BRISBANE VALLEY FLYER

May - 2021

www.wattsbridge.com.au
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BRISBANE VALLEY SPORT AVIATION CLUB INC

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

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Old and Older – Vintage fire-engine, DH-82A, and Waco EGC-8, at Boonah

Contents

From the Club

Hello all and I hope you are all well,

With consideration to request to the members from the board and their responses the club ventured out of the clubhouse and away from the airport for the April meeting.

Our April meeting was held at the Cormorant Bay Recreational Reserve at Wivenhoe Dam where we had a very good day with 16 members, 3 visitors and one pesky Bird (kept swooping us all). The meeting was held under the picnic shelters, the ones that we claimed when we arrived early and staked our claim to.

After the meeting we had a BBQ lunch with myself and Les cooking the meat patties and the sausages using both of the BBQs at the shelter while the other members prepared the salads and all of the other goodies (too many to name). But thank you all for chipping in.

Everyone attending expressed pleasure in being able to get out with friends and club members, and to have a pleasant club meeting before sitting back and chilling with good fellowship. In light of the enthusiasm expressed for the venture, we hope to do this again in the future.

It is hoped to be able to hold a Xmas in July function this year, so stay tuned for further announcements.

Our next meeting will be back at club house on the 1st May, so hope to see you all there.

Peter Ratcliffe, BVSAC President

The Nose Goes Left, or Maybe Right

By Rob Knight

Pilot's DO need to keep straight on take-off. It's not really a recommendation – it's a statement of fact because failing to keep straight can ruin your whole day and make the day for the aircraft repairers. So why can a pilot drive a car under full control at 100 km down the motorway to go flying, and then not be able to keep their single engined aeroplane straight for 15 seconds on the runway as they accelerate?

Controlling Swing on Take-Off

All single engined aeroplanes naturally suffer swing on take-off, a characteristic that must be corrected by the pilot. The term swing is just another name for yaw so why do single aeroplanes yaw on take-off?

There are several reasons for swing, and most are caused by the engine and/or the propeller. Specifically, they include:

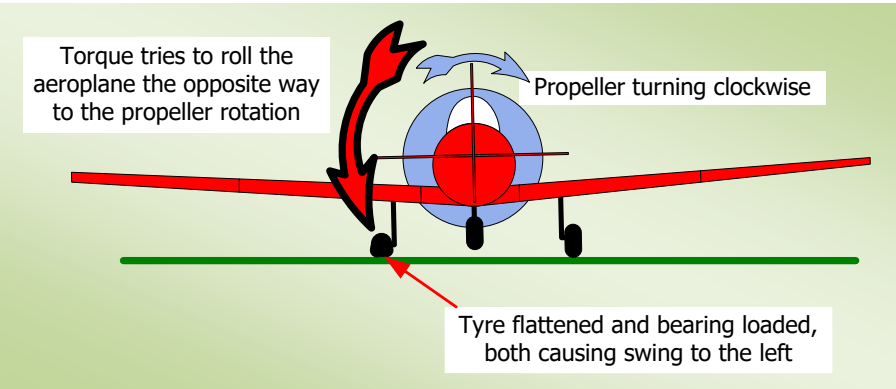
Crosswind effect,
Asymmetric blade effect ("P" factor),
Propeller torque effect.
Slipstream effect,
Gyroscopic effect,

Cross wind effect.

Only in a perfect world does the wind always blow down the runway. Alas, we don't live in a perfect world and, inevitably, all pilots are regularly faced with take-offs when the wind is blowing partly or wholly across the runway.

Torque effect

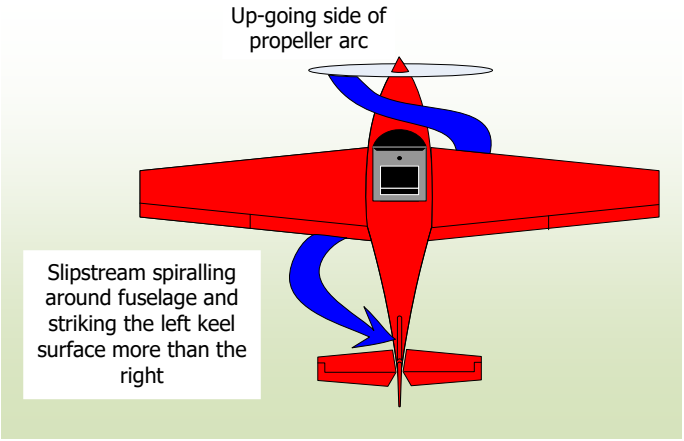
This is the reaction of the airframe to the forces turning the propeller. If an aeroplane's propeller turns clockwise when viewed from the cockpit, the fuselage tries to turn anticlockwise. On take-off, this force presses the port main wheel harder onto the runway surface which increases load on the bearing but also mainly flattens the tyre. Both these effects cause drag on the port side and thus yaw (swing) to the left.



Torque effect causing swing.

Slipstream Effect.

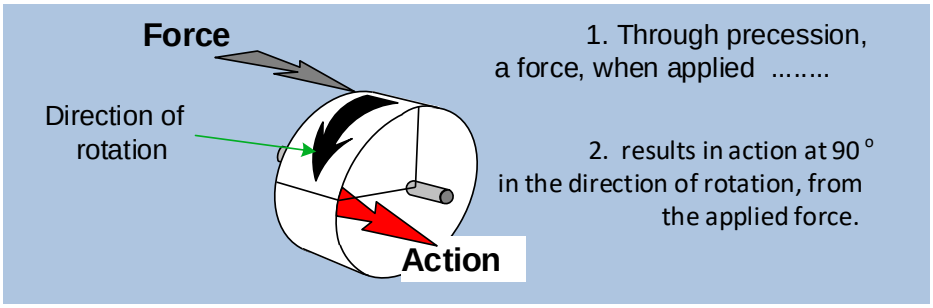
While one could be forgiven for imagining that the propeller blows the slipstream directly backwards along the fuselage, this is not actually the case. Instead, the propeller imparts a swirling flow which impacts more on the side of the rear fuselage behind the UPGOING propeller blade. As the up-going propeller blade is on the left side on a clockwise turning propeller, the slipstream strikes the left keel surface behind the centre of gravity and pushes the tail to the right. The aeroplane will turn about its centre of gravity and the nose will swing left.



Slipstream causing swing.

Gyroscopic Effect.

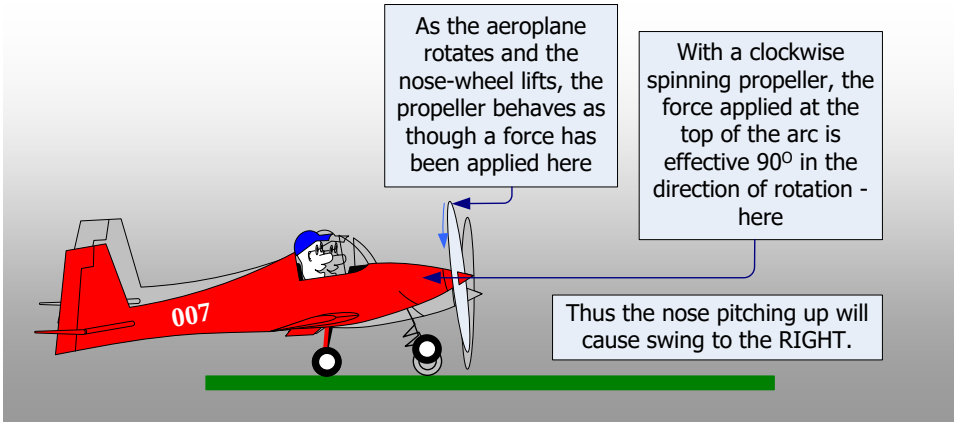
A propeller is a spinning mass, a gyroscope, and when a force is applied to a gyroscope the action will take place parallel to the force and at 90° in the direction of rotation to the point of application of the force. Gyroscopic force will cause a nosewheel aeroplane to experience swing to the RIGHT as the nose is pitched up on take-off.



