lower flaps or move a control surface.

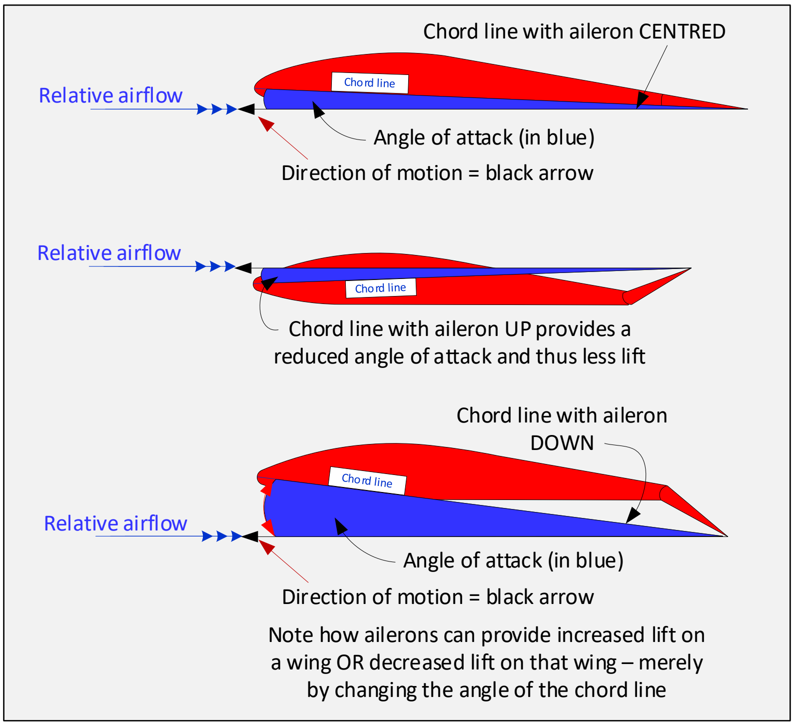
I. Lowering Flaps:



When flaps are lowered, the drooping of the trailing edge will cause the chord line to change. If the aeroplane's level flight path is maintained, this will cause an increase in the angle of attack and thus an increase in the lift and drag across those parts of the wing ahead of the flap location. Note that flaps are inevitably inboard on the trailing edge of a wing and both work together, except in rare designs where the flaps and ailerons are designed to function together (flaperons), they do not function differentially (i.e., one up, the other down).

II. Applying aileron:

Unlike flaps, which usually only go down, ailerons move either up or down. Primarily used for lateral control (roll), they function by either decreasing lift over the section of wing ahead of their location by going UP, or increasing lift by going DOWN. Moving a control column to the left will cause the left aileron to go up and decrease the lift on the left outer wing whilst simultaneously, the right aileron will go down and increase the lift on the right wing. The total effect is to roll the aircraft to the left. This is a clear situation where the ailerons are changing the chord line to change the angle of attack. Note that in both these cases, the sketches are based on the assumption that the aerofoil's direction of travel is from right to left.



III. Change the aeroplane's nose attitude with no change in the aeroplane's flight path:

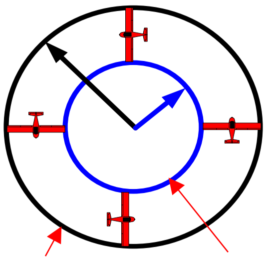
A pilot changes the nose attitude (or just "the attitude") using the stick or yoke pressed backward or forward. In an unstalled aeroplane, easing it backwards will raise the nose attitude, or pressing it forwards will lower it. This will change the angle of attack respectively increasing it with a rising nose attitude, or decreasing it when the nose is lowered.

Obviously, this is an interim thing when the airspeed is constant because increasing the angle of attack will increase lift and the aeroplane will begin to ascend. And vice-versa – reducing the angle of attack by lowering the nose will set up a descent. But a stall doesn't wait before it occurs, and any time the critical angle of attack is exceeded the aerofoil/wing WILL stall until the angle of attack is reduced to below that oh-so-critical angle.

IV. Bank/turn the aeroplane whilst climbing or descending.

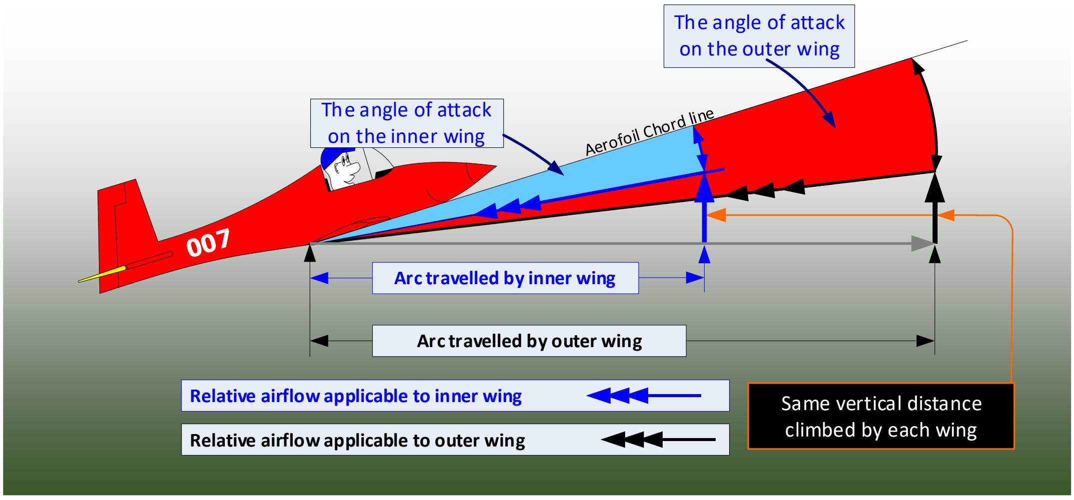
Now this one did take considerable time for me to sort out. For ages I couldn't see how the angle of attack could differ on each wing if the aircraft was not rolling, but eventually I saw the light and discovered that they really do.

