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Cessna 327, The Baby Skymaster

See page 7.

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Greetings members,

Best wishes

Peter Ratcliffe
President BVSAC

Torque Talk and P-Factors

By Rob Knight

After touching on the slipstream effect and it's not-so-subtle properties in previous issues of the Flyer, there are other veiled forces relating to the propeller that can strongly influence the safety of single engined aircraft. Like the slipstream effect, these, too, influence the lateral and directional behaviour of an aeroplane. In these cases, the torque (torque effect) of the engine produces a rolling moment about the longitudinal axis, while the P-factor produces a yawing moments about the normal (or vertical) axis.

Torque, or torque effect, relates to the engine exerted torque on the propeller shaft necessary to turn the propeller. However, as Sir Newton reminds us ad nauseum, every action has an equal and opposite reaction. The reaction to engine torque is propeller torque which, in turn, acts through the engine mounts and works to rotate the airframe in the direction opposite to the rotation of the propeller. Thus, engine torque, through propeller torque, ultimately produces a rolling moment in the airframe, which is countered with aerodynamic forces provided through the wings by the ailerons.

The whole time the propeller is turning clockwise, the airframe's trying to turn anticlockwise.

The torque of the engine, and hence the rolling moment it exerts on the aeroplane, is at its maximum at full throttle. However, the ability of the airframe to generate aerodynamic force is proportional to the square of the airspeed, so the ailerons will have the least power available to fight engine torque at low airspeed. Two critical flight conditions where high power and low airspeed combine are at lift-off, with the engine at full power and the speed is low, and at the beginning of a missed approach, when the pilot applies full power to stop the descent and begin climbing again, with flaps extended and undercarriage lowered.

For most aeroplanes, the rolling moment due to engine torque is small enough relative to the control power of the ailerons for control to be easily maintained. Prominent exceptions include single engined aircraft with very powerful engines, such as many warbirds. Some WW-II fighters have so much torque that the ailerons cannot not overcome the torque if the pilot abruptly applied full power at low airspeed. Such an example is the F4U Corsair. It was particularly susceptible to this because, as a Navy fighter, it had to fly slowly enough to land on aircraft carriers, but also had to have a very powerful engine to give it the top speed and high rate of climb it needed to be an effective fighter. A pilot, slamming the throttle forward suddenly to initiate a wave-off (aircraft carrier talk for a go-around), would find his aircraft rolling uncontrollably in one direction whilst he was holding full opposite aileron. This caused a serious number of accidents in service, and the problem continued when civilians, used to lower-powered aeroplanes started flying surplus fighters after WW-II.

The problem of uncontrolled torque rolling also appears when people install turbine engines on some composite kit aeroplanes originally designed around piston engines. Turbines with 400 to 500 hp were installed, replacing the original 160 to 200 hp piston engines. There were several fatal accidents with these early turbine conversions where the aeroplane lifted off at full power and immediately entered an uncontrolled roll to crash on the runway.

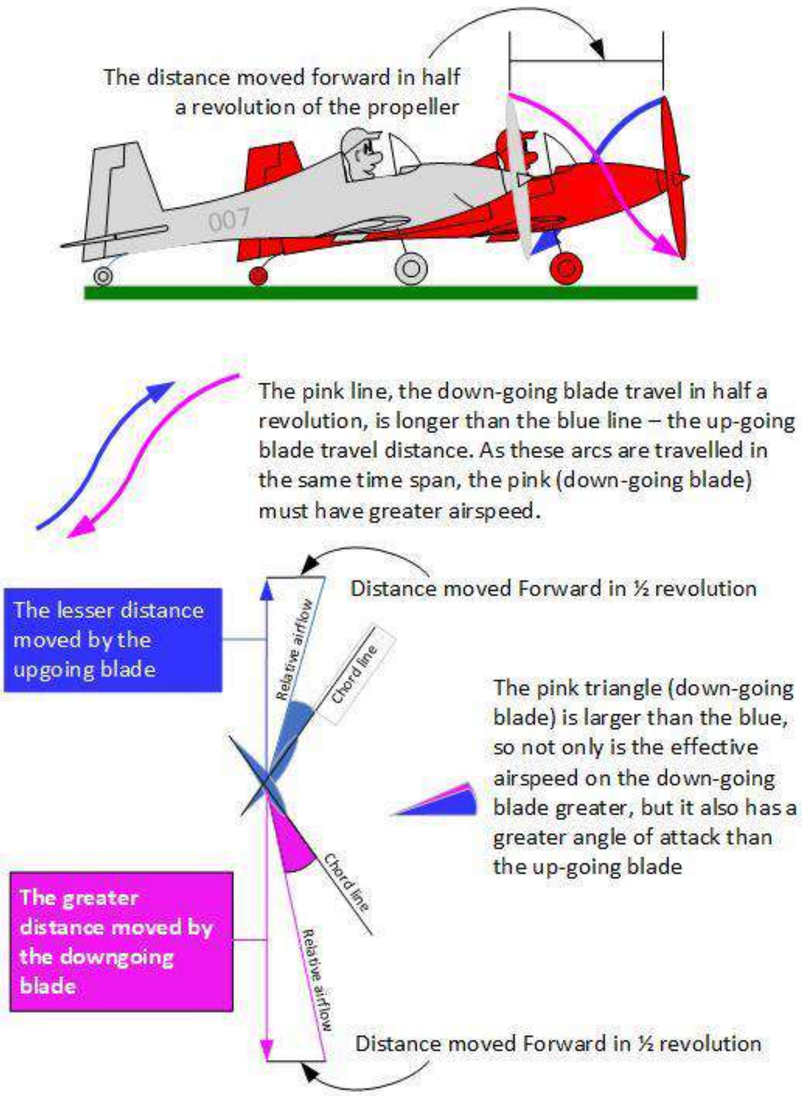
The correct technique for these high-powered singles, is to realize that they have a much higher minimum control speed (V_{MC}) than the previously flown and lower powered versions of the aircraft. The greatly enhanced power limits available after the upgrade means a substantial revision upwards of the said V_{MC}. Below this new V_{MC} it is only safe to use partial power. The aeroplane can still fly and climb perfectly well at airspeeds below this new VMC value because the engine has so much excess power that even at part throttle it provides enough power to climb. But, and here's the crunch, it is unsafe to use full power until the airspeed is above this specific, updated critical airspeed. For low powered light aeroplanes, torque's greatest hazard is perhaps the flattening of a tyre on take-off, requiring rudder to maintain the desired direction

It's important to note that, although torque is so significant on high-powered aeroplanes, it does not denigrate the importance of the P-factor issues. The P-factor also rises with increasing power applied, so in addition to the pure rolling moment caused by torque, the pilot must also and still contend with the yawing moment created by the P-factor.

The P-factor, also called asymmetric blade effect, is the result of the propeller blades having differing angles of attack depending on which sector of the propeller disc they are travelling through. Yes, I thought that this was a bit too far-fetched, too, but it really is the case.

If the propeller arc is perpendicular to the direction of motion, then the relative airflow is parallel to the direction of aircraft motion. In this situation, the up-going blade will have exactly the same angle of attack as the down-going blade. Also, the airspeeds experienced by each blade will be the same.

However, having the aeroplane in a nose-high attitude at low-speed, such as a nose-wheeled aircraft at lift-off, or a tail dragger accelerating tail-down, tilts the propeller's plane of rotation relative to the direction of motion and thus to the relative airflow. Now the blades will encounter different angles of attack, and experience different airspeeds, as they move around the propeller arc. An up-going blade sees a lower blade angle of attack and airspeed than if the shaft were parallel to the wind. Conversely, a down-going blade sees higher blade angle of attack and airspeed.