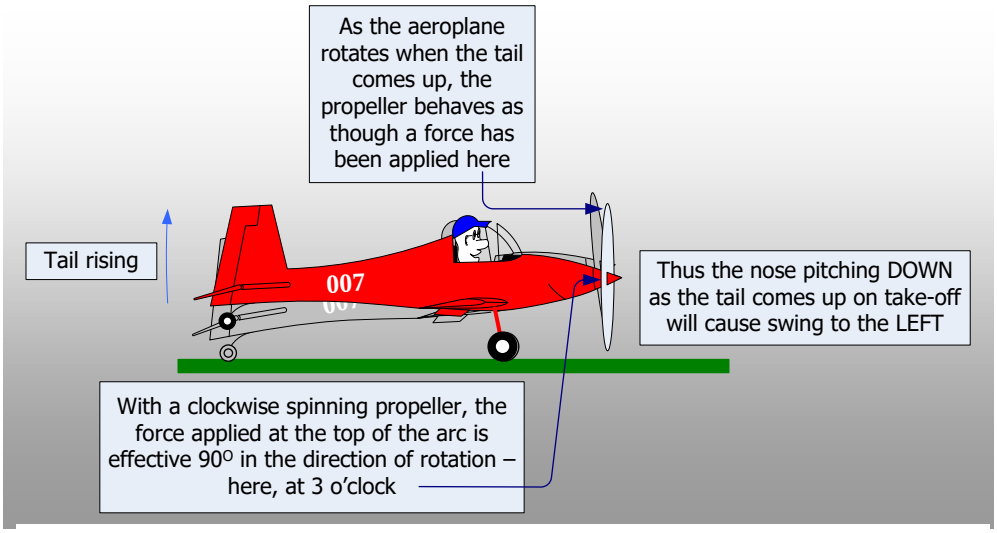
The illustration above depicts the raising of the tailwheel on a taildragger aircraft on take-off. Note that this effect is not reproduced in nosewheel aircraft on take-off. Instead, gyroscopic effect is noticed when the aircraft is rotated nose-up, just before lift-off. This shows a force on the right side of the propeller arc, swinging the nose LEFT as the tail is raised on take-off.

On a nose-wheeled aircraft, as the nose is pitched up by the pilot, the gyroscopic force on a clockwise turning propeller will cause a swing to the RIGHT.

As the nose is raised on take-off in most recreational aeroplanes the angle change is only a few degrees, the force is not great and easily correct with appropriate rudder. See the illustration following for further explanation



Propeller turning clockwise from the cockpit, gyroscopic force causes right swing on rotation.



Propeller turning clockwise from the cockpit, gyroscopic force causes LEFT swing on tail-wheel aircraft as tail rises on take-off.

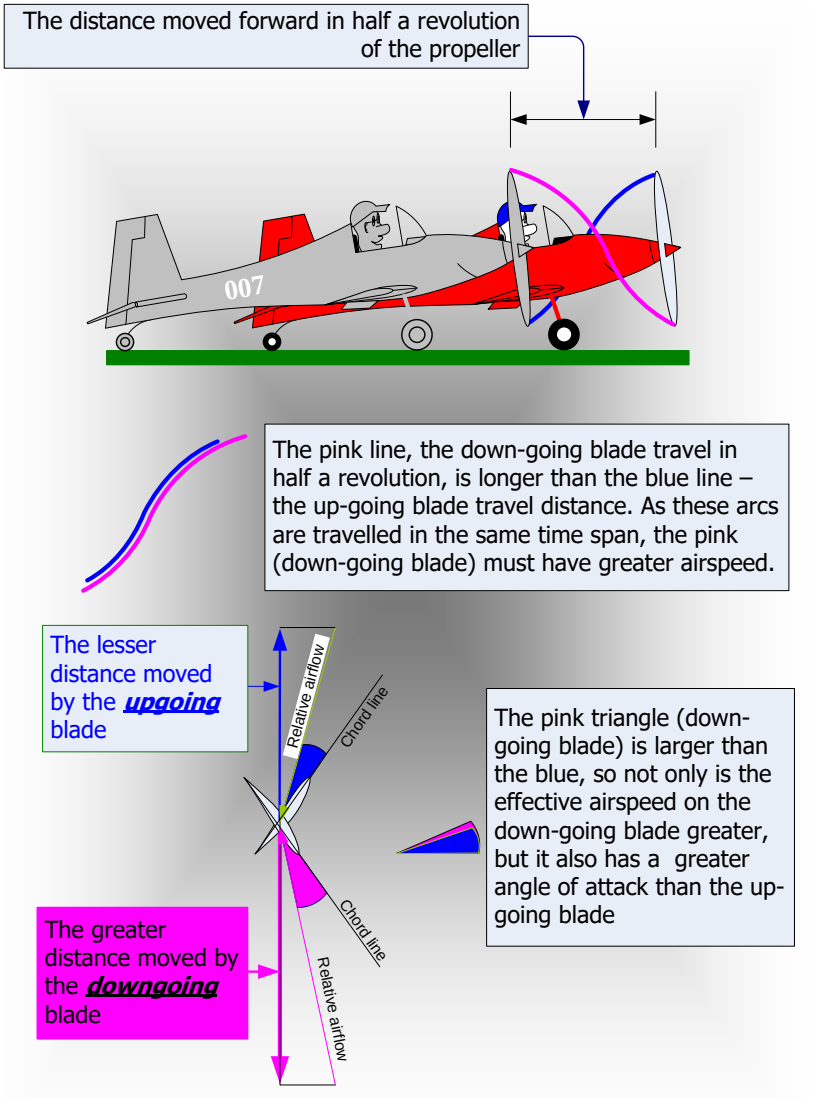
Just to confirm, in the case of a tail-wheel aeroplane, LEFT swing occurs when the tail is raised on take-off. Because the aircraft is pitching nose-down in this case, the force acts the other way, on the right side of the arc, and so the swing is the other way - to the LEFT.

Asymmetric Blade Effect (or "P" Factor).

"P" factor occurs when the aeroplane is not moving in a direction perpendicular to the plane of rotation. The typical "P" factor situation is when a tail-wheel aeroplane is accelerating with its tail still on the ground, or a nosewheel aircraft is accelerating on the runway with its nosewheel raised off the ground.

In both these situations the aeroplane is moving forward with the propeller's plane of rotation at an angle to the aeroplane's movement path.

In this case, as the aeroplane moves forward, the down-going propeller blade has both a greater airspeed and a greater angle of attack than the up-going blade and so produces more thrust. As the down-going blade is on the right side of the propeller arc on a clockwise turning propeller, the right side of the propeller arc produces more thrust than the left side and the consequent LEFT swing it produces must be controlled with rudder.



The Cause of Asymmetric Blade Effect. Note that this sketch is not to scale.

Times where asymmetric blade effect is a critical consideration include:

1. Lifting the aeroplane off the runway before adequate flying speed is reached on a short take-off, and
2. going around with full power when the airspeed is very low and the nose attitude is high.

   CAUTION - When going around, power must be added slowly enough so the there is sufficient airspeed for the rudder to control yaw.

So far, the discussion has all been around the effects of a propeller that is rotating clockwise. The yaw/swing effects produced by a propeller that turns the other way, anti-clockwise from the cockpit, are reversed – the nose will swing to the right. This should be no surprise because it is the rotation that caused the swing in the first place.