In any turn each wing scribes a different arc around the centre of the turn - the outer wing travelling a greater distance than the inner wing because its arc is greater.



Now I must add that, not only does the outer wing travel a greater arc (black) than the inner wing (blue), but will travel it in the same time as the inner wing arc.

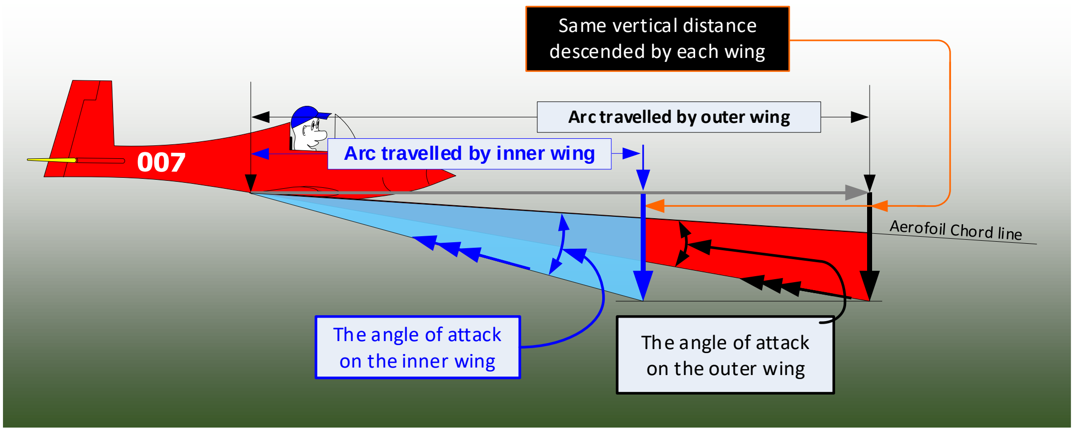
However, if the aeroplane is climbing, not only is the outer wing moving faster, but it has a greater angle of attack as well.



The sketch above depicts the differing arc distances travelled that cause of the variations in relative airflow directions. As the angle of attack is defined as being the angle between the chord line and the relative airflow, obviously, having different relative airflow directions whilst maintaining the same chord line angles, MUST provide different angles of attack.

The sketch clearly displays the fact that, in a climbing turn, the outer wing has a higher angle of attack. Note that the sketch is not-to-scale.

Now for the descending turn. The sketch below shows that, in a descending turn the inner wing has the higher angle of attack.



You'd better believe it! In a descending turn the inner wing has a lower airspeed AND has a higher angle of attack than the outer wing.

This is not a case of a magician using smoke and mirrors. In any banked climbing or descending turn, each wing will have a different angle of attack to the other. Normally this merely results in a tendency to overbank, but when considering inadvertent stalling, the topic takes on a more sinister application.

V. Roll the aeroplane:

As an aeroplane rolls, the relative airflow will approach the chord line from different direction. The down going wing will thus acquire a higher angle of attack because the downward moving aerofoil, will meet rising air caused by its rolling action.

The reverse will occur on the upward moving wing – it's aerofoil will receive the relative airflow from a higher point and this will result in a lower angle of attack.

The precise application of the concept thus far, is to demonstrate that the angle of attack varies with the application of controls, and under certain other conditions of flight. A lack of knowledge of these conditions can set up the ducks in a row and lead to disaster.

Now follow me through the next scenario. Take the situation where a pilot on descent and on base leg realises that they are little high. Pre-occupied, they start their turn onto finals a fraction late and overshoot the extended centreline. Bank is applied to turn but it's not enough so they increase the angle a little. Nervous, the stick is drawn back a little and, un-noticed, the airspeed begins to fall but still no-where near the accepted stall speed. A little rudder is furtively added – just a bit to increase the yaw. The nose begins to swing just a little faster and the yaw causes further roll inwards, into the turn. As the aircraft rolls, the roll further changes the relative airflow on the inner wing and increases the angle of attack to a point in excess of the critical angle. Then a shudder as the stall breaks over the inner wing and the aircraft snaps towards the lower wing. The critical angle on the inner wing was exceeded because of the aircraft's descent and the yaw applied by the pilot even though the ASI indicates above the normal stall speed. If the pilot, in fright because of the sudden roll inwards, applies full out of turn aileron the aircraft will autorotate and the spin has been entered. The pilot, unaware of the true cause of the roll, snap, and now spin, and in a state of shock/horror, pulls hard back on the stick and spins vertically in the ground.

End of story……… - not quite.

Prologue. Now let's pull this tragic situation apart and examine each of its contributing factors, one at a time. The aircraft was turning and a turn produces loading, so the stall speed would be increased.

The aircraft was descending and the wings were not producing lift to equal the weight so this would, to some extent at least, mitigate the stall speed rise due to any loading from the turn.

The pilot had inadvertently raised the nose and slowed the aircraft so its angle of attack on both wings would have been higher than when the airspeed was correct and not decaying.

The use of inappropriate rudder to increase the yaw has the effect of increasing the airspeed on the outer wing and decreasing it on the inner wing (further effects of Controls – second lesson in the Pilot training books).