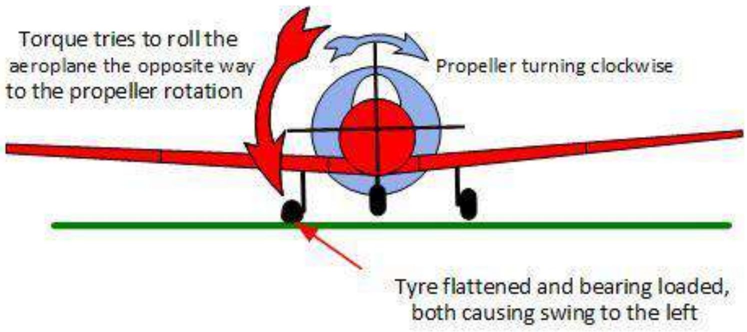


The down-going blade has both a greater angle of attack AND a greater airspeed than the up-going blade so more thrust is produced on the down-going arc of the propeller disc. Note that this sketch is schematic and not to scale.

Because of this asymmetry in blade angle of attack and airspeed, more thrust is generated on the side of the propeller arc with the down-going blade than on the arc of the side with the up-going blade. Therefore, propellers turning clockwise, having the down-going blade on the right side of the nose, will pull the nose left at high power settings, especially when the airspeed is low. Obviously, propellers turning anticlockwise from the cockpit will experience forces pulling the nose to the right caused by these influences, and thus suffer right swing on take-off requiring left rudder to correct.

Summary

Torque: As stated earlier, torque constitutes a hazard to light, common or garden wariety lower powered aeroplanes in that it causes swing on take-off. Propeller torque, that opposite-acting reaction to engine torque, tries to rotate the aircraft in the opposite direction to the propeller rotation. Whilst the aeroplane's wheels are still on the ground on the take-off roll, the force rolling that airframe against the propeller rotation squashes one wheel and its tire harder onto the ground. This causes a flattening of the tire which adds to the ground friction and rolling resistance applicable to that wheel. It also adds loading and frictional drag inside the wheel bearing on that wheel which further restricts rolling. If the propeller rotates clockwise from the cockpit, the left wheel and tire will have the added rolling resistance and cause the nose to yaw left. In this case, right rudder will be needed to keep straight.



Torque effect on take-off with clockwise rotating propeller

P-Factor: It should now be clear that P-factor is an aerodynamic phenomenon experienced by a moving propeller, wherein the propeller's thrust line moves off-centre relative to the propeller disc when the aircraft is at a higher angles of attack. With this in mind, the issue exists for propeller-driven aircraft in three critical flight situations. These are:

I. Raising the tailwheel on a taildragger on take-off,
II. Immediately at and after lift-off, and
III. When instigating a go around, especially if the airspeed is particularly low.

The result of P-factor is yaw. On take-off and lift-off, this will be seen and recognised by the pilot seeing his/her growing misalignment with the runway, but on a go-around, the balance ball could be the first visible clue that the issue exists, and requires immediate resolution. Whatever the triggering clue, at low level it is vital the pilot maintains the aeroplane's directional control.

Finally, from the Effects of Controls lesson, yaw has a further effect – roll. If a pilot fails to detect and correct the yaw created by the P-factor on a go around, the uncorrected yaw will promote uncommanded roll, so now the pilot has two issues to contend with – a directional correction coupled with a simultaneous requirement to stop the roll and return to wings level. With a clockwise rotating propeller, the yaw left will promote a roll left which will require a lowering of the left aileron to counter. Who really wants to lower an aileron to further increase that wing's angle of attack when the airspeed is low and the P-factor is at its maximum? This can cause the left wing to stall and drop – neither nice nor habit forming. And potentially, all because the pilot failed to recognise and stop the yaw generated by the P-factor with rudder.

Happy flying

Smaller, Lighter, The Cessna 327 'Mini Skymaster'

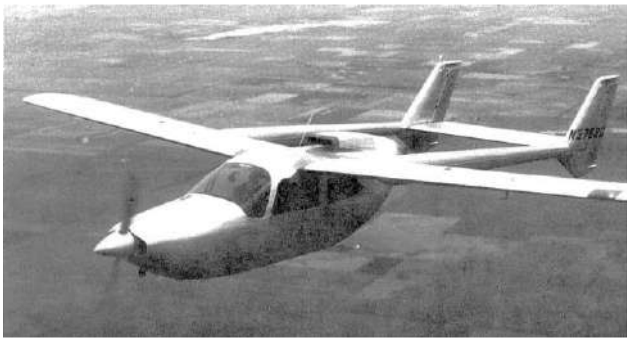
By Jason McDowell June 27 2023

The 327 was Cessna's solution to a downsizing opportunity. Then it ended up in a NASA wind tunnel.

A close-up shot of the 327, undergoing testing in NASA's Langley Research Center in Hampton, Virginia. [Credit: NASA]

Once upon a time, GA aircraft manufacturers pursued market niches with the ferocity of wild dingos. When marketing teams identified a potentially underserved customer segment, they wasted no time introducing minor variations to existing models to accommodate it. Compared to today's offerings, the resulting variety of aircraft was spectacularly broad and varied.

When Cessna determined some customers would be willing to pay a bit more for a slightly more powerful 172, for example, the company introduced the 175 Skylark. This was little more than a 172 with a different engine, but the company was in pursuit of new market segments and opted to advertise it as an entirely different model.



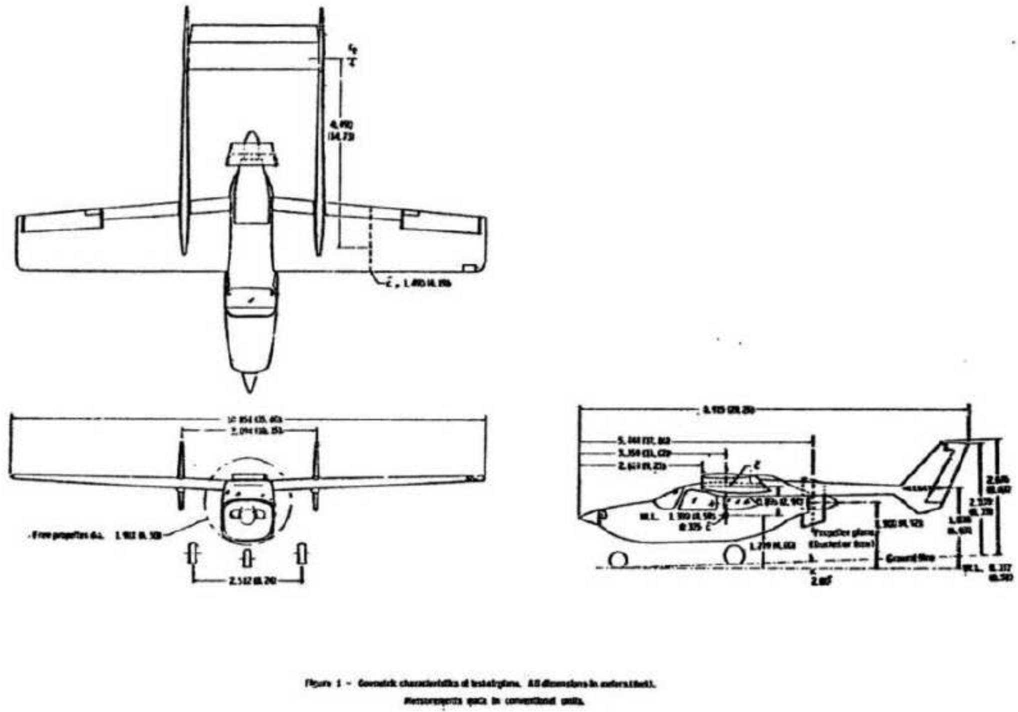
One of the few publicly available photos of the Cessna 327 prior to its time with NASA. In this view, the compact fuselage, sleek windscreen, and lack of wing struts are evident. [Credit: Cessna]

Similarly, Beechcraft identified markets for both full-sized and smaller light twins in the forms of the Baron and Travel Air. With four seats instead of five or six, thriftier 4-cylinder engines, and significantly lighter weight, the Travel Air was presented as a simpler, more compact solution that emphasized economy rather than outright performance.

