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RAA
RECREATIONAL AIRCRAFT ASSOCIATION
RÉSEAU AÉRONEFS AMATEUR CANADA

From The President's Desk

Gary Wolf RAA 7379

CONTRIBUTORS

I would like to thank Bill Bird, Chris Staines, Fred Grootarz, Barry Meek, and George Gregory for their contributions to this issue of your Recreational Flyer magazine. Congratulations to the members of Chapter 85 who have just completed and flown their Zenith Cruzer.

Canada has a broad aviation history that continues to this day, and putting your experience into words enriches all of us. This is an all-volunteer association and we depend on members for articles. Please send to either gregdesign@telus.net or garywolf@rogers.com

Canada has a broad aviation history that continues to this day, and putting your experience into words enriches all of us.

ADS-B in CANADA

The USA and Canada are both heading towards ADS-B, the Americans in 2020 and Canadians about 2023. The Americans have two frequencies, 1090 MHz for high airspace and 978 MHz for typical GA aircraft at lower altitudes. 1090 has narrow bandwidth so it can handle only positional information, while 978 has enough width to allow provision of very useful weather information, a sweetener to encourage American pilots to install ADS-B in their planes. Canada appears to be adamant that 1090 will be the sole system here and although it is initially in Class A and B airspace there is the likelihood that it will eventually find its way to Class C. An American amateur builder who does his own installation can buy 978 MHz equipment that will send and receive for a price in the range of $2-2.5K, less than half the price of the 1090 MHz installation we will be faced with here.

Once we have 1090 ADS-B here and in our Class C it will be interesting to see how Transport handles American GA aircraft that wish to use ADS-B airspace. Will Transport exempt Americans from the requirement or will they be willing to keep Americans out of our airspace? There is a parallel with the Basic Medical that is now available to American pilots. When an American files a flight plan into Canada no one is asking what medical he has, yet to use the same airspace Canadians are still required to have a real and verified medical. Transport appears to be turning a blind eye to this situation and there is the possibility that it will be the same for American GA aircraft with 978 ADS-B.

ALCOHOL AND CANNABIS

The pertinent reg reads:

602.03 No person shall act as a member of an aircraft•(a) within 12 hours after consuming an alcoholic beverage;•(b) while under the influence of alcohol; or•(c) while using any drug that impairs the person's faculties to the extent that the safety

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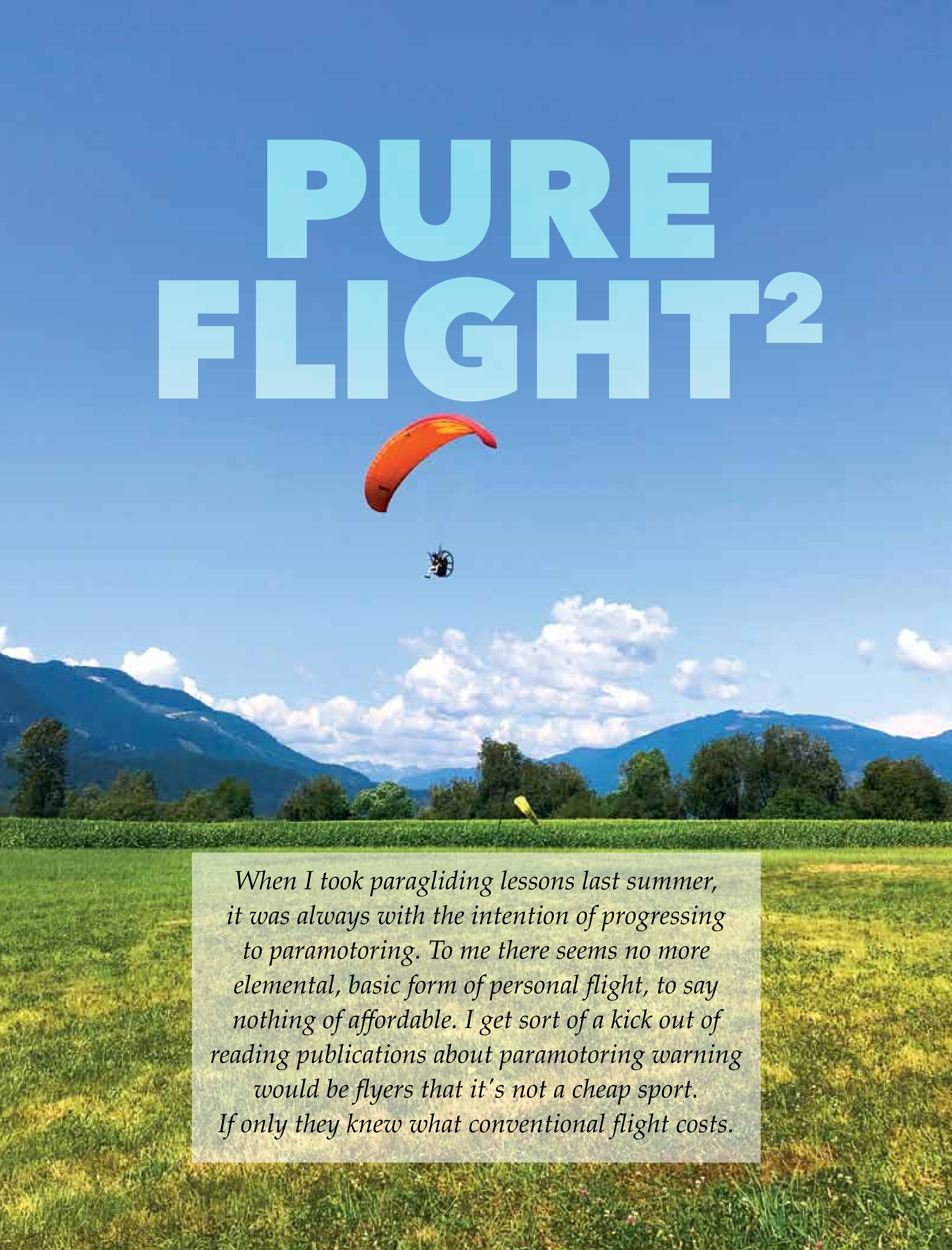
features

columns

George Gregory

Above: A Navion at Delta Heritage Airpark. George Gregory photo.
On the cover: Chapter 85's Cruzer.