Add the effect of the added loading in the turn, to the already high angle of attack on the inner wing, and then the effects of both onto the reduced airspeed of the yaw, and the onset of the stall is inevitable.

At this time, a very slight movement forward of the stick would have reduced the proximity of the stall on the inner wing, adding full power and commencing a go-around would have removed all associated safety issues. The aircraft would have flown away to make another and better judged approach. The relevant lines for gathered statistic details would have remained blank. But the pilot didn't, and they resultingly weren't.

It was the application of substantial roll-out aileron that sealed the fate of the aircraft and its occupants. With the application of that out-of-roll aileron, the wing area ahead of the aileron on the inner wing immediately and deeply stalled. With the inner wing producing far less lift and, simultaneously, far higher drag, than was being experienced by the outer wing, the aircraft snap-rolled inwards because of the lift lost in the stall and the nose was savagely yawed down by the extremely high drag experienced by that stalled inner wing.

When pilots really believe that an aeroplane stalls when the airspeed is too low the scenario above becomes inevitable. A stall is NOT an airspeed issue – it's simply an angle of attack issue compounded by the seldom discussed fact that the angle of attack on aeroplane wings can change considerably with control applications and with changes to the aircraft flight path. Too many pilots qualify and continue to believe for the rest of their flying lives, that the angle of attack only changes when the aeroplane is in level flight and the pilot raises the nose as the airspeed falls to enter a practice stall.

Life really isn't that simple and only training can correct this impression.

In conclusion, some would argue that I am supporting the inclusion of an angle of attack indicator on the instrument panel. That is incorrect. While there are such indicators, easily acquired and not particularly expensive, it would be just as bad having pilots trying to fly using an instrument inside, when their head eyes and brains should be very much outside – like when on approach. Angle of attack indicators are not the answer, they would merely increase the issues. It is pilot understanding that needs to improve, and that can come only with improved education.

Think Angle of Attack and Fly Safely.

De Havilland to develop updated water bomber called DHC-515 Firefighter

De Havilland Aircraft of Canada has re-launched development of an updated water bomber based on the stalwart CL-series line of firefighting aircraft.


A CL-series aerial firefighter

The Canadian airframer has committed to developing its DHC-515 Firefighter, a variant had been called the CL-515 prior to a recent organisational realignment by De Havilland parent Longview Aviation Capital, De Havilland says on 31 March.

"After an extensive business and technical review, we are pleased to announce that we have launched the De Havilland DHC-515 Firefighter programme, which will involve negotiating contracts with our European customers and ramping up for production," says De Havilland chief executive Brian Chafe.

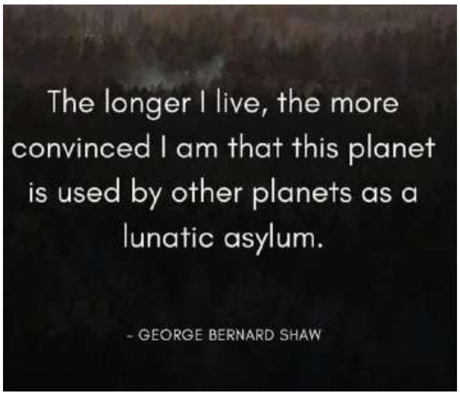
The move puts the Canadian manufacturer on a path to restarting production of an aircraft family that, over decades, proved its worth in the fleets of the world's aerial firefighting services.

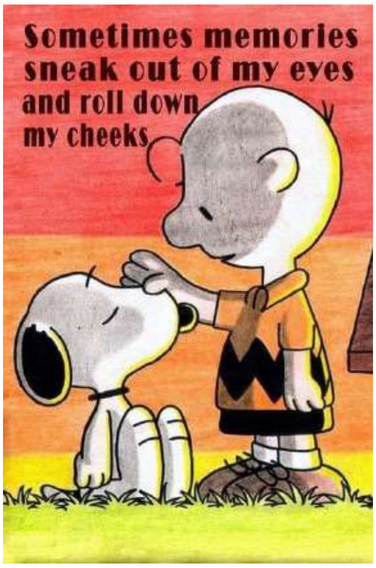
De Havilland aims to deliver its first DHC-515 by mid-decade.


Canadair CL Series 414, in action in Italy

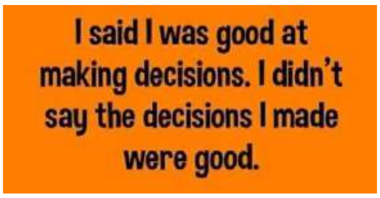
FLY-INS Looming

Murgon (Angelfield) (ALA)	Burnett Flyers Breakfast Fly-in	**Next Planned – June 12th, confirm at http://www.burnettflyers.org/?p=508**
Gatton Air Park (YGAS)	Breakfast Fly-In	**Sunday, May 8, 2022**
Shute Harbour YSHR	Fly-In and Runway Dinner	**Whitsunday Airport 10/09/2022**





So many people are too judgmental, I can see that just by looking at them.



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Warbird – The Brewster Buffalo

Was it a diamond, or was it a disaster?

By Barrett Tillman. 22/09 2021

DURING WORLD WAR II THE FINNISH VARIANT OF THE U.S.-BUILT BREWSTER BUFFALO PROVED MORE THAN A MATCH FOR TOP SOVIET, GERMAN AND BRITISH FIGHTERS

A US Navy Brewster Buffalo

It was an incongruous scene. On a June day in 1942 a few stubby, blunt-nosed U.S.-built fighters bearing swastika markings climbed eastward to intercept British-built fighters bearing red Russian stars. Meanwhile that month on the opposite side of the planet the same American-made fighters suffered a disastrous encounter with the Imperial Japanese Navy near Midway Atoll.