Fresh off the successful launch of the unique, twin-boom Skymaster, Cessna began exploring the same opportunity in 1965. Recognizing the market might have room for a smaller, lighter version of the Skymaster, it built a single prototype of the Cessna 327. While it was never given an official name, various sources use the nicknames “Baby Skymaster” and “Mini Skymaster.”

The rationale behind this model was likely rooted in findings shared by other manufacturers—that many owners and operators of twin-engine aircraft travel alone or with only one passenger most of the time. For these customers, it made little sense to haul around excess seats and cabin space while burning additional fuel and paying more to maintain larger, 6-cylinder engines. The diminutive Wing Derringer was an extreme example of minimalist light twins.

The 327 was Cessna’s solution to this downsizing opportunity. Essentially a 172-sized Skymaster, it was both smaller and lighter than the larger centerline twin. Equipped with two 4-cylinder, 160 hp IO-320 engines, it utilized Cessna’s strutless, cantilever wing, and raked windscreen, similar in design to the 177 Cardinal series.

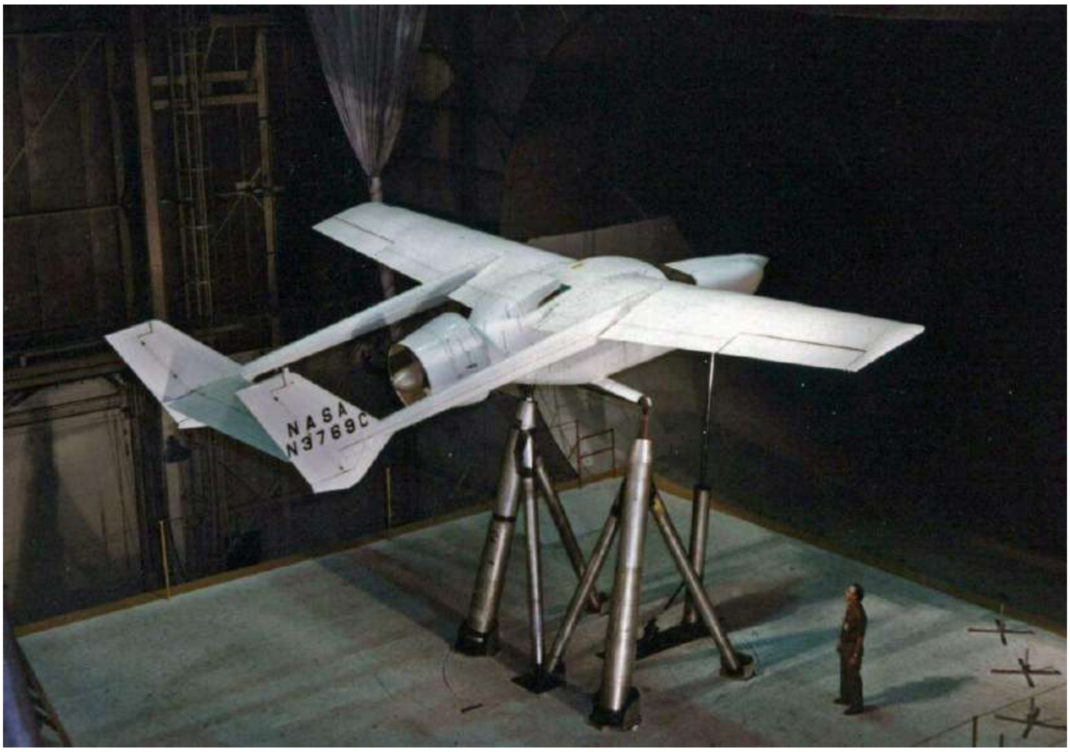


A three-view diagram of the Cessna 327 reveals its blend of Skymaster layout with Cardinal design. [Credit: NASA]

The smaller size and sleek lines gave the 327 a sporty look compared with the more utilitarian Skymaster. But like the Skymaster, the front seats were positioned well ahead of the wing’s leading edge. Combined with the lack of wing struts, this would have provided outstanding outward visibility and positioned the 327 to be a favourite for aerial photography.

Cessna never published any dimensions or performance specifications for the 327. Using comparable light twins with the same engines as a reference, we can predict the 327 likely would have had a maximum take-off weight of 3,500-4,000 pounds, with a maximum cruise speed of 150-175 mph.

The airplane’s final role would be filled at NASA’s Langley Research Center. There, it was used in the full-scale wind tunnel, or FST, for noise-reduction studies. This research was conducted by Cessna, NASA, and Hamilton Standard in 1975 to evaluate various propeller and propeller shroud designs.



With the front propeller removed, NASA studied various configurations of propellers and shrouds to learn more about propeller noise and efficiency. [Credit: NASA]

Fuel burn would also have been correspondingly lower, roughly on par with a Piper Twin Comanche with similar engines.

The NASA team removed the front propeller and fitted the 327 with an assortment of three-blade and five-blade options housed within a custom-built shroud. Perhaps surprisingly, the shroud was found to actually increase propeller noise slightly as opposed to reducing it as expected. The airplane was later fitted with Hamilton Standard's experimental "Q-Fan," a ducted fan design that was touted to transition from full forward thrust to full reverse thrust in less than one second.

No official record exists outlining the 327's ultimate fate. The apparent lack of any information beyond the 1975 wind tunnel testing suggests the airplane was scrapped after that. This was perhaps part of a contractual agreement with Cessna, as the company was known to have discarded other prototypes during that era.

We're left with a smattering of photos and a few piles of technical reports. Coincidentally, with the introduction of electric vertical take-off and landing vehicles and a renewed interest in noise-reduction technologies in the GA sector, the studies might prove valuable even today. And for that matter, a compact, efficient piston twin with the safety of centerline thrust might as well.

Jason McDowell

Jason McDowell is a private pilot and Cessna 170 owner based in Madison, Wisconsin. He enjoys researching obscure aviation history and serves as a judge for the National Intercollegiate Flying Association. He can be found on Instagram as @cessnateur.

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Flying in The Yellow

By Rob Knight

***Yellow infers caution, and any flight where the ASI needle points into the yellow arc on the ASI should be conducted with considerable care, and only in smooth air*.**

While some modern cockpits display the airspeed on a vertical speed tape, the same colour references apply so I will continue to work with the ubiquitous round-dial version with which most of us are more familiar.

For full comprehension of any topic, basic definitions must be clearly grasped. In this case it is vital that the meanings of the coloured arcs on the ASI[1] are understood.

To refresh, the white arc depicts the range of airspeeds permitted with flap extended. The low IAS[2] end of the white arc registers the stall speed with flaps lowered, and the top end designates the V_{FE}[3], the maximum IAS permitted with flap extended.

The standard type ASI fitted to most light aircraft.
White arc = Flap Extension IAS range.
Green arc = normal ops IAS range.
Yellow arc = IAS for SMOOTH air ONLY, and no excessive control movements.
Red Line = V_{NE} – the NEVER EXCEED IAS.