The various factors that I have laid out above all have the rudder as their controlling authority as they all influence directional control. Obviously, with the tail wheel on the ground, the directional control is as powerful as the tire friction with the runway. However, once the tail is raised, the swing forces must be countered with individual braking (not generally advisable) or the aerodynamic forces produced by the rudder and fin, and the airspeed, when the rudder is actuated by the pilot.

Herein lies a problem when aircraft are re-engined with larger engines and there is no change to either the fin/rudder areas or the length of the fuselage to further empower those tail areas. Take, for example, the Piper PA-20 Pacer or PA-22 Tri-Pacer. This airframe was originally powered by a 125 hp Lycoming 0-290-D engine and its tail surfaces were designed to provide control on take-off for this power. Subsequent four seat variants produced by Piper included the Tri-Pacer which was fitted with engines up to 150 hp as standard although Piper offered 180 hp as an option. Note that this was the Tri-Pacer variant, with a nose-wheel and therefore less issues with swing on take-off.

I recently read of a Tri-Pacer airframe being re-constructed to a tailwheel configuration, and the 150 hp engined replaced with one of a 180 hp. In just a few subsequent months, it was related to me, the aircraft had departed LEFT from the runway whilst taking-off, with full right rudder applied. After some discussion, it was suggested that the pilot was raising the tail too early in the take-off. If that was the case, the heavier engine would assist the elevator in raising the tail early, but the available control might be inadequate at that airspeed to contain the swing forces provided by the more powerful engine. If so, the answer is simple – don't raise the tail until adequate airspeed for swing control is available. Start the take-off with the stick back to maintain positive traction between the tail-wheel and the runway, and only take the stick forward to raise the tail when sufficient airspeed for control had arisen.

Happy Flying

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2021 Propeller Buyer's Guide

Which Propeller is right for you?

By LeRoy Cook - Kitplanes Magazine - January 31, 2021

Unless you're building a SubSonex jet like editor at large Paul Dye, you'll eventually have to choose a propeller to mount on your project. As with many facets of aviation, there are compromises to be considered; the perfect propeller for one performance task may not work as well in others. Expanding the range of acceptable compromises is what prop builders and designers are always attempting to do.

At the heart of it, a propeller is a rotating aerofoil required to operate at widely varying airspeeds along its length. Its job is to convert the potential horsepower of the engine into effective thrust in the most efficient manner possible. The brothers Wright had researched the theories of lifting devices more thoroughly than just about anyone in their time, so armed with their knowledge, they whittled their own chain-driven propellers for the 1903 Flyer.

Wood props are light and beautiful, but a metal propeller can be built thinner and is more durable. (Photo: Dana Hague)

Fortunately, we don't have to do that. There are dozens of propeller makers out there, waiting to supply the exact prop needed to get our projects into the air. You can choose from a list of certified propellers like those on production airplanes, or you can install one of the non-certified propellers made specifically for Experimental/Amateur-Built aircraft, supplied by a builder of certified props. Or you can go with a custom unit from one of the many "boutique" propeller makers that have been building props for home-builts for years.

The Art of Thrust

Making propellers continues to be a blend of art and aerodynamic science. Whether formed from aluminium, composite or laminated wood, achieving the absolute best size and shape for a particular propeller installation takes a lot of creative skill as well as knowledge of the underlying principles.

The interlinked dimensions of the propeller's diameter and effective pitch determine most of the results achieved when a prop is bolted to the engine crankshaft. Advantages stemming from the material used in construction can make up for less-than-perfect proportions; metal props, for instance, can be formed into thinner aerofoil shapes than a wood propeller. Wood props, on the other hand, have a natural ability to absorb vibration and they're cheaper. Composite construction offers extended life and some ability to flex into a different pitch under load.

The type of propeller to be used depends in large part on the kit designer's weight and power recommendations. A fixed-pitch propeller is, as the name implies, an unchangeable concession between climb performance and cruise speed. A ground-adjustable prop has its blades fitted into a hub that allows rotation to change pitch through a range of options. An in-flight adjustable propeller lets the pilot select a pitch that best suits the phase of flight at the moment, although rpm still rises and falls in response to airspeed and power changes. And the crème de la crème solution is the

constant-speed propeller, an in-flight adjustable prop that's linked to a governor that makes minute pitch adjustments to hold rpm steady after the pilot sets the desired power.

Weight is always a consideration. The lightest propeller is a simple fixed-pitch one, with wood or wood-core composite construction weighing less than aluminium. Constant-speed propellers add considerable weight, often where it isn't wanted from a center of gravity standpoint, in trade for flexible performance options and reduced workload.

Does blade count matter when pursuing efficiency? Not so much, as careful design can offset the theoretical advantage of fewer blades. Veteran wood/composite propeller maker Craig Catto says, "As for the difference between a two-blade and three-blade propeller, from a performance standpoint the two-blade and three-blade are very similar, almost equivalent. The three-blade propeller is smoother due to its ability to distribute the power pulses from the engine. Weight varies depending on design; a two-blade propeller weighs between 10 and 14 pounds and a three-blade propeller weighs between 11 and 15 pounds. The difference in weight (from using a wood-core prop instead of a metal prop) will provide a noticeable savings in fuel alone."

Unfortunately, you cannot put just any prop on any engine. Hole patterns must accept the mounting bolts on the engine, pitch and diameter must meet the power rating and airspeed range expected, and some crankshafts won't accept a constant-speed propeller, most of which need pressurized oil for pitch adjustment. Propeller suppliers know how to work with your engine and aircraft combination.

A Year of Changes

The challenges of 2020's pandemic scare did not adversely affect most of the propeller makers we spoke with. Early in the year there were some order cancellations that slowed business for a while and overseas shipments were halted briefly as embargoes were put in place, but by and large we were told, "We're still here, working with proper precautions and shipping product." We did find that Tennessee Propellers is no longer in business, the owner evidently making good on the retirement he was planning in 2019, and Props, Inc. seems to have closed up shop as well. Also, we were unable to get a response from Kent Tarver at Tarver Propellers, who holds the rights to the venerable Koppers Aeromatic automatically adjusting propeller.

Whichever supplier you choose for your homebuilt, there's no doubt that a good propeller is essential for the success of your project. Fortunately, there's a host of reputable companies that can take your dream into full thrust.

Certified Propeller Manufacturers

GT Propellers

Based in Italy, GT Propellers has been around for over 50 years and is best known for its collaboration with Tecnam Aircraft that began in 1992. The company makes fixed-pitch, ground-adjustable and constant-speed props, mostly certified under EASA 21P standards. Wood and composite construction is used, available in 200 model variations.

Hartzell Propeller, Inc.

Most of GT Propeller's LSA and light airplane propellers are two and three blade designs using monolithic carbon technology with a metal leading-edge strip. The GT3G Multi Mission Propeller is an innovative high-performance three-blade ground-adjustable propeller, optimized for maximum efficiency on touring and aerobatic airplanes, as well as STOL aircraft. It can be used with engines ranging in power from 160 to 280 hp.

Hartzell Propellers

Hartzell Propeller continues to evolve its product line to support the Experimental and homebuilt market. Hartzell manufactures both aluminium and structural composite-blade propellers that are compatible with a wide variety of engines. Hartzell recently added the structural composite three-blade Raptor hub propeller series to its line-up of Experimental aircraft products, providing increased performance with an additional weight savings. Raptor propellers are available for damped-crankshaft Lycoming (I)O-360, IO-390, and (I)O-320 series engines.

The latest product introduced from the Raptor hub propeller series is the structural composite three-blade Pathfinder, optimized for STOL. The Pathfinder is ideal for pilots who value take-off and climb performance as their top priority. The Pathfinder is available for damped-crank (I)O-360 and (I)O-390 series engines. As a great option for backcountry operation, the 44-pound Pathfinder provides a lightweight three-blade alternative to the two-blade Trailblazer series. The Trailblazer prop is standard equipment on the new nosewheel equipped NXCub from CubCrafters, with the Pathfinder as an option.