The barrel-shaped American-made fighter was the Brewster Buffalo. Both the Finns and the U.S. Marine Corps flew the type—though with vastly different outcomes. Near Midway the Marine squadron VMF-221 lost 13 out of 20 Buffalo, while the Finns typically outshot their Soviet enemies by orders of magnitude.

To explain the difference requires strategic and tactical context.

The geography of Finland, which shares borders with Sweden and Russia, shaped its potential for conflict. Neutral Sweden had not fought a war since 1814, when Norway secured its independence. But Finland and its antecedents had waged war against Russia about a dozen times, mostly in the tsarist era through the early 19th century. During the worst weather many Finnish soldiers sat back to enjoy vodka.

In August 1939 the Soviet Union and Nazi Germany stunned the world by signing a nonaggression pact. Three months later Russia, coveting the Karelian Isthmus north of Leningrad (present-day St. Petersburg), attacked Finland. The Winter War, as the subsequent conflict was called, lasted until the spring of 1940 when Helsinki agreed to Moscow's demands, ceding 11 percent of Finnish territory.

US Brewster F2A Buffalo

In that period the Finnish air force, the Ilmavoimat, was tiny. Excluding training and liaison machines, its combat strength varied from 110 to 166 aircraft. The inventory represented a smorgasbord of types from Britain, France, Holland and Italy, among others. Standardization was an obvious goal, but not easily achieved.

Meanwhile, World War II erupted in September 1939 as panzer armies swept across Europe. In April 1940 the Germans attacked Norway. As Finland was officially neutral, Helsinki allowed Wehrmacht forces to cross its territory en-route to Norway. When Germany invaded Russia in June 1941, Helsinki and Berlin became de facto allies, although Finland never joined the Axis. At that point the United States cut off aid to Finland, including replacement aircraft and parts.

Man for man the Finns were among the world's finest fighter pilots. Necessarily small, the Ilmavoimat sought to produce world-class aviators to oppose the nation's most likely enemy—Russia. Toward that end, during the 1930s the Finns sent senior airmen to foreign nations to gather information on fighter aviation.

The "father of Finnish fighter tactics" was then Capt. Gustaf Erik "Eka" Magnusson. He sought exchange tours in France and Germany during the 1930s and tested a variety of European fighters, leading to Finland's adoption of Holland's Fokker D.XXI fixed landing gear monoplane.

With Lt. Col. Richard Lorentz, Magnusson adapted lessons learned from France and Germany and applied them to Finland's nascent fighter arm. The result was spectacular success in combat. As leader of Lentolaivue (LeLv) 24, Magnusson produced the most effective fighter squadron in his air force. During the 1941–44 Continuation War, flying Brewsters and Messerschmitt Me 109s, LeLv 24 claimed 781 aerial victories against 33 losses—a ratio of nearly 24-to-1.

The Finns recognized the benefit of more flexible formations, using the later world-standard four-plane flight ahead of the Luftwaffe. The optimum fighter flight comprised two four-plane divisions, each with two sections of leader and wingman, sometimes staggered in altitude. Rather than the 30- to 45-degree "pursuit curve" flown by nearly every air arm, the Finns joined the U.S. Navy in training wide-angle shooting, out to 90 degrees. The ability to hit at full deflection became a force multiplier for the inevitably outnumbered Finns.

Whatever the normal exaggeration attending a unit's score, the vastly lopsided results spoke volumes. Magnusson led from the front. When he departed LeLv 24 in 1943 to command a flight regiment, he had 5.5 personal kills, leading a roster that included Finland's top In the lead-up to war the Finnish government considered three American aircraft with which to upgrade its fighter arm, each an all-metal monoplane with retractable landing gear and an enclosed cockpit, including the Grumman F4F and Seversky EP-1, an export version of the P-35. Since the Grumman types were not yet available, and the EP-1s went to Sweden, Helsinki focused on Brewster's new naval fighter, the F2A-1. As Finland was not yet at war, the administration of President Franklin D. Roosevelt declared the F2As "surplus," and Helsinki received 44 before an embargo took effect.

Brewster Aeronautical Corp. was a descendant of Brewster & Co. of Long Island, N.Y., founded in 1810 as a carriage maker and later producing luxury automobile bodies and airplane parts. In the mid-1930s to early '40s Brewster Aeronautical had limited success with its SBN scout bomber for the U.S. Navy and SB2A/A-34 dive bomber for multiple services, though neither saw combat.

The Navy had already entered the monoplane age with the Douglas TBD Devastator and Vought SB2U Vindicator dive bombers, both of which were aboard carrier decks in 1937. A monoplane fighter was bound to follow, and it arrived on two tracks: Brewster's F2A-1 (tentatively the Twister, later Buffalo) and Grumman's F4F-3 (tentatively Comet, later Wildcat). The Brewster, a major leap from Grumman's F2F and F3F biplane fighters, entered fleet service in 1939. With hydraulically operated landing gear, the F2A was well ahead of its Grumman counterparts' hand-cranked wheels. The F2A also boasted a spacious cockpit with a large "greenhouse" canopy to afford pilots better visibility than in most contemporaries.