The green arc indicates the normal operating IAS range of that aircraft, that range of airspeeds within which most flying in that aeroplane occurs. Its lower limit is the stalling speed or minimum steady flight speed and the Upper limit signifies the V_{NO}[4], the maximum structural cruising speed - the highest IAS that this aeroplane may safely fly in any but the smoothest of air and, then, only with minimal control inputs. This is the point where the manufacturer removes any guarantee of the structural integrity of his aircraft – above the green range – St Christopher goes home - YOU ARE ON YOUR OWN.

The yellow arc is the cautionary airspeed range. Its colour warns that that any turbulence encountered whilst the needle indicates within this range may cause airframe damage leading to unthinkable consequences. Since few light aeroplanes can cruise in this speed range under most circumstances, we seldom spend any time understanding how very different the airframe overstress protection scheme is when operating in the yellow arc instead of the green one. It's not just CASA giving us a colourful instrument to look at - there is a very good reason for this warning/caution range painted onto the dial of the airspeed indicator in front of us.

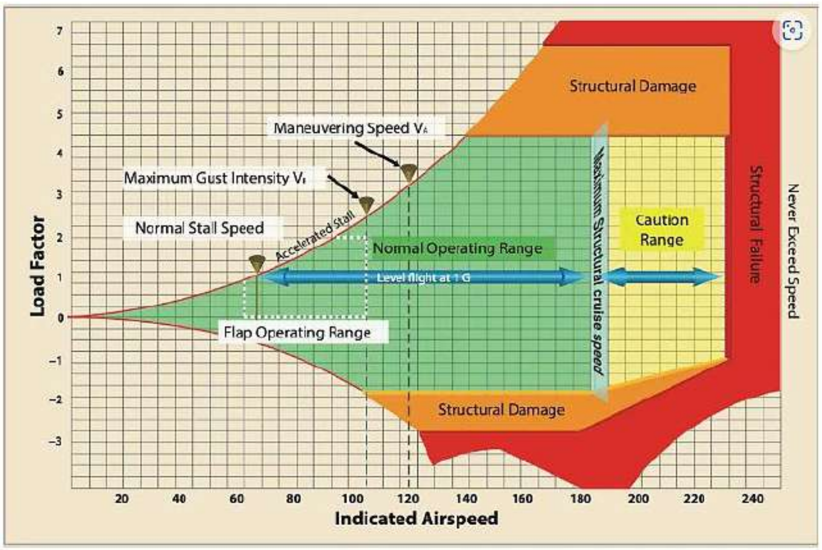
At the top end of the yellow arc is the red line which, like any other red line, indicates the end of the road if you exceed it. Perhaps this statement is a little extreme, but the manufacturer is giving you fair warning that it is absolutely unsafe to operate the aircraft, even in the smoothest of air, at an IAS in excess of this speed.

Unless you're doing a CPL, you are not likely to be presented with a VG graph (aka VG diagram). However, aeroplanes fly for the same reasons and within the same parameters whether it's an RAA certified pilot, a PPL, CPL, ALTP, or even an astronaut that's holding its stick, so it certainly has general interest to everyone. In the VG graph, "V" represents velocity and "G", the G loading (or load factor). Its design purpose is to present a visual image of the relationship between an aircraft's

[1] ASI – Airspeed indicator.
[2] IAS = indicated airspeed.
[3] V_{FE} = The maximum IAS with flap extended.
[4] V_{NO} = Maximum Structural Cruising Airspeed (maximum IAS for normal operations).

airspeed and the forces that accrue on the airframe when operating at those speeds. An example is reproduced below.

Note that all airspeeds are IAS values as they represent the forces the atmosphere exerts against the airframe. Caution: although specific stresses at very high speed may cause an aircraft's limiting speeds to be lower, the shape of the diagram would remain the same.



Sample of an FAA PHAK (Pilot's Handbook of Aeronautical Knowledge) graph. Note this its use of MPH rather than our knots as the airspeed measure

The sample VG graph on the right was extracted from the FAA's Pilot's Handbook of Aeronautical Knowledge (FAA-H-8083-25B. Colloquially known as the "PHAK") it is generic in that it uses airspeeds for a hypothetical aircraft. As noted in the PHAK, "each aircraft has its own Vg diagram specifically valid at a certain weight and altitude." The PHAK takes a stab at explaining this very complex diagram in a few words on pages 5-37 and -38. Readers of this publication that apply the definitions of the speeds that define the boundaries of the normal operating range and the caution range will quickly see how this diagram applies to the ASI's yellow arc. Note that the provision of VG diagrams is a modern innovation, older aeroplane type flight manuals and POHs will not contain such details in this visual format.

DEFINITIONS OF VNE, VNO, AND VA

Some pilots may be confused by the terms VNE, VNO, and VA. If you are one, then be assured that you are in good company.

In essence, each of these limiting airspeeds indicates a different level of airframe (and therefore aircraft occupant) protection against potentially overstressing the aeroplane's structure. These speeds can be defined as:

- VNE: **Velocity Never Exceed (Never Exceed Speed),** is the maximum IAS at which the aeroplane may ever be flown. This airspeed is the manufacturer's stated maximum airspeed for this design. It is indicated by a red radial line on the ASI face.
- VNO: **Maximum Normal Operating Speed (Maximum structural cruising speed)** is the maximum IAS at which you can safely fly this aeroplane design in smooth air. It is indicated by the upper limit of the green arc on an airspeed indicator. If you fly above VNO, - in the yellow arc (or "caution range"), and you strike turbulence, you could cause real damage to the aircraft structure.

- **V$_A$: Design manoeuvring speed,** not indicated on a coloured arc, this is the IAS above which it is imprudent to make full application of any single flight control (or "pull to the stops") as it may generate a force greater than that to which the aircraft's structural was designed.
  The primary reason that V$_A$ is not displayed on a coloured arc is that the value is not fixed, as the other values are. The V$_A$ varies with changes in aircraft weight, decreasing as the aeroplane weight decreases, and increasing as its weight increases.
  The published V$_A$ is the IAS that applies at the airplane's maximum take-off weight. Flying at or below the design manoeuvring speed does not allow a pilot to make multiple large control inputs into one axis, or single control inputs in more than one axis at a time, without endangering the airplane's structure.

Most light aeroplane manufacturers recommend flying at (or preferably below) V$_A$ when operating in turbulent air. This could be clarified by stating that in moderate or greater turbulence, the pilot should slow to a speed at which the maximum speed reached in gusts is still below the V$_A$ for the aeroplane's current weight. If your POH only lists a V$_A$ at your MTOW, then you'll have to guess. But be sure to guess with care!

Consider also, at the V$_A$, your aeroplane may reach its maximum G limit before the wings stall and unloads the airframe. It won't cause structural damage, but you'd be in for a pretty wild ride - changing from 3.8 or 4.4 G to zero G in an instant is a severe shake-up Slower is better, so long as the IAS remains above the aeroplane's minimum control speed whilst experiencing the turbulence.

Lastly - these airspeeds, potentially so vital to airframe protection in turbulence or while manoeuvring, occur within the green arc, the normal green operating range as depicted in the previous images. They are NOT restricted to the yellow arc alone. Therefore, when operating within the ASI's yellow arc, it would demonstrate an extreme lack of wisdom to subject the airframe to any turbulence or savage/extreme control inputs whatsoever.

Aircraft certification rules are quite clear. They require establishing limit speeds that provide protection against damage to the aeroplane when operating in the green arc based on encountering a 30 fps wind shear. That's a rapid, 1800 fpm change in wind speed or direction. This means that if you remain below your maximum structural cruise speed (V$_{NO}$) and impact a shear of this extent, no permanent damage should occur (whew, that's good news).