McCauley Propeller Systems

After becoming a wholly owned division of Cessna Aircraft in 1960, McCauley Propellers continues today under the Textron Aviation umbrella. McCauley entered the propeller manufacturing business in 1941, marketing its first forged aluminium propellers in 1946. Constant-speed, feathering and de-icing capabilities quickly followed.

With 350,000 propellers in service and 500 models available, McCauley has expanded into composite propellers with its Blackmac Carbon series. The company is headquartered in Wichita, Kansas, and production takes place in Columbus, Georgia.

McCauley Propeller Systems

MT Propeller

MT Propellers

MT-Propeller provides propellers using its “natural composite” wood-core blades for certified and Experimental installations. Production and company headquarters are located in Germany, but North American support is provided by a Deland, Florida, service center as well as a network of service stations. The majority of MT-Propeller’s product line encompasses constant-speed hydraulic control, offering feathering and reversing features where applicable.

Sensenich Propeller Company

Approaching 80 years in business, Sensenich is one of the few propeller companies providing props built of three basic materials—wood, aluminium and composite. It operates in two separate but co-managed locations, the original headquarters near Lancaster, Pennsylvania, and a facility in Plant City, Florida, where wood and composite propellers are made.

A wide range of propellers for certified, Light Sport and Experimental applications are available from Sensenich, including ground-adjustable composite props for Jabiru, ULPower and Rotax engines. A PowerSweep blade planform is incorporated into the composite propellers. Two- and three-blade units are available for the Lycoming O-320 and O-360 installations in Van's RV airplanes, and large-diameter propellers are offered for STOL airplanes like the Bearhawk, RANS and Zenith designs. Meanwhile, aluminum propellers are available for typical homebuilts like Van's and Glasair Experimentals, and traditional wood propellers are furnished in a variety of styles.

Sensenich Propeller Company

Certified Propellers

Company	Founded	Construction	Horsepower Range
GT Propellers	1969	Wood and composite	30 to 2500 hp
+39 0541 69 33 99			
Hartzell Propeller, Inc.	1917	Metal and composite	Up to 2180 hp
800-942-7767			
McCauley Propeller Systems	1938	Metal and composite	100 to 1200 hp
800-621-7767			
MT-Propeller USA, Inc.	1981	Natural composite	Up to 5000 hp
386-736-7762			
Sensenich Wood Propeller Co.	1932	Wood and composite	50 to 275 hp
813-752-3711			
Sensenich Propeller Mfg. Co. Inc.	1932	Metal	65 to 200 hp
717-569-0435			

Non-Certified Propeller Manufacturers

Airmaster Propellers

New Zealand-based Airmaster produces a wide range of hubs for constant-speed, electrically controlled two- and three-blade propellers, using blades from Warp Drive, Kiev, WhirlWind and Sensenich. Their primary focus is on Experimental and ultralight aircraft.

Airmaster Propellers Ltd.

Using the electric controller's mode selector, the pilot can choose pre-set settings for take-off, climb and cruise, after which the controller will maintain a selected rpm. U.S. sales for Airmaster include Arion Aircraft, The Airplane Factory, Custom Flight Creations, Kitfox LLC, Kaolin Aviation Services, RANS Aircraft, and Rocky Mountain Kitplanes.

AXSport Aviation

Newcomer AXSport Aviation, based in Capetown, South Africa, has developed a line of three-blade electrically controlled constant-speed carbon composite propellers, suitable for 80- to 180-hp Rotax and Lycoming engines. The controller provides manual variable-pitch or automatic constant-speed modes, using a hub CNC machined from aluminum billet. Designed to ASTM F2506 Light Sport Aircraft specifications, the overhaul interval is 1000 hours or five years. Light weight and low cost are AXSport Aviation's advertised advantages.

Arrowprop Company

In business since 1961, Arrowprop is located in Meeker, Oklahoma, and builds composite propellers for ultralights and small Experimentals with horsepower ratings up to 100. As the company states, "Our major products now are composite propellers, engines, and reduction drives for use on bowfishing rigs, floundering rigs, wind machines and ultralights." Propeller diameters up to 72 inches are offered. Arrowprop formerly made wood propellers that are now outsourced, available on special order.

Bolly Aviation

Bolly Aviation

Based in Virginia, South Australia, Bolly Propellers offers carbon fibre-epoxy ground-adjustable props in its Optima Series, which is furnished in five categories, from ultralight propellers with a 20-hp rating to Experimental aircraft propellers with a 180-hp rating. The Series 3 and Series 5 propellers will be most applicable for home-builts. The Bolly Optima Series 5 comes in 56- and 60-inch diameters, two- or three-blade styles, for up to 180 hp. The BOS3 props are optimized for LSA use and are available in two-, three- or four-blade styles, up to 125 hp. All Bolly props are fitted with a DuraTuff leading edge coating.

Catto Propellers

Building wood-core propellers encapsulated in structural composites, Catto Propellers has long offered two- and three-blade fixed-pitch props for Light Sport and Experimental aircraft. Craig Catto started his company in 1974, and after more than 45 years it continues to enjoy a reputation for dependable products. Electro-formed nickel leading edges are an option on all Catto props.

Catto Propellers

After extensive development, Catto is expanding its line to include constant-speed propellers. During the past year, production of the new three-blade CS prop began, which is targeted primarily for a few specific Lycoming O-540 installations.

Competition Aircraft, Inc.

Known for its UltraProp line of ground-adjustable composite propellers for a variety of purposes, Competition Aircraft has been in business since 1984. Originally targeted for ultralights, PPCs and trikes up to 50 hp, the basic UltraProp grew into the UltraProp II, adding blades to handle power ratings up to 25 hp per blade. Two-, three- and four-blade props are 66 inches in diameter, while five- and six-blade UltraProp IIs are 67 and 67.5 inches across.

Culver Props

Culver propellers, formerly associated with Valley Engineering in Rolla, Missouri, since 2001, is now operating on its own since Valley Engineering has closed down. Alaina Lewis' small factory has been relocated a few miles down the road and still turns out custom wood propellers for the Experimental aircraft market. They specialize in vintage profiles, popular with WW-I replica airplane owners. Maple, cherry, mahogany and birch woods are used; the two-blade fixed-pitch props are suitable for installations up to 300 hp.

Culver Props

DUC Hélices

DUC Hélices FLASHBLACK

DUC Propellers USA in Sebring, Florida, opened in January 2019, a subsidiary of propeller and rotor maker DUC Hélices, which is located in Lyon, France. Its EASA-certified forged-carbon composite propellers are targeted for Experimental and ultralight aircraft of up to 180 hp, along with helicopter and gyrocopter rotors. DUC Hélices is now offering ground-adjustable, in-flight variable-pitch and constant-speed propellers.

DUC's SWIRLBLACK-3 Hydraulic is termed the world's lightest three-blade constant-speed hydraulic propeller, along with the FLASHBLACK Hydraulic, which comes as a two- or three-blade configuration with an Inconel leading edge. The company also offers 100% electric variable-pitch propeller systems with carbon/titanium blades, available in two, three, four, or five-blade models.

GSC Systems

For over 35 years, GSC Systems has been building wood props for the trike, powered parachute and paraglider market. It makes Tech II and Tech III ground-adjustable propellers in, logically enough, two- and three-blade configurations, as well as fixed-pitch models. Using clear Eastern maple, the CNC-shaped laminated props are coated with urethane, and an inlaid leading edge protection strip is available as an option.

Hoffman Propellers, GmbH

German-made Hoffman propellers are distributed by Steen Aero Lab in the U.S., among other outlets. Using wood-core blades coated in fibre-reinforced epoxy, a wide range of propeller styles are available in fixed-pitch, ground-adjustable or hydraulic constant-speed models. The Hoffman HO-V constant-speed is popular with aerobatic users. Hoffman Propellers has been in business for over 65 years.