The prototype XF2A-1, powered by a Wright R-1820 Cyclone nine-cylinder radial engine, first flew in December 1937. A typical early order of 54 production F2A-1s ensued with fewer than a dozen delivered to the carrier USS Saratoga. The Roosevelt administration, sympathetic to Finland during the 1939 Winter War, diverted 44 of the Brewsters to the Ilmavoimat, though the first six arrived too late for combat. Though tiny Finland humiliated the Soviet Union in its expansionist land grab, inflicting about four times as many casualties on the Russians, weight of numbers told. In March 1940, after three months of fighting, the nations signed their settlement. Brewster made up its production deficit by delivering most of the improved F2A-2s to the U.S. Navy that summer.

RAAF Brewster Buffalos

Other nations receiving Buffalo were Britain (Royal Navy, Royal Air Force), Australia (Royal Australian Air Force) and the Netherlands. In 1941–42 the RAF and RAAF flew against Japan in Singapore, Burma and Malaya, while the Dutch East Indies air force defended Borneo and Java before the Japanese overwhelmed them.

Designated Model 239s, the Finnish Brewsters were very similar to the Navy's F2A-1 with Wright Cyclones. Despite the type's dreadful onetime combat in U.S. service, pilots of several nations enjoyed flying it, as it was reasonably fast for the era (300 mph) and had responsive controls. Finns nicknamed it Taivaan Helmi (roughly the "Sky Pearl").

Researchers with Britain's Royal Aircraft Establishment at Farnborough Airfield evaluated a Brewster in 1940 and found it far better than the Buffalo's subsequent reputation. "The elevator control is not too sensitive as on the Spitfire or too sloppy as on the Hurricane," evaluators wrote. "When airborne it increases speed quite rapidly and has a good initial rate of climb." Approach to landing was flown at 90 to 95 mph with an "excellent" forward view. Most pilots tended to flatten the glide angle slightly higher than normal, "but the aeroplane settles down after a small float with no bounce, bucket or swing."

The evaluators were especially enthused about the Brewster's metal ailerons. "They are crisp and powerful, and the stick forces are not too light at low speeds nor too heavy at greater speeds," they wrote. "The pilots considered them to be a very definite improvement on the Hurricane and Spitfire fabric-covered ailerons."

Minus military equipment (guns, sights, etc.), the Brewster deal with Finland was concluded in December 1939 at an average price of $54,000 per aircraft with 950 hp Wright R-1820 radials. After stateside acceptance tests on three 239s, the first of the remaining 41 were sent to Sweden, arriving through March, the month the Winter War ended. It was initially armed with three Finn-built Colt MG 53-2 .50-caliber machine guns and one MG-40 .30-caliber light machine gun, later upgraded to four .50s.

Additional assets included a reflector gunsight and armored seats. At the time many fighters employed World War I–type telescopic sights with limited fields of view, or metal ring and bead sights. Recognizing the advantage of wide-angle gunnery, the Finns produced a German-type reflector sight.

"A major factor for good shooting results…was that every pilot was taught [by 1939] to hold their fire until within 50 meters of the target," Finnish historian Kari Stenman wrote. "After the Winter War experiences more emphasis was put on shooting skills, with known results.

"Every fighter pilot course had two gunnery camps—one for fixed targets, and one in the air. Then all newcomers in the squadron were put as a wingman of a veteran for a number of missions until the veteran 'released' the pilot for normal duties."

The Finnish Brewsters operated in an oppressive climate. Roughly a quarter of Finland lies north of the Arctic Circle. Far to the south, the capital of Helsinki averages a high temperature of 48 degrees Fahrenheit with an average low of 37. Five months average below freezing, while three months (December through February) experience highs in that range.

Seizing an opportunity to regain lost territory, Finland partnered with Nazi Germany in 1941 in the Continuation War. The Ilmavoimat owned about 235 aircraft at that point, with fewer than 200 considered operational.

With about 116 fighters (34 Brewsters, 26 Fiats, 27 Moranes and 30 Fokkers) against nearly 500 Soviet aircraft on the Finnish front, the Ilmavoimat was spread thin from the first day, June 25, when the Soviets bombed several Finnish airfields and cities.

LeLv 24 engaged repeatedly that day, claiming 10 kills without a loss. In the first combat two pilots tackled 27 Tupolev SB bombers below 5,000 feet only five minutes from base. Staff Sgt. Eero Kinnunen and Cpl. Heimo Lampi made repeated passes, claiming five kills between them, evenly divided. "I gave chase, and the enemy suddenly closed, forcing me to pull up alongside him," Lampi wrote in his after-action report. "At this point the rear gunner hit me from very close range. I pulled up and banked again behind the bomber, firing a short burst into it which created a fire on its right side. It subsequently hit the water burning. I saw Staff Sgt. Kinnunen also down two aircraft." By month's end the tally board showed seven more victories with one loss in an accident.

FAF Brewster B239 Buffalo in June 1944

In the first seven months of the war three Finnish pilots—Warrant Officer Juutilainen and Sgt. Maj. Lauri Nissinen of LeLv 24 and Sgt. Maj. Oiva Tuominen, a Fiat ace of LeLv 26—tied for top honors with 13 victories each. By year's end LeLv 24 was credited with 135 Soviet planes downed vs. two losses, one to combat.

Between combat flights three of LeLv 24's Brewster aces acquired perhaps the most famous Finnish mascot of the era. In July 1941, at the outset of the Continuation War, 1st Lts. Jorma Karhunen (26.5 Brewster victories) and Pekka Kokko (10) visited Sgt. Maj. Nissinen (22.5), then recovering in a hospital from wounds. A friendly Irish setter named Peggy Brown introduced herself to the fliers, who spoke to the dog's owner. Rationing made it difficult to feed pets, so the pilots agreed to keep Peggy Brown for the duration. According to squadron legend, she sweated out combat missions listening to her friends' voices in the base radio room. True to their word, the fliers returned Peggy Brown to her master by year's end 1944.