Certification rules for piston-powered aircraft give the manufacturer a break at V$_{NO}$. At any IAS above the V$_{NO}$ the wing has only to withstand a 15fps gust, or 900fpm, up to the red line, VNE. Read this as meaning that your structural protection is cut in half above your aeroplane's V$_{NO}$ because above this IAS the aircraft has the control authority to exceed its maximum load factor. That's why the yellow arc is the "CAUTION" range, and why you'll want to remain in the green arc except in very smooth air.

Load Factors and "G" Meters

It's true that there is a deliberate margin between design or limit load, specifically the published maximum, and the ultimate load. Ultimate load is 150 percent of design load—for the utility-category airplane depicted in the previous Vg diagram, design load is +4.4 g and ultimate load is +6.6 g. But there is a significant difference between the two—you don't have the same protections all the way to the ultimate limit.

For certification, aeroplanes must endure up to the design load without damage to its primary structure. The aeroplane is designed to not suffer catastrophic failure of its primary structure unless it exceeds the ultimate load limit. However, note that, in the grey margin between design and ultimate limits, the aircraft's primary structure will likely be damaged or permanently deformed, just not damaged so severely that the aeroplane breaks up in flight. In other words, exceeding the design load limit may not pull it apart, but it is still capable of severely damaging the airframe to the extent that, after the termination of that flight, it is beyond economic repair from an airworthiness point of view. Same thing, really, for the aeroplane – but you survived even though the aeroplane did not.

FLYING IN THE YELLOW

So, what's the verdict? Is it safe to fly in the yellow arc?

In general, the answer is "Yes", But, only as long as you have complete certainty that:

I. you will not meet anything more severe than the lightest of turbulence; and/or

II. you will not need to apply any flight control (elevator, aileron, or rudder) to its maximum deflection to counter the effects from a gust, to recover from wake turbulence or because you choose to make an abrupt manoeuvre, and/or

III. you will not need to apply some undefined amount of flight control input (aileron, elevator, or rudder) to more than one flight control at the same time.

In other words, **IF** you can be confident and sure that you can continue to fly with essentially no change in control position, **AND** the air is predictably smooth, **you may be safe** flying with the IAS needle indicating in the yellow arc.

HOWEVER - You'll need to have a good level of knowledge of the factors that may cause turbulence, and a corresponding high degree of situational awareness as to how the conditions may have changed since your last weather update. Unless you have absolute certainty that you can maintain essentially neutral flight controls and avoid turbulence, it is not safe to fly in the yellow arc.

Aerodynamic drag on an aircraft rises as the square of the value of the increasing IAS. Therefore, it's easy to see that all the forces acting on the aircraft will rise as the square of the speed rise. With this in mind, the higher the ASI needle indicates into the yellow arc, the greater all aerodynamic forces will be to act on and potentially damage the structure.

TO CONCLUDE

The yellow arc covers a range of indicated airspeeds derived during the certification process for that specific aeroplane type. The yellow arc depicts a regime in which the aeroplane will withstand only very minor turbulence and/or very small control deflections, and where there is no longer any built-in airframe protection to prevent dangerous overloads, such as exists at lower speeds. The yellow arc is, indeed, an IAS speed range to operate in only with extreme caution.

Happy Flying

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Sleeping on the job – a lesson in staying alert

By Dale Hill. Published April 10 2023 AIRFACTS Journal

Have you ever been 'bone tired'? I mean so tired that not only were your eyes drooping, you felt like your bones were too.

When flying in Southeast Asia (SEA) on 4.5–5.0 hour-long Forward Air Controller (FAC) missions in an OV-10 Bronco, you got tired. When you flew two such missions on the same day (what we called a 'double-bang'), you would get really tired. When you flew three or four double-bangs over four or five days, you got bone tired!

The North American Rockwell OV10 Bronco, counter Insurgency aircraft

In the summer of 1973, the Khmer Rouge (Communist forces in Cambodia) were trying to bring about the fall of Phnom Penh, the capitol city of Cambodia; we called it Papa-Papa. If they were successful, it would likely mean the collapse of the government.

To counter this pressure, we FACs of the 23rd Tactical Air Support Squadron (callsigns 'Nails' and 'Rustics') were flying our Broncos along the Lines of Communication (LOCs) leading into Papa-Papa. The military defines LOCs as "A route, either land, water, and/or air, that connects an operating military force with a base of operations and along which supplies and military forces move."

We FACs directed airstrikes against enemy emplacements providing protective cover along the LOCs leading to Papa-Papa. This provided safe passage for the convoys that kept the citizens of Papa-Papa and the forces protecting them fed, fuelled, and armed.

As the Khmer Rouge tightened their 'noose' around Papa-Papa, we had FACs operating in very close proximity to one another. However, with two FACs working along the same LOC with one controlling fighter aircraft attacking targets on one side of that LOC while, at the same time and only a short distance away, another FAC was controlling additional fighters bombing targets on the opposite side, things could get complicated. For instance, both FACs would have to restrict the attack headings the fighters used as well as the direction in which they pulled off of the target after dropping their bombs. We had to make certain they didn't cross the LOC along which we were operating.

It was decided that we should put two FACs in each airplane, a guy in the front seat (the GIF) and a guy in the back seat (the GIB). Each Guy had specific tasks using two of the five radios with which our Broncos were equipped. The GIF would coordinate with the convoy commander on #1 of the two VHF/FM radios and direct the fighters on the UHF radio as they dropped their ordnance. Meanwhile, the GIB coordinated with nearby FACs on the #2 VHF/FM radio and made requests for additional fighters with the Airborne Battlefield Command and Control Center (A-B-TripleC – an EC-130 with a battle staff onboard) using the VHF/AM radio. When not too busy, we tuned the HF radio to either Radio Australia or the BBC for background music as we worked; "*Whistle while you work!….*"

The GIF controlled the frequencies to which our five radios were tuned, but both Guys had a control panel in their respective cockpit to control the volume of each radio. To select the radio on which they would transmit, they each had a circular wafer switch located on the console aft of their throttles. Rotating the wafer switch counter-clockwise, the UHF radio was the first stop with the VHF/FM-1 radio next; then came the VHF/FM-2 radio, the VHF/AM radio, and finally, the HF radio. Both Guys used their left thumb to press a spring-loaded toggle switch on the #2 engine throttle in their respective cockpit upward to transmit over the radio selected by their wafer switch.

Both Guys could monitor all the radios, but we normally kept the volume buttons turned down on the two radios we weren't primarily using. That way, if someone started yelling to the GIF on the UHF radio, the GIB could quickly turn up the volume to find out what all the excitement was about.

This arrangement made the intercom (IC) between the GIFs and the GIBs an essential part of the equation. The OV-10 was a noisy airplane and we never flew with a 'hot mic'. Instead, thumbing that throttle mounted toggle switch downward enabled the Guys to speak on IC, thus allowing them to coordinate what each was doing and to keep each other informed as to what was happening on their respective radios.

The OV10 Bronco, a mean machine

Double-bangs normally began with an early launch (take-offs after 9:00 AM were a 'late go') from our squadron's forward operating location at Ubon Royal Thai Air Base (UBP); the Rustics home station. After our first mission, we would land at Papa-Papa (PNH) mid to late-morning to refuel and rearm our trusty steeds and grab a bite to eat. We would then launch to cover another stretch of the LOCs assigned to us by the ABCCC.