Ivoprop Corporation

The Ivoprop series of carbon fibre propellers take their name from company founder Ivo Zdarsky, who flew himself to freedom from communist Czechoslovakia in 1984. A unique embedded torsion bar allows electrical pitch adjustment at widely varying airspeeds in flight or manually on the ground. Available in Ultralight, Medium or Magnum types, in two- or three-blade configurations, the Medium series is for engines up to 150 hp and the Magnums can go up to 700 hp. A stainless-steel leading edge protects the gel-coated blades.

Ivoprop Corporation

Performance Propellers USA, LLC

Performance Propellers

Still located in Donie, Texas, Performance Propeller's Frank Johnson says he's "still building the best wood props available." Each of his props are custom made, and the customer is welcome to try their new propeller out to verify rpm, sending it back for tweaking if required. After that, the final finish and rainproof leading edge is installed. Built of laminated wood, two- and three-blade Performance Propellers are available exclusively for Experimental and aerobatic aircraft up to 300 hp.

Powerfin Propellers

Based in Hurricane, Utah, Powerfin builds a line of ground-adjustable carbon fibre propellers, primarily for Rotax engine installations in light Experimental and LSA aircraft. They'll even match the blade colour to your airplane's paint, if you want. Two-blade to five-blade hubs are offered, and there are four different blade styles in the Powerfin series. It was "business as usual" when we spoke in late 2020, but the company spokesman hinted of new products under development, so keep an eye on their website.

Prince Aircraft Co.

Lonnie Prince offers an exclusive P-Tip end-plate design that, like a winglet, effectively increases the length of the blade; his 68-inch diameter P-Tipped propeller reportedly performs like a 72-inch unmodified prop. A scimitar blade shape adjusts pitch over a four-inch range as airspeed changes, Prince says. With 40-plus years of experience making wood/carbon fibre propellers, Prince Aircraft is known for its one-off prototyping work. As we interviewed Lonnie this year, he was working on a 30-foot eight-blade fan for a NASA wind tunnel project.

Edward Sterba Propeller Co.

Ed Sterba is still in the hand-carved wood propeller business, using maple, birch and cherry laminations with a urethane insert for leading edge protection. He does not have a website, but a web search turns up his basic information; he can be reached by email or phone. His Sweptback propellers are primarily designed for VW engine installations, which was his original focus, and the Race series are for Continentals and Lycomings used in RVs, Midget Mustangs and Long EZs, up to 200 hp. The latter have a curved leading edge and narrow tip profile.

Sterba Propellers

Sterna Propellers

Sterna Propellers

Florida-based Sterna Propellers started 25 years ago, building custom ground-adjustable composite-construction props for light Experimental aircraft. It also builds rotor blades. The propeller line targets a power range of 30 to 75 hp per blade. Sterna's composite propeller is made with continuous high-performance pre-preg carbon fibre material. The blades are formed in one piece and are hollow inside with reinforced ribs. They also feature embedded nickel leading-edge protection and an aluminium shank.

Warp Drive, Inc.

Based in Ventura, Iowa, since 1989, Warp Drive continues supplying its well-known ground-adjustable propellers with carbon fibre blades. It offers two- to six-blade hub designs, primarily for ultralights, powered parachutes, gyroplanes and trikes, as well as LSA and Experimental airplanes up to 180 hp.

WhirlWind Propellers Corporation

WhirlWind Propellers of El Cajon, California, started in 1995, producing composite-blade constant-speed propellers, and 25,000 blades later it's an established supplier of ground-adjustable two- and three-blade propellers for the Experimental and LSA market. Initially, WhirlWind's propellers were built with a wood core and a composite overlay, but it now uses a patented all-composite closed-mold net-shape blade manufacturing process. The company also builds propellers for airboats, UAVs and wind tunnels.

Whirlwind propellers Corporation

For Lycoming 320/360 and Continental O-200 engines, WhirlWind offers two-blade ground-adjustable props, and it supplies two- and three-blade scimitar-shape styles for Rotax, Viking and ULPower engines. WhirlWind also has blades for the V530 hub on the Russian M-14P engines.

Whirl Wind Aviation, Inc.

A sister company to WhirlWind Propellers, Whirl Wind Aviation is based in Austinburg, Ohio, where it manufactures composite constant-speed propellers for Experimental aircraft. It offers 10 series of props to meet nearly every requirement, the latest being a new 300-72 three-blade propeller that weighs five pounds less than the 200-RV two-blade prop.

At just 36 pounds, the new 300-72 propeller is the lightest weight constant-speed propeller in its class. The 300-72 proprietary blade design features patented carbon fibre X-core thermoset composite construction, with an electroformed nickel leading edge for superior erosion resistance and FOD protection.

Whirl Wind Aviation Inc.

Company	Founded	Certified/Experimental	Construction	Horsepower Range
Airmaster Propellers, Ltd.	1999	Experimental	Metal/composite	80 to 200 hp
+64 9 833 1794				
AXSport Aviation	n/a	Experimental	Carbon composite	80 to 180 hp
+27 82 780 7111				
Arrowprop Company, Inc.	1961	Experimental and ultralight	Wood and composite	Up to 100 hp
405-279-3833				
Bolly Aviation	1978	Experimental	Composite	15 to 180 hp
+61 8 8380 8396				
Catto Propellers	1974	Experimental and ASTM	Composite	65 to 300 hp
209-754-3553				
Competition Aircraft, Inc.	1984	Experimental and ultralight	Composite	Up to 100 hp
530-268-3048 or 888-634-9839				
Culver Props	1983	Experimental	Wood	Up to 300 hp
573-364-6311				
DUC Propellers USA, Inc.	1997	Experimental	Composite	100 to 160 hp
863-991-0113				
GSC Systems, Inc.	1984	Experimental	Wood	35 to 115 hp
250-549-3772				
Hoffmann Propeller GmbH Co. KG	1955	EASA and Experimental	Wood/composite	Up to 500 hp
+49 0/8031-1878-0				
Ivoprop Corporation	1986	Experimental	Composite	Up to 700 hp
800-FOR-PROP or 562-602-1451				
Performance Propellers USA, LLC	2009	Experimental	Wood	50 to 300 hp
713- 417-2519				
Powerfin Propellers	2008	Experimental	Composite	Up to 160 hp
435-627-0942				

Company	Founded	Certified/Experimental	Construction	Horsepower Range
Prince Aircraft Company	1979	Experimental	Wood and composite	100 to 300 hp
419-877-5557				
Edward Sterba Propeller Company	1980	Experimental	Wood	30 to 200 hp
941-778-3103				
Sterna Aircraft	1996	Experimental	Composite	30 to 450hp
909-979-4535				
UltraProp				
(see Competition Aircraft)				
Warp Drive, Inc.	1989	Experimental	Composite	Up to 180 hp
641-357-6000 or 800-833-9357				
WhirlWind Propellers Corp.	1995	Experimental	Composite	80 to 400 hp
619-562-3725				
Whirl Wind Aviation, Inc.	1995	Experimental	Composite CS	200 to 400 hp
440-275-1540				

Photos: LeRoy Cook and courtesy of the manufacturers.