Finnish squadrons led nomadic lives, moving once a month or more and dispersing by flights to avoid making easy targets for Soviet bombers. Sometimes they suffered shortages of aviation fuel from Germany. The Finns selected the Brewster in part because of its compatibility with 87-octane aviation gasoline, the European standard until Britain began obtaining 100-octane fuel in 1940.

Continuing combat and attrition steadily eroded LeLv 24's inventory. By early 1943 just 24 Brewsters remained operational, forcing the transition to Me 109s with other squadrons over the next year.

Finnish fighters' priority targets were twin-engined Tupolev SB-2 and Ilyushin DB-3 bombers, given their potential to destroy or damage key targets. But more often Brewster pilots met up with Soviet fighters. The top three Sky Pearl pilots—1st Lt. Wind (with 39 victories in a Brewster), Warrant Officer Juutilainen (34), and 1st Lt. Jorma Karhunen (26.5)—claimed 23 Polikarpov I-16 monoplane fighters, 18 Polikarpov I-153 biplanes and 11 Hawker Hurricanes. Encounters with more modern Russian fighters—Yaks, MiGs and LaGGs—were rare until the Finns began the conversion to Messerschmitts in early 1943.

By the June 1941 outset of the Continuation War Juutilainen was a 27-year-old veteran of the Winter War who'd scored three kills flying the Fokker D.XXI. Flying against the Soviets with LeLv 24, he was constantly in combat, thrice claiming triple kills in a day on his way to the top of Finland's ace roster.

Transitioned to Brewsters, Juutilainen called the 239s "fat hustlers, just like bees. They had speed, agility and good weaponry, too.…We were happy to take them anywhere to take on any opponent."

Juutilainen described his combat experiences in the memoir Double Fighter Knight, referring to his two Mannerheim Crosses (medals). He pressed attacks to minimum range to ensure lethal accuracy. Juutilainen recalled one particularly close-quarters dogfight with a Soviet Hurricane:

I came in at high speed from above and behind and pulled the throttle back to idle. The target grew in my gunsight. It was a very clean airplane and looked brand new. Now I was approaching the perfect firing range and looked around me one more time. No other enemies were in sight. The pipper on my sight was just slightly in front of the nose of the Hurricane, and my glide angle was about 10 degrees. Now I could count rivets on the target.

In contrast to such salty veterans as Juutilainen and 32-year-old Maj. Eino Luukkanen (56 victories), Wind began the Continuation War as a 21-year-old lieutenant. He found his shooting eye early, achieving ace status in six scoring encounters.

Lacking external supplies, the Finns waged a constant battle to keep their Brewsters operational. Therefore, the Ilmavoimat's innovative, industrious mechanics and engineers worked hard to provide spare parts, and during their frequent moves to staging bases crew chiefs rode in their assigned plane's baggage compartment.

From 1941 to '44 LeLv 24 Brewsters claimed 477 victories for the loss of 19 in combat and six more in accidents or destroyed on the ground. Many have claimed that at 25-to-1 Finnish Brewsters recorded the highest victory-loss ratio of the war, but in fact that title belonged to the Grumman/Eastern FM-2 version of the F4F. Flying from escort carriers in 1944–45, the "Wilder Wildcat" scored a 32-to-1 record, undoubtedly the highest ratio of the piston era.

Between early 1943 and early '44 the Finnish air force converted four of its six fighter units to Messerschmitt Me 109Gs, though the surviving Brewsters remained operational through war's end.

To experienced Brewster pilots the German fighter plane was lacking. Corporal Lampi later recounted his attachment to the Brewster to historian Dan Ford. "The old friend Messerschmitt, who was a real hard fighter, was my next plane after the Brewster, but it totally lacked in humaneness," Lampi said. "I could not love it the way I loved my friend Brewster. Nor any other plane for that matter." Lampi made ace in the Brewster and added eight more victories in the 109.

LeLv 24 flew its Pearls until May 1944, when the survivors went to LeLv 26, which claimed 35 victories with the type. The squadron scored the Brewster's last victory against the Soviets on June 17, 1944, three years almost to the day from the type's first combat. That September, however, Helsinki's degraded geostrategic position forced a settlement with Moscow in which Finland was required to expel German forces from its borders. By then the Brewsters were long in the tooth and nearly unsupportable.

Thus, the Finnish Brewster pilots flew their final missions against the Luftwaffe during the seven-month Lapland War. On October 3 ground controllers vectored LeLv 26 planes to intercept a dozen Junkers Ju 87Ds threatening Finnish shipping in the Gulf of Bothnia. First Lt. Erik Teromaa and Staff Sgt. Olva Hietala each claimed Stukas, ending the Brewster's participation in World War II. By war's end only eight Sky Pearls remained. Five kept flying until 1948 and were ultimately scrapped in 1953.

For decades aviation enthusiasts have assumed Finland's squared-off swastika insignia somehow equated to Nazi Germany's tilted black emblem. Actually, the Finnish blue swastika on a white background served as its military's insignia from the nation's establishment in 1918, whereas the German version of the ancient good luck symbol wasn't formally adopted until 1935. By war's end the Finns changed to a blue-and-white roundel.