One day, 'Rowdy' (a Rustic FAC) and I flew a 'double-bang' mission. We were both weary from earlier 'double-bangs' in the preceding days, but we were also young and 'bulletproof', or so we believed! I was the GIF on the first mission and Rowdy was the GIB as we supported a convoy coming up the Mekong River. We directed several airstrikes on enemy positions attacking the convoy. As we neared the end of our mission, we were relieved by some other Guys and headed to Papa-Papa for a break.

After lunch and a much too brief 'siesta' in the shade, we got airborne with Rowdy as the GIF and me as the GIB. We returned to supporting the convoy coming upstream on the Mekong. The afternoon sortie was routine as we again directed airstrikes against enemy attacks on the convoy.

When we reached 'Bingo' fuel (the minimum needed to get home safely) we briefed the Guys relieving us and headed back to Thailand. Flying northward, we cleaned the canopy on which we had used grease pencils to scribble information about those airstrikes we had controlled. It all had to be briefed to Intelligence when we got home, so we copied it down and then erased it from the canopy; the information would become classified because it updated the 'order of battle'.

As we cleaned up our mess, we climbed to 10,000 feet MSL to get into cooler air (Broncos are unpressurized with no air conditioning); it also got us mostly out of the way of other airstrikes. Once we levelled off, Rowdy announced, "Bud, I'm pooped – you fly while I catch a quick nap." He trimmed up the airplane (in the Bronco's back seat, there was only a stick with no trim button) and made me the PIC.

I responded, "Before you ZZZ-out, how about tuning the HF to the BBC?" Rowdy quickly dialled in a frequency we all knew and then told me he was locking his shoulder harness so he wouldn't lean into the stick.


Bronco front cockpit and panel

The music that came into my headset was what I would call 'Dinner Music' as it reminded me of an orchestra playing soft music in the dining room of a fancy hotel. As tired as I was, I would have preferred Rossini's "William Tell Overture", but figured dinner will soon be over and I'll get some livelier music.

Rowdy got quiet really quick leaving me to point the airplane roughly north while waiting to pick up the TACAN signal at Ubon. With few NAVAIDs available to us over most of SEA, we FACs were good at dead reckoning and also very familiar with the local landmarks.

As I cruised along listening to the music playing on the radio over the drone of our twin turboprops, thoughts of a cold beer (or two) over dinner were on my mind. I was also watching the cumulus clouds building in the tropical afternoon as the 'Dinner Music' continued, and**… . . .*I suddenly awoke with a start!***

<u>WAIT!</u> I'm supposed to be flying, not sleeping! Where am I? Where am I going? I checked the instruments and saw I was now heading west at 10,500 feet. I glanced around and knew exactly where I was, so I turned back to a northerly heading.

"**OK!**" I told myself, "**I NEED TO STAY AWAKE!!!!!**" I started by punching off the HF button; I didn't need any more 'Dinner Music' or I might be missing dinner while floating in a life raft in the Gulf of Thailand after we run out of gas and have to bail out!

I can do this, I thought; I just need to not be droning along! I decided to follow my T-37 IP's advice, 'If you're bored with boring holes in the sky, then do Snoopy Flips!' My version of Snoopy Flips was to begin climbing up the clouds I encountered and, when I topped them, I would roll nearly inverted and fly back down their back side. My idea was to make this a roller coaster ride and to do it so that I never touched a cloud. This was fun, I thought, and I'm going to try and be smooth enough that I won't wake Rowdy up.

Things were going fine for the first four or five clouds as I easily topped them and flew down the back sides; Rowdy never stirred. However, as I topped yet another one and began my roll across the top, the UHF radio burst to life as someone, somewhere yelled on Guard channel (243.0), "**SAM! SAM! Take it down!!!!**" I don't know where this call originated, but we were in an area where Surface to Air Missiles (SAMs) didn't operate; however, my heart still skipped a beat (or two!).

This was a common radio transmission in SEA whenever the enemy launched a SAM trying to shoot down an airplane. 'Taking it down' was a tactic used where we would roll into the direction from which the SAM was coming in an attempt to out-manoeuvre it. SAMs had small wings and our goal was to make the SAM try such a tight turn that it would either tumble or else not make the corner and miss us. It was a gamble and the timing was especially critical, but it worked when flown correctly.

To say the least, Rowdy was no longer asleep! He was awakened by someone screaming about SAMs on the radio as I was rolling inverted and pulling the nose downhill. He grabbed for the stick while I yelled on IC, "Everything is OK!" But he wasn't having any of it. Grabbing the stick and rolling quickly left and then right, he determined I was right – there was no SAM.

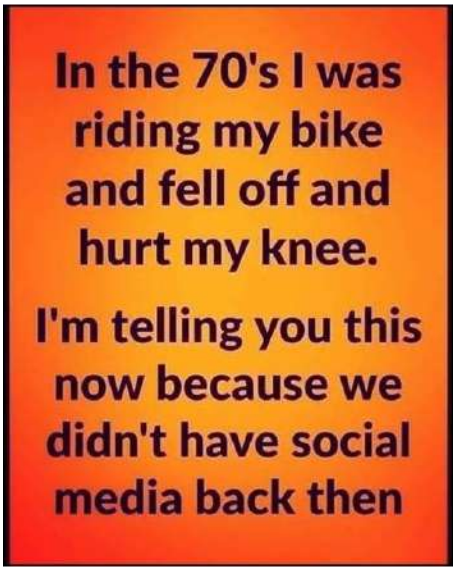
Now we were both wide awake, so we continued homeward dropping down to buzz some water buffaloes we encountered along the way. After landing, we debriefed and grabbed a cold beer (or two).

I never again fell asleep on the job!

Author

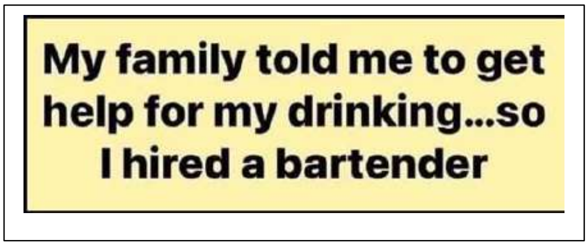
Dale Hill

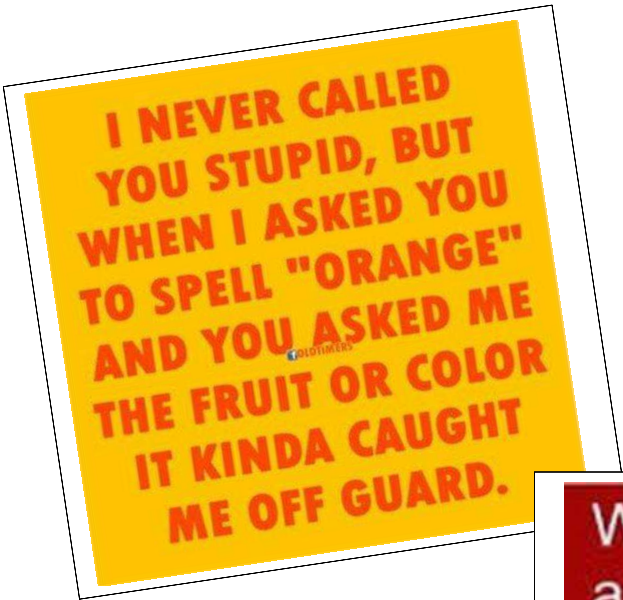
Colonel (ret) Dale "Boots" Hill served 22 years in the Air Force, beginning his tour of duty flying 165 missions in the OV-10 as a Forward Air Controller in Vietnam. He was then a T-38 IP, A-10 IP and flight examiner, and an F-16 IP and commander of the 61st Top Dawgs. He worked assignments at TAC HQ (he told other fighter pilots where to go—they would tell him where to go). At the Pentagon he served on the Air Staff as a planner for Operation Desert Storm and on the staff of the Secretary of the Air Force. He lives in Canton, GA, with his wife, Susan, near three (soon to be four) of their seven (soon to be eight) grandchildren.