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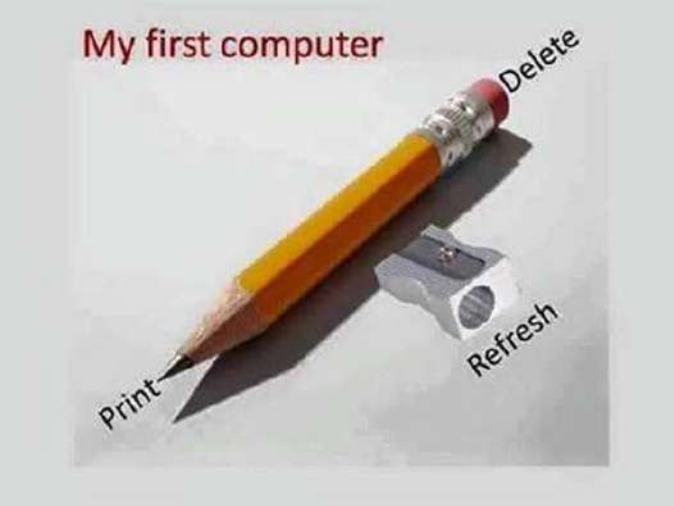


Going Direct: You Can't Make This Up:

Pilot Sues Airline for Emotional Distress After Mechanical Failure Led To PTSD

The first officer filed suit against QantasLink after one of the plane's engines failed in flight, leading, she says, to post traumatic stress disorder.

A former Cobham Aviation first officer is seeking $780,000 in damages from Qantas after she was on board a 717 that suffered a mid-air engine failure.

Jacinda Cottee claims she suffered post--traumatic stress over the incident, which she blames on the flag carrier for not maintaining its aircraft properly.

Qantas has said in response that the situation was caused by a manufacturing fault and insists all pilots are trained to respond to engine failure events.

A QANTASLINK B717

Cottee was operating the QantasLink flight QF1799 from Alice Springs to Brisbane on 10 March 2018 when the Rolls-Royce engine failed about 550 kilometres from its destination. At the time, witnesses heard a "loud bang" and the plane began to shake.

"One passenger claimed they were told to brace, and were sending goodbye messages to loved ones, while the crew briefed one man on how to operate the emergency door on the aircraft," read the report. "Passengers cheered on the Qantas crew after the landing."

The aircraft didn't need to make an emergency landing but passengers were met by emergency services in Brisbane as a precaution.

At the time Cobham, or National Jet Systems, had operated a fleet of 717s on behalf of QantasLink.

It was later reported a later engineering inspection revealed damage to the compressor blades and the engine was removed.

Cottee's claim is based on lost past and future earnings, and court documents lodged in Brisbane District Court say she believes the responsibility for the incident lay entirely with her employer and QantasLink.

"The claimant says that the maintenance when the accident occurred was largely performed in Canberra (and) due to poor maintenance practices with the 717 aircraft, the maintenance was ultimately moved from Canberra to Singapore," a statement of claim says. "Further, the 717 aircraft was removed from service on the Hobart route due to ongoing issues with maintenance."

"What happened to me highlights the importance of airlines providing care to all crew members following an incident, especially in the mental health space," said Cottee. "National Jet Systems did not provide proper crisis care after the event."

Slater and Gordon principal lawyer Kavita Maharaj also argued QantasLink breached its "duty of care" and overlooked safety.

Qantas said in response that this was the only engine shut down on QantasLink's B717 fleet over a five-year period, while its lawyers HWL Ebsworth stated, "It may well be that no member of the Qantas Group is the entity responsible for the maintenance or service of the engine."

"The cause of the engine issue from the flight in March 2018 was investigated and Rolls-Royce determined it was a manufacturing fault and not related to maintenance," a Qantas spokesperson later told *Daily Mail Australia*.

"All Qantas aircraft are maintained to the highest safety standards, and our fleet of Boeing 717 aircraft have a 99.99 per cent reliability rate. This is the only engine shut down on QantasLink's B717 fleet over a five-year period.

"Like all pilots, the first officer had been trained on how to respond in the event of an engine power failure."

Last week, World of Aviation reported how the passengers onboard United Airlines Flight 328 have reportedly hit the airline with a class action lawsuit after a plane's engine made worldwide headlines by catching on fire mid-flight.

Chad Schnell, the passenger leading the class action, claimed that the incident caused him severe emotional distress, and accused the airline of failing to properly inspect and maintain its aircraft fleet, thus causing the incident.

The lawsuit, filed with a Colorado court, stated that the engine in question "spectacularly failed" before "scattering pieces of the engine over Colorado and leaving passengers to a horrifying view of a fire on the wing".

"The 231 passengers on board UA328 were lucky to escape with their lives, as the flight managed to land with no serious physical injuries; however, it left these passengers in fear for their life for nearly 20 minutes," it said.

In a statement released after the lawsuit was filed, United Airlines backed the actions of its employees and reiterated its emphasis on safety.

"We remain proud of the ability of our employees to safely get our UA328 customers back to the airport and ultimately on to their destination later that same day," the statement said.

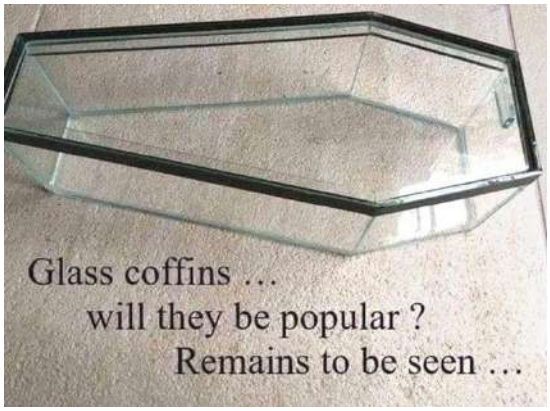
"Safety remains our highest priority – for our employees and our customers. Given the ongoing federal investigation, we will not comment further on this lawsuit at this time."

> *As an instructor, I cannot but wonder at the suitability of such a personality to operate as a pilot, in the capacity of either a Captain or a First Officer. Training is given, and the level of acquired knowledge and expertise in handling an engine failure, both in the carrying out of the exercise in the handling of the aeroplane, and also the carrying out of the emergency procedures relating to the safety of the aeroplane, its crew and payload is a matter of course. To claim PTSD as a result leaves me shaking my head.*
>
> *Sorry lady, BUT THAT'S WHAT PILOTS DO! Didn't she know that!*
>
> *Editor*

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

FLY-INS Looming

13 June 2021	Murgon (Angelfield) (ALA)	Burnett Flyers Breakfast Fly-in



What the Hell is THAT?

It's a Lilium Jet

The Lilium Jet is a proposed German vertical take-off and landing electrically powered personal air vehicle designed by Lilium GmbH. The Lilium Jet five-seater prototype first flew in May 2019

Many different subscale aircraft were tested first, and different design variants were studied where the wings would fold forward, so that the aircraft could be driven as a VTOL and recharge in only few hours from a standard 240 V electrical outlet. A first half-scale demonstrator, Falcon, flew in 2015. The unmanned first flight of the two-seat Eagle full sized prototype was on 20 April 2017 at the Mindelheim-Mattsies airfield, Bavaria, Germany.

Lilium jet in flight

The five-seat unmanned Lilium Jet was flight tested at Oberpfaffenhofen airfield near Munich. By October 2019, after 100 flights, it was transitioned from vertical to horizontal flight, reaching over 100 km/h (54 kn), but not yet fully horizontal. It managed 25° banked turns, high ascent/descent rates like in operations, hover turns and sideward translations. Electrical, fan and flap failures were mitigated by the electrical and flight control systems. The company employs around 350 people in Munich and expects to create around 500 jobs by 2025.

In July 2019, Lilium announce London, UK, as its base to develop its software engineering team. The engineering team is led by Carlos Morgado, former chief technology officer of Just Eat. Lilum announced the completion of its first manufacturing facility in October 2019. The same month, the Lilium five-seater Jet received a Red Dot Award: Design Concept for "Best of the Best".

The first prototype was destroyed by fire during maintenance on 27 February 2020. A second partially-constructed prototype was undamaged.