Wind was the most successful Brewster pilot with 39 victories in type. Juutilainen scored 28 of his 34 Brewster victories in the aircraft coded BW-364. Other pilots added 14.5 more in BW-364, probably making it the champion U.S.-built fighter of all time with 42.5 credited kills.

Thirty-six of Finland's 96 top fighter pilots became aces in Brewsters, including six of the top 10. For perspective, four Finns scored 20 or more victories in Brewsters, a record only exceeded in U.S. service by five P-47 pilots. Combining victories scored in all aircraft types, Juutilainen finished with 94, Wind with 75 and Luukkanen with 56. Three other Finns ran career totals above 40, only one of whom flew Brewsters.

Today just one Buffalo variant remains. Finland's BW-372 was damaged by a Soviet Hurricane in 1942 and ditched in a lake near the Russian border. Recovered in 1998, it was purchased by a Florida museum in 2004 before returning to Finland for display in unrestored condition at the Finnish Air Force Museum. MH

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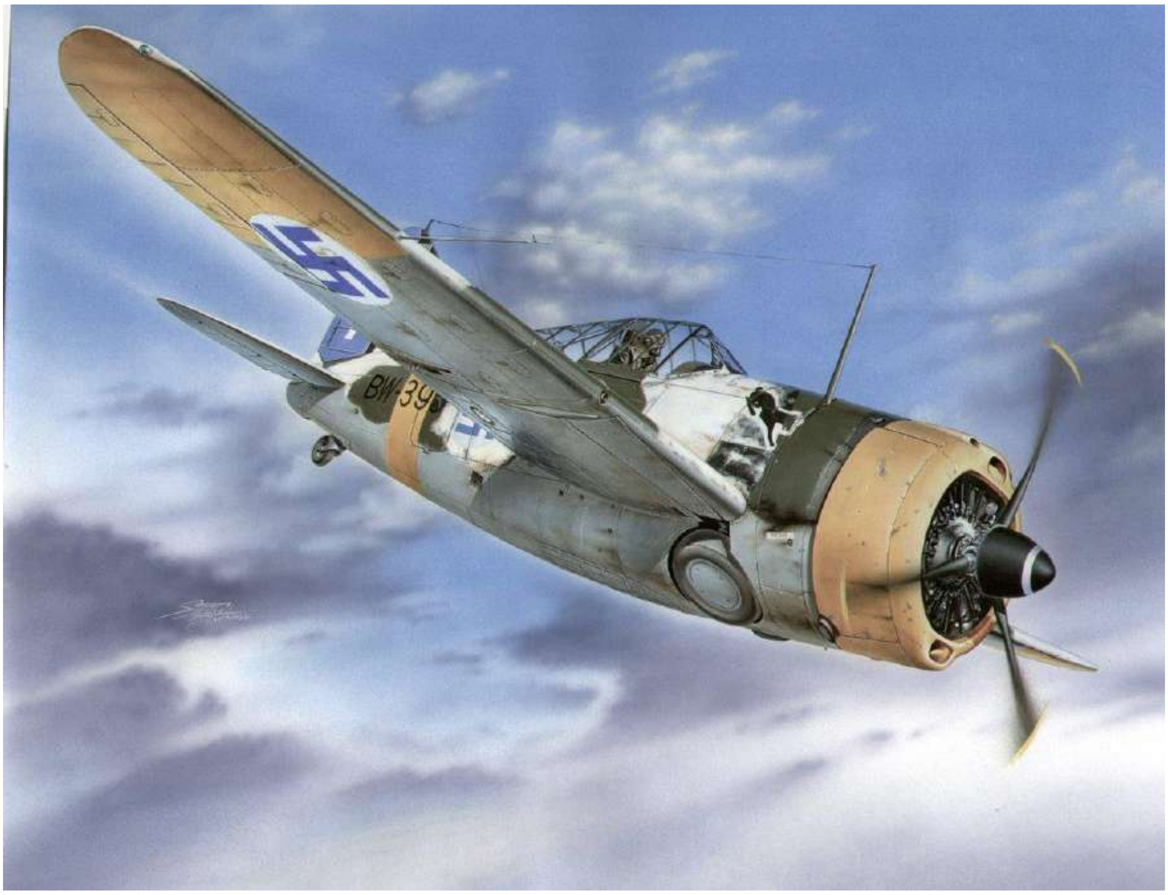


Keeping up with the Play (Test yourself – how good are you, really?)

1. A pilot on approach has a 90° crosswind at 10 knots. At 50 feet AGL, terrain effects and obstacles cause the wind to shift to a direct headwind, still at 10 knots. Which of the listed effects are likely to become apparent over the time from 50 feet AGL to the flare?

   A. The airspeed will likely rise.
   B. The airspeed will likely decrease.
   C. The aeroplane's sink ate is likely to increase.
   D. The aeroplane's sink rate is likely to decrease.
   E. A and D are both correct

2. When in a steady level turn at a constant rate and angle of bank, the wings are scribing a circle with the outer wing making a larger arc that the inner. This will cause the outer wing to suffer a slightly higher airspeed and therefore provide greater lift. Why, then, will the angle of bank remain constant as the greater lift on the outer wing should therefore cause the bank angle to increase?

   A. The outer wing has an increased angle of attack whilst turning.
   B. The outer wing has a decreased angle of attack whilst turning
   C. If the aeroplane's bank angle is constant in a turn, sufficient out-of-turn aileron must be being held by the pilot to stop this natural overbanking tendency.

3. Whilst in level flight above 3000 feet AMSL, tracking 310° and allowing for 12° port drift, at which of the following altitudes should you be flying to comply with the Mag Track tables?
   A. Odd thousands of feet plus 500 (above 2500).
   B. Even thousands of feet plus 500 (above 1500).