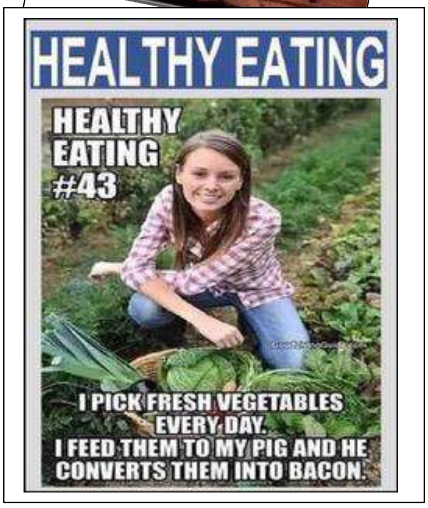


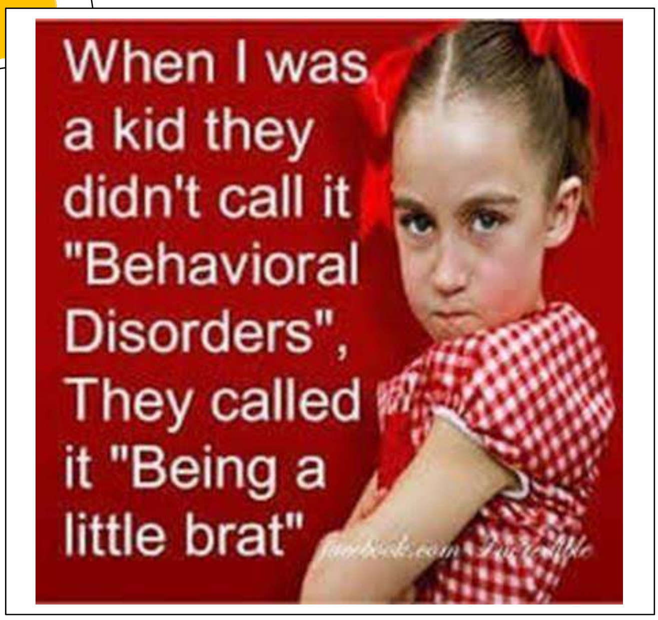
FLY-IN Invites Looming

WHERE	EVENT	WHEN
Murgon (Angelfield) (YMRG)	Burnett Flyers Breakfast Fly-in	**Find Next Planned EVENT Sunday 15 October.** **Confirm details at:** http://www.burnettflyers.org/?p=508









Yup, some people can't handle the truth!

My Favorite Animal

Our teacher asked what my favorite animal was, and I said, "Fried chicken."

She said I wasn't funny, but she couldn't have been right, because everyone else laughed.

My parents told me to always tell the truth. I did. Fried chicken is my favorite animal.

I told my dad what happened and he said my teacher was probably a member of PETA. He said they love animals very much.

I do, too. Especially chicken, pork and beef.

Anyway, my teacher sent me to the principal's office.

I told him what happened, and he laughed, too. Then he told me not to do it again.

The next day in class my teacher asked me what my favorite live animal was.

I told her it was chicken. She asked me why, so I told her it was because you could make them into fried chicken.

She sent me back to the principal's office.

He laughed, and told me not to do it again.

I don't understand. My parents taught me to be honest, but my teacher doesn't like it when I am.

Today, my teacher asked me to tell her what famous military person I admired most.

I told her, "Colonel Sanders."

Guess where the fuck I am now...

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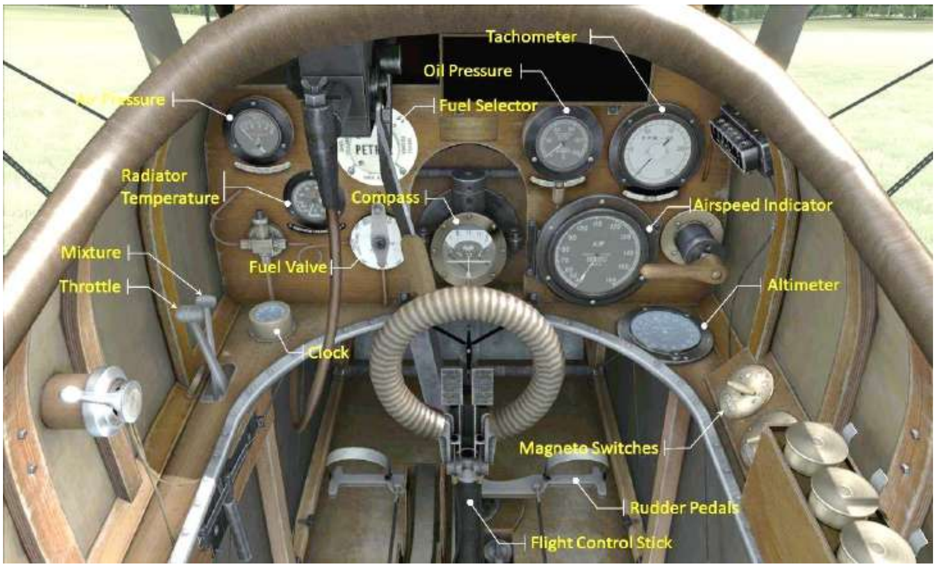
The Ace-Maker - The R.A.F. S.E.5A

by Budd Davisson

When World War One broke out in 1914, the airplane was barely eleven years old and was nothing more than a plodding, noisy kite barely more dangerous than an observation balloon. As a weapon, it was difficult to take seriously. Four short years later it had been transformed into a multi-dimensional weapon system of awesome potential and the Royal Airplane Factory's S.E.5a is a classic case in point. It showed clearly that in time of war man quickly finds more efficient ways rain death on his enemy.

R.A.F. S.E.5a

The Scout Experimental 5, (S.E.5) was designed specifically to eliminate the awful short comings aircraft such as the Sopwith Camel, while at the same time, giving it a combat edge over Germany's lethal Fokkers. The heart of the design for the SE-5 was the Hispano Suiza, liquid cooled V-8. Here was a 150 hp, easily controlled engine that was much easier for the neophyte pilot to operate and it didn't constantly try to twist the airplane into a pretzel as did the whirling rotary of the Camel.



S.E.5a instrument panel. Impressive for its times.

The less cantankerous engine was coupled with an airframe that replaced the fragile bones of the Camel with a robustness that would stand the new pilot in good stead both in combat and in day-to-day operations. It was an extremely easy airplane to take off and land, something that absolutely could not be said about the Camel and its all-or-nothing kill switch engine control. Moreover, when being thrown around during a dogfight, it was working with the pilot, where the Camel often fought its pilot requiring him to compensate for its eccentricities. Although not as manoeuvrable as the Camel, the SE-5 was much easier to fly (read that as less dangerous), and this meant a pilot could concentrate on killing his enemy rather than being killed by his own airplane. Because of this, the RAF could take a fledgling pilot and make him into an effective aerial warrior in a much shorter period of time.