In February 2021, an article indicated that development on the five-seat prototype had ceased and that work was underway to develop a seven-seat aircraft, with projected first flight in 2022.

In April 2021, press reports indicated the establishment of fourteen dedicated vertiports spanning Florida, with service via the seven-seat Lilium Jet to begin in 2024.

Design Features

The Lilium Jet is planned as a seven-seater aircraft (six passengers, one pilot.) It is powered by 36 electric motors, with six of them on each of the two front wings and twelve on each rear wing. In addition to the fixed part of the wings, the propellers and engines are each installed in twelve tiltable wing parts. These are referred to by the manufacturer as flaps, in analogy to Landing flaps. The drive-carrying "flaps" are pivoted downwards for vertical launch. At the transition to the horizontal position, forward thrust is generated. This is energetically much more economical than the lift from pure rotorcraft.]

The seven-seat Lilium Jet targets a range of 280 km (150 nm). Its 36 electric ducted fans are powered by a 1 MW (1,300 hp) lithium-ion battery; less than 200 hp (150 kW) is required to cruise.

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And Now a Touch of the OLDS's, from 73 Years Ago

From the History Files

The Beechcraft Model 34 "Twin-Quad" was a prototype airliner designed and built by Beechcraft in the period between World War II and the Korean War. At this time many aircraft manufacturers in the United States anticipated a boom in civil aviation and a large number of designs left the drawing board only to ultimately fail. The Model 34 was one of these failures, partly because of its unusual design, and partly because of the thousands of ex-military transport aircraft that were available at the time for a fraction of the price of a new aircraft.

The design was a four-engine high-wing monoplane with tricycle undercarriage, originally designed for 14 (three abreast seating with six additional seats mounted on the side) and eventually converted to take 20 passengers. The side "couch seats" were also able to be folded away so that cargo could be carried internally in the cabin. Individual storage space was provided for each passenger seat on the fuselage side above the seat. In order to accommodate a larger cargo load, a cargo hatch was located near the pilot's compartment.

The unusual aspects of the design were the butterfly or V-tail and engine layout that led to its popular nickname, "Twin Quad." The four engines were buried in the wings, with each pair of engines connected to a single propeller via clutches and a common gear box.[1] The engines were horizontally opposed eight-cylinder air-cooled Lycoming GSO-580s (GSO denoting "Geared Supercharged and Opposed", with each engine featuring a built-in reduction gear box in addition to the common propeller gear box). The engines were rated at 400 horsepower at 3,300 rpm. The tail was unusual because, unlike the vertical and two horizontal surfaces found on most aircraft, the Twin-Quad's was a two-surface V-tail similar to the tail fitted to Beechcraft's other new product at the time, the Model 35 Bonanza. The V-tail configuration was flight-tested on a twin-engine Beech AT-10.

The twin-tailed Beech Model 34

Another, but more conventional, design aspect was that the belly was made strong enough to sustain minimal damage in the event of a "wheels-up" landing, with built-in integral landing keels or "skids." The wing measured 70 ft (21 m) from tip to tip and the fuselage was 53 ft (16 m) long. With the top of the V-tail almost 18 ft (5.5 m) above the ground, and a design maximum take-off weight (MTOW) of 20,000 lbs, the Model 34 was to that date the largest and heaviest Beechcraft civil design, with only the smaller XA-38 Grizzly military aircraft outweighing it.

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

1. Some aeroplane engines contain a coil in the ignition system What purpose does this coil serve?
   A. A type of spring undercarriage suspension.
   B. The coiled or twisted locking-wire preventing the ignition system, from coming loose.
   C. A device to provide sufficient high-tension spark for the engine to run properly.
   D. A device to maintain a constant and correct tension on the ignition system to ensure the engine timing is maintained correctly.

2. Considering the centre of pressure (COP) and the separation point (SP) on an aerofoil, as the angle of attack is increased on a unstalled wing:
   A. The COP and the SP both move forward.
   B. The COP moves forward along the chord line, and the SP moves aft.
   C. The COP and the and the SP both move aft along the chord line.
   D. The COP moves aft along the chord line and the SP moves forward.

3. Why is the angle of attack on a turning aeroplane's inner wing greater than on the outer wing?
   A. They are not – the angle of attack must be the same – it's logical.
   B. The outer wing travels a greater arc so the inner wing must have a greater angle of attack.
   C. The spillage at the wing tip modifies the angle of the incoming relative airflow.
   D. Because the aileron is up to make the aeroplane bank.

4. A pilot flies a direct track between two points. Outbound he has a 10-knot headwind, and inbound a 10 knot tailwind. Why does the flight take longer than if he made the flight in calm, no wind conditions?
   A. Because a headwind reduces the IAS.
   B. Because headwinds are usually stronger than tailwinds.
   C. Because flying with a headwind, the aircraft has additional airspeed, and drag will rise as the square of that increased airspeed.
   D. Because, outbound he is flying at a lower groundspeed for longer than he flies at the higher groundspeed when inbound

5. For how long is a TAF valid?
   A. 6 hours from the time of issue.
   B. 12 hours from the time of issue.
   C. 30 hours from the time of issue
   D. Its validity is stated on the document.

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 7400893632), or email me at kni.rob@bigpond.com.

1. C is correct. The "ignition coil" provides the high voltage electrical force to provide a spark necessary to fire the induced charge in the cylinder at the beginning of the combustion stroke.
   See, https://en.wikipedia.org/wiki/Ignition_coil.

2. A is correct. As the angle of attack of an unstalled aerofoil increases, both the centre of pressure AND the separation point both move forward.
   See, https://www.bobtait.com.au/files/pdf/errata/Aerody_Page_3.8.pdf
   https://en.wikipedia.org/wiki/Flow_separation. Wikipedia.

3. B is correct Both wings (and the rest of the airframe) descend the same amount, but, because the inner wing does it over a shorter distance because of the difference in the arc length travelled, the inner wing has a greater angle of attack.

4. D is correct. Wind MUST ALWAYS increase flight times, because the aircraft flies longer at the lower speed in a headwind than it does at the higher groundspeed in a tailwind. The only way to improve this is to arrange a tailwind both ways.

5. D is correct.
   See page 2, http://www.bom.gov.au/aviation/data/education/taf.pdf

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There's no safety in Statistics (If there's no integrity)

By Rob Knight

The use of statistics to influence our thinking has long since reached endemic levels and has become so familiar we tend to accept the most outrageous statements without question as a matter of course. To illustrate this point, look no further than our own aviation industry and the propaganda that is aimed at it from various sources, each with its own agenda.

That mankind has a subliminal fear of falling has been accepted as fact for many years and the premise is supported by the commonly experienced sensation of falling and waking with a jolt when drifting off to sleep. Experts have proffered the theory that this inherent fear stems from when our fur-covered ancestors lived in caves and there was always the possibility of falling to their deaths. It was so strongly imprinted that this latent fear still inhabits our subconscious tens of thousands of years later. Considering the power of fear and phobias, it is understandable that humankind may have a built-in survival desire to avoid places from which they can fall.

Caves have gone and have been replaced for aviators by aeroplanes, transferring this ancient phobia to the modern era. The conditioning from behind the far distant curtains of time has been reassigned to flying and the general public seeks to watch every piece of news that confirms their subconsciously held conviction that you can fall out of aeroplanes so they must therefore be unnatural and dangerous and that pilots, who chose to fly, should be certified; not to fly, but as inmates of mental institutions.

This phobic fear of falling, retained by the public, has been well recognized by the news media and the news moguls feed the public's morbid interest in aviation with daily reports on accidents, incidents, and fatalities. The public is subjected to regular prominent TV images of bent and broken aeroplanes, even if no injuries occur. When people are killed, the count is usually high because an airliner accident that kills one person will most often kill the majority (if not all) on board. Such displays and promotion of fatality numbers serve to reinforce the phobia that flying is inherently dangerous and promotes the concept that, if that many innocent people can die in a single accident then this must be a very dangerous activity. Over-cooked colour graphics with plenty of red showing are provided to support this underlying theme and the public are subconsciously bound to extract the last details of every gory tragedy. These are the money shots, the images that sell news and TV dramas.