4. You notice the anticipated QNH is lower at your destination aerodrome than your departure. In general terms, should you expect port or starboard drift during flight along your track?
   A. Port drift.
   B. Starboard drift.

5. Whilst in a banked turn, which of the following must a pilot do to increase the rate of turn and decrease the turn radius?
   A. Increase the angle of bank and increase the power.
   B. Maintain the bank angle and decrease airspeed.
   C. Increase the bank angle and decrease airspeed.
   D. Increase the bank angle and increase airspeed.

See answers and explanations overleaf

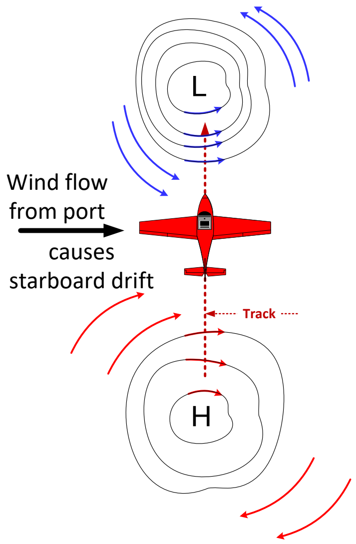
If you have any problems with these questions, See Notes below or call me (in the evening) and let's discuss them. Rob Knight: 0400 89 3632 (International +64 400 89 3632), or email me at kni.rob@bigpond.com.

1. E is correct. The wind directional swing from across the aeroplane's path (crosswind) to head-wind will cause an increase in airspeed which will cause the sink rate to decrease.

2. C is correct. Whilst in a level banked turn the lift will be greater on the outer wing because it must have a slightly higher airspeed. This will cause a slow increase to the angle of bank UNLESS .... sufficient out-of-turn aileron is applied by the pilot .
   Note that when in a climbing turn, the angle of attack is INCREASED over the outer wing (caused by the spiral ascending path the aeroplane is following) which will aggravate this over-banking tendency and require additional out-of-turn aileron to be applied.

3. B is correct. Pneumonic – Flying west, evens are best.
   The magnetic track tables are readily available in the VFRG and are provided under the topic of **Specified VFR cruising levels** (CASR 91.275) on page 217, in VFRG V7.0.

4. B is correct. For the QNH to be lower at your destination, you must be flying from a higher-pressure area to a region of lower pressure. As the airflow around a high-pressure area in the southern hemisphere rotates anti-clockwise, and the air rotates about a low-pressure area clockwise, you must have a wind blowing from your port side which will give you starboard drift.



5. C is correct. There Are two points to note when answering this question.
   - If the aircraft bank angle increases without changing the airspeed, the rate of turn increases, and vice versa.
   - For minimum radius of turn, minimum airspeed is required.

   Thus, to increase the turn rate and to reduce the radius of that turn, the angle of bank must be increased (first point, above) AND the airspeed reduced (second point).

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William Watson on Tel., **0447 186 336**

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For further details contact Tony Meggs on (02) 66891009 or tonymeggs@fastmail.fm

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$12,000.00 neg

Imported and built 2001. Two seats side by side, powered by 80 hp 912UL Rotax, driving a Warp Drive 3 bladed prop. Cruise 70-75 kts. Empty weight 304kg, MTOW 544 kg, Payload 240 kg. Fuel tanks hold 78 litres. With fuel burn averaging 16 litres/hr, still air endurance (nil reserve) is theoretically 5 hours, or 350 nm. Aircraft always hangared. It has been set up for stock control/ mustering or photography, and is not fitted with doors. Registered until 13 October 2021, currently flying, and ready to fly away.

Total Hours Airframe: 144.6. Current, up-to-date, logbook.

Total Hours Engine: 1673.9. Annuals/100 hourly inspection due 10/09/22. 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.

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

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

Must sell: two aeroplanes are one too many. Quick sale - Fly it away for $12,000 neg.

Contact **Rob Knight tel. 0400 89 3632**, **or email** kni.rob@bigpond.com for details and POH.

AIRCRAFT for Sale

LIGHTWING GA-55. **$25,000.00 (Neg)**

Registered 25-0374

Engine ROTAX 912, 80HP, 853.3 Hours

Reluctant sale of this great aircraft, I have owned her from June 2004.

Excellent fabric, Red and Yellow, always hangered, and comes with the following extras:

* 2 Radios
* Lowrange GPS
* EPIRB
* Aircraft Dust Covers.
* Manuals – various
* Fuel Pressure Gauge
* Extra Tachometer
* New Headsets
* Paint
* Oil

Work performed at Lightwing Ballina:

* Wings recovered, tanks resealed, new brakes, wheel bearings and hubs, new wing tips.

Other work carried out:

* Windscreen replaced, door panel replaced, choke cables replaced, ignition upgrade.

Rotax:

* Engine modifications, gearbox rebuild.

Currently hangared at Boonah in Queensland.

Contact Kevin or Natalie McDonald on 07 54638285

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.

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

Phone John on 0417 643 610

ROTAX 582 motor.

Ex flying school, TTIS 600 hours, and running faultlessly when removed from aircraft for compulsory replacement.

No gearbox, but one may be negotiated by separate sale if required.

Interested parties should contact…..

Kev Walters on Tel. **0488540011**

Wanted to Buy

95-10 ultralight project for newly formed syndicate in SEQ. Anything considered.

On our behalf, please contact the editor, Rob Knight, on 0400 89 3632.

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