The original 150 hp SE-5 had little effect because of reliability problems and the limited number to reach the front. However, by 1918, the 150 Hispano Suiza had been replaced with the more powerful, geared 200 hp Hispano and later the Wolseley Viper, which gave rise to the ‘a’ in SE-5a. With either engine the airplane carried a synchronized Vickers, belt-fed .303 calibre machine gun firing through the propeller and a drum-fed-Lewis gun on the top wing in a sliding mount. The Lewis could be fired straight ahead over the prop or upwards at an oblique angle. The ability to fire upward let the SE-5a pilot shoot into the belly of an unsuspecting enemy or fire across the circle, when in a dogfight.

At the front – S.E5a, ready for combat, WWI.

Fast (135 mph, or 117 knots), easy to fly, with a high rate of climb, the SE-5a became an ace-maker, including Mick Mannock (73 kills) and Billy Bishop (72 kills). The fact that the SE-5a was in combat barely a year, speaks volumes: In that short period of time, the airplane cut a swath through the enemy and, in so doing earned itself a place in history’s fighter hall of fame.

Note

Wait -0 there’s more - there was an S.E.5b

The S.E.5b was a variant of the S.E.5 with a streamlined nose and upper and lower wings of different span and chord. The single example, a converted S.E.5a, first flew in early April 1918. It had a spinner on the propeller and a retractable underslung radiator. Its performance was little better than the S.E.5a, with the extra drag of the big upper wing offsetting gains from the more

The S.E.5b

streamlined fuselage. The S.E.5b was not considered for production. In January 1919, it was tested with standard S.E.5a wings and in this form survived as a research aircraft into the early twenties.

Specifications for the S.E.5a

- **Crew:** One
- **Length:** 20 ft 11 in (6.38 m)
- **Upper wingspan:** 26 ft 7 in (8.10 m)
- **Upper chord:** 60 in (1.52 m)
- **Lower wingspan:** 26 ft 7 in (8.10 m)
- **Lower chord:** 60 in (1.52 m)
- **Height:** 9 ft 6 in (2.90 m)
- **Wing area:** 244 sq ft (22.7 m^2)
- **Aerofoil:** RAF15
- **Empty weight:** 1,410 lb (640 kg)
- **Gross weight:** 1,935 lb (878 kg)
- **Max take-off weight:** 1,988 lb (902 kg)
- **Undercarriage track:** 60 in (1.5 m)
- **Powerplant:** 1 × Hispano-Suiza 8 or Wolseley Viper water cooled V8 engine, 150 hp (110 kW)
- **Propellers:** 2 or 4-bladed fixed pitch wooden propeller, 7 ft 9 in (2.36 m) diameter

Performance

- **Maximum speed:** 138 mph (222 km/h, 120 kn)
- **Range:** 300 mi (480 km, 260 nmi)
- **Service ceiling:** 17,000 ft (5,200 m)
- **Wing loading:** 7.93 lb/sq ft (38.7 kg/m^2)

Armament

- **Guns:**
  - 1 x .303 in (7.7 mm) forward-firing Vickers machine gun with Constantinesco interrupter gear
  - 1 x .303 in (7.7 mm) Lewis gun on Foster mounting on upper wing
- **Bombs:**
  - 4x 25 lb (11 kg) Cooper bombs, two under each lower wing, to be dropped in 2, 3, 4, 1 order.

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

1. For an aeroplane in steady, level turn, what will happen to the centre of pressure if the stick is moved back?
   A. It will move backwards, along the chord line, towards the trailing edge.
   B. It will move forward, along the chord line, towards the leading edge.
   C. It will move spanwise, towards the tip of the higher wing.
   D. It will move spanwise, towards the tip of the lower wing.

2. Define the term **VEER**, as it refers to wind direction?
   A. To change directions in a random fashion.
   B. To maintain a constant wind direction.
   C. To change wind direction with the compass.
   D. To change wind direction against the compass.

3. Considering the diurnal variation in surface wind velocity in the Southern Hemisphere, what is the general change in wind velocity at dusk?
   A. The W/V will veer and decrease.
   B. The W/v will back and increase.
   C. The W/V will veer and increase.
   D. The W.V will back and decrease.

4. In most aeroplanes, reducing power during trimmed level flight will cause the nose to drop. Why?
   A. Reducing power reduces the thrust which reduces the drag and allows the nose to drop.
   B. Reducing power lowers the thrust line and pulls the nose down
   C. Reducing power reduces slipstream which reduces the effectiveness of the elevator allowing the nose to pitch down.
   D. Reducing power reduces the thrust force and the thrust/drag couple no longer balances the lift/weight couple allowing the nose to pitch down.

5. Define the term DEWPOINT.
   A. The temperature of descending precipitation.
   B. The theoretical temperature at which precipitation will begin
   C. The temperature at which a parcel of air reaches saturation and any further cooling will cause precipitation to commence.
   D. The temperature to which rain or snow will cool.

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. B is correct.
   With increasing angles of attack the centre of pressure on an unstalled wing will move forward, towards the leading edge And vice versa. AT the stall, the centre of pressure will move abruptly rearwards, towards the training edge which is why aircraft noses sag at the stall.

2. C is correct.
   VEER indicates a change in the direction from which the wind is blowing where the direction change is clockwise around the compass. For example. If a southerly wind veers, it will begin blowing from 200˚. The antonym for veer, is "BACK", and a backing wind from the south, would change and begin to blow from 160˚.

3. A is correct.
   At dusk, when the heating of the earth's surface decreases because of the lowering of the sun's angle, there is less thermal activity so a reduction in the surface wind speed because stronger winds aloft are not being drawn down and surface friction slows the speed. With a lowering of the surface wind speed, Coriolis force will reduce and thus the wind direction will veer. Note – the W/V usually veers and decreases at night compared to the daytime values.

4. D is correct.
   An aeroplane in steady level flight is in equilibrium where the lift/weight couple exactly balances the thrust/drag couple. Reducing the magnitude of the thrust vector by reducing power causes an imbalance between the two couples, and the lift/weight couple which naturally pulls the nose down will be more powerful. Reducing power in most aeroplanes will see the nose pitch down.

5. C is correct.
   The temperature at which a parcel of air reaches saturation and any further cooling will cause precipitation to commence. Note that dew is a form of precipitation as it is a precipitate from the air.

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

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Aircraft Books, Parts, and Tools etc.

Contact Rob-on mobile – 0400 89 3632

Tow Bars

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

Aircraft Magnetic Compass (Selling on behalf)

Item		Price
Wired for lighting • Top of panel mount, • Needs fluid replenished.		**Open to Offers**

Propeller Parts

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

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

Or email me at:

kni.rob@bigpond.com

Aircraft for Sale

Kitset - Build it Yourself

$1,780.00 neg

DESCRIPTION

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

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

Box sections and tubes

Flow Meter, Navman, Ballistic Chute, etc

A very comprehensive kit of materials

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

Or Mob: 0419 758 125

Ribs, tubes, spats, etc

Thruster T85 Single Seater for sale.

$9,750.00 NEG

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

The aircraft at Kentville

New Engine Rotax 503 Dual Ignition has only 10

Fuel tank

Instrument panel

Details

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

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

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

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

Offers considered. Call Tony on 0412 784 019

AIRCRAFT for Sale - LIGHTWING GA-55.

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 McDonald on 0419 607 637

Sky Dart Single Seat Ultralight for Sale.

$4,500.00 NEG

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

The landed Sky Dart III rolling through at YFRH Forest Hill

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

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

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

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

Single Seat T84 Thruster, disassembled and ready for rebuild.

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

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

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

And, most importantly – the aircraft logbook!

Asking price $5000.00

Contact John Innes on **0417 643 610**

Aircraft Engines for Sale

Continental O200 D1B aircraft engine

Currently inhibited but complete with all accessories including,

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

$POA

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

Phone John on 0417 643 610

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**

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