But while the thinking person will quickly realise that there are far more dangerous pursuits than aviation to in which to indulge, the lesser thinkers won't, because in these alternative activities injury casualties and fatalities mount more slowly and are not sensationalized in the news. Without the daily dose of yet another aeroplane crash to raise the awareness stakes, the significance of these other dangerous activities is lost to the majority of the public and the ability to properly rationalise the real risks evaporates. But not everyone wants this point of view to be held.

While thinking people accept that modern flight is safe, to counter the damage done by the news in portraying flying as being something requiring a death-wish, some people and organisations fall back on issuing flawed statistics to provide pseudo support of the aviation safety image. The veracity of these flawed statistics is difficult, if at all possible to check, so, without careful thought and a real understanding of the rationale behind the statistic used, the results can be superficially reassuring but realistic nonsense.

Take for instance the statistic that makes the claim that more people are killed by donkeys each year than are killed in aircraft accidents. To many, reading such a statement would give psychological ease. Most people see few donkeys, if any at all, and for an authoritative source to make this claim that something so obscure and rare is obviously more deadly than air travel is a great reassurance. However, think about it. Can this really be correct? Is it a realistic and reliable statistic? How many donkeys kick/bite/maul humans to death? Do we ever read about such occurrences in the papers or see it in full-colour graphic detail on the TV screen? How can this be a true comparison of actual risks? There is a vast amount of material available relating to aircraft deaths and fatalities but there are no such relevant statistics for death by donkey. Look at the basis for each side of the claim – aviation has been increasing for decades while donkey numbers have diminished to a tiny fraction of what they were. Also note the complete and absolute denial of this statistic by the American Donkey and Mule Society (Check out their websites, FAQ section).

This modern use of statistics to support outrageous claims is presented every night in TV advertising. On the box right now is a toothpaste advertisement that assures viewers that their product kills 99.9% of bacteria in a user's mouth. In reality, such a body count on bacteria is not good; we need certain bacteria to remain healthy, but, of greater relevance is the question as to how do they ascertain this stated value they present as a well-known fact? Did they do an experiment with a thousand greebies in a test tube? Did they add a squirt of tooth paste and find all the greebies dead except for one purple one, looking back up at them, waving its arms and grinning from ear to ear? Of course not! The 99.9% statement cannot be accurate as stated. It is there just to impress non-thinkers. Like the, "more donkey deaths" data, it has been compiled on the spot by an "expert" writer of TV advertising assuming that the majority of people will accept the detail at face value because it's too hard to analyse the whole context in which it is presented.

Some other examples to illustrate the foolishness of such statistic use could be:

The number of recreational aeroplanes occurring at night is virtually zero, so it is therefore a fact that it is safer to fly recreational aeroplanes during the hours of darkness.

Or

Pilots who are blind in one eye are not listed in aircraft accidents so all pilots should blind themselves in one eye so they will be able to fly more safely.

I trust that this will make you a little more discerning of the bounds of reality the next time you see a statistic used.

Please note that clinical tests and experts have proved that 98.712941729% of readers will find this article helpful!

Aircraft Books, Parts, and Tools etc.

Books

Birch & Branson Vol. 1 Basic Flight Training	Pre-owned but excellent condition	**$65.00**
As the Pro Flies (by John Hoyt)	Used but "mint"	**$60.00**
Fate is the Hunter (by Ernest K Gan)	Pre-owned but very good	**$45.00**

Parts and Tools

Item	Condition	Price
VDO Volt Readout instrument	Brand New	**$70.00**
Toolpro 3/8 drive Torque Wrench	As new	**$50.00**
Altimeter. Simple – single hand	As new	**$50.00**
Oil Pressure indicator, (gauge and sender)	New – still in box	**$80.00**
Flight bag. 3 section (2 x zips and 1 x locking flap)	Used but good	**$100.00**

Tyres

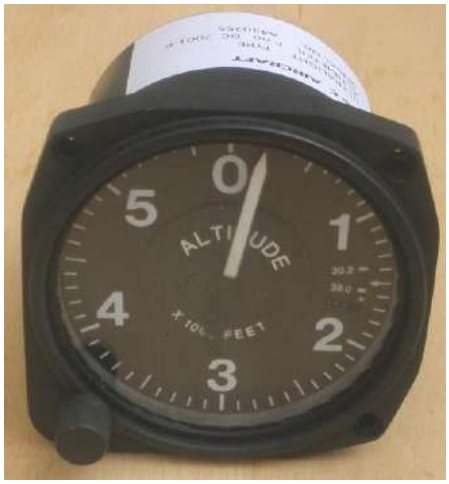
1 only – 13cm X 5.00 – 6 tyre	Unused	**$20.00**
1 only – 13cm 4.00 – 6 tyre	Unused	**$20.00**

Headsets

AvCom headset. Functions perfectly	Excellent	**$150.00**

Contact Rob Knight via either kni.rob@bigpond.com, or **0400 89 3632**.

Altimeter for Sale



This simple altimeter I purchased at Oshkosh is now surplus to my requirements and I am seeking a new home for it.

Its face is absolutely clear, it has never been used, and the subscale is provided in "HG.

It is in as-new condition and certificated. For a copy of the certificate, and/or further details, contact

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

Mob: **0419 758 125**

$120

Aircraft for Sale

¾ scale replica Spitfire

$55,000 neg

This aircraft is airworthy, flown regularly, and always hangared. Registered 19-1993, it is powered by a 6-cylinder Jabiru engine (number 33a-23) with 300 hours TTIS. The airframe has logged a mere 320 hours TTIS. This delightful aircraft has recently been fitted with new mounting rubber, a new alternator and regulator, a new fuel pump, and jack stands

It handles superbly and is available for immediate collection or delivery by arrangement.

Kept at Kentville in the Lockyer Valley, interested parties should contact either:

Kev Walters on Tel. **0488540011** or

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

Aircraft for Sale

$ Make Me an Offer$

Cobham Cobra

An opportunity to buy a unique aircraft.

I now have a Foxbat, and can't to afford to keep 2 aircraft. The Cobra was advertised for about a year in Sport Pilot, with many enquiries, but no resulting sale. Rather than continuing to spend on hangarage and advertising I decided to de-register it, remove the wings, and trailer it home to my shed. I don't intend to ever fly it again so, make me an offer. It provides very cheap and enjoyable flying.

It is a one-off design, a single seater with a fully enclosed cockpit. It has a 24-foot wing-span, and is powered by a VW engine that provides sporty performance and superb handling. The airframe has logged 653 hours and the engine 553 since installation. It is easy to start, but requires hand-propping.

To see it in action, go to
https://www.youtube.com/watch?v=V5Qx4csNw_A&list=PLpBv2A6hk66Tg9DiCsjEtt4o4o8ygcTju&index=1&t=22s

It cruises at around 80 knots at 11-12 litres/hr. The tanks hold 48 litres so it has a very reasonable range. For my approaches I use 50 knots on my initial approach down to 40 knots on short final. You will want a fair bit of tailwheel time.

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

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Slipstream Genesis for Sale **$14,000.00**

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 knots. Empty weight 304kg, MTOW 544 kg, Payload 240 kg. Fuel tanks hold 78 litres. With fuel burn averaging 16 litres/hr, still air endurance (nil reserve) is theoretically 5 hours, or 350 nm. Aircraft always hangared. It has been set up for stock control/ 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 done 01/09/20. 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 $14,000.

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