PURE FLIGHT²

When I took paragliding lessons last summer, it was always with the intention of progressing to paramotoring. To me there seems no more elemental, basic form of personal flight, to say nothing of affordable. I get sort of a kick out of reading publications about paramotoring warning would be flyers that it's not a cheap sport. If only they knew what conventional flight costs.

Photo Credit: Parajet

AND SO IT WAS that I found myself again at Eagle Ranch on a lovely May afternoon. A mixup in emails found me arriving with the day half spent, but I was game to give it a try. After being out of the paragliding saddle since last summer, I was a little nervous about starting off with a flight off Mount Woodside, and we didn't start there. As a prospective paramotor pilot, we did a few winch tows, something I'd not done before, and done on level ground at the Ranch's LZ. A simple harness attached to the front of the paragliding harnass; the winch mounted on the back of a small SUV next to where the pilots would launch. The cable ran to the end of the field, was mounted on a pulley there, and returned back to the take-off spot, so pilots launch where the winch operator can observe their takeoff. The whole idea is to get the pilots used to the idea of thrust on level ground.

A few other pilots went up before I had my turn, and in a few seconds I found myself aloft, albeit for a few seconds. The wind-sock, in the middle of the field nearly skewered me before slipping underneath as I overcontrolled to the left, then to the right, and I overcontrolled that as well. The flight was mercifully cut short. Another attempt was made, somewhat more satisfactorily before heading up the mountain for a much more satisfying paraglide back to the field. I hope to finish up later this summer.

How expensive is it?

Brand new rigs, wing and motor combined, can be had for less

Photo Credit: Mike Fifield

Ambient winds have a lot more time to affect the wing in flight, having a much greater effect on glide angles and ground speed; and it's quite easy to encounter a wind that exceeds your forward speed.

than $10,000 CAD, with used equipment even cheaper. With "entry level" 4 place aircraft costing as much as a house, the cost of paramotoring is chump change.

Nor is the cost of training onerous. Lessons typically start with free flight lessons at $200 per day which includes gear rental, with the length of training dependent on aptitude. Paramotor lessons are $250 per day and generally take an additional 2-3 days to achieve the 30 flight requriement mandated by our friends at Transport Canada. FlyBC's web page states that costs to obtain a paramotor license are typically $1200-1500 CAD. Can you even buy a transponder for that much?

The idea of being able to take your aircraft home at the end of each flight, or to take it on holidays is pretty neat. It opens up the possibility of seeing a lot more world from the air, places that would cost a mint to fly to in a light aircraft. Anywhere a jet can take you or a car can drive, you can pack your wings and explore your destination from the air to your heart's content. Imagine an aircraft that costs a fraction of conventional aircraft, uses a fraction of the fuel, requiring far less maintenance, and with no tie-down fees. And it offers about the purest flying experience you could hope for. It is infinitely liberating, and give you the ability to fly whenever your desire coincides with agreeable weather.

Although one should be reasonably fit to pilot any sort of aircraft, those of us who are worried we don't have the stamina or leg strength to foot-launch can opt for three or four wheel carts to launch with; one company, Fresh Breeze of Germany, even sells a contraption called a Flyke: a pedal powered tricycle meant to be used with a paramotor so you can pedal to your launch point and then take the whole device aloft with you. A sort of pedal-powered roadable aircraft.

Where can I fly from?

That depends. Prospective site must be in legal airspace and match your skill. PPGs are not generally transponder equipped, but even if they were, airports with towers have bigger fish to fry than putting up with a bunch of ultra-slow ultralights.

Parks and schoolyards are generally a no-go. Private property is allowed if it's not in a built up area, but if you're flying off a farmer's field, permission is important.

Uncontrolled airports hold some promise, but care and consultaion with all the stakeholders is vital.

Paramotors fly patterns like any other aircraft, but the altitudes are different; typically 200-300 feet AGL. Cruising is usually 200 - 500 feet AGL, which is lower than conventional aircraft operate anyway - unless they are practicing forced or precautionary landings in a practice area or dusting crops. The usual rules about distances from people, buildings and equipment apply, and paramotors are not allowed to fly over cities or towns.

Characteristics

Paramotoring *is* fundamentally different from rigid winged aircraft. The whole set up is so much more... fluid. It's a whole new world, and in some senses my experience in fixed wing light aircraft creates barriers that other neophytes would not have to face. If you are a conventional pilot, there is a lot of skill that is decidedly not transferable, and a lot that has to be unlearned. Paramotoring is just as much aviation as any other sort of flying; it has its peculiar advantages and joys, and its own peculiar ways that it can kill you. It can be quite counterintuitive to conventional pilots, and it deserves respect.

First of all, you hang from a set of lines that must always be in tension; negative G's can throw you into your wing, wrap you up, and plummet you to the ground like a sack of wet sand. And even when safely on the ground, a puff of wind from the wrong direction can bring the whole assembly can settle on your head in a frustrating tangle of lines and fabric. You are far more at the mercy of breezes that would barely get the attention of someone taxiing around in a 2400 pound Cessna.

When typical airpeeds are around 20 kmh, you can imagine what a gust of similar velocity from behind can do to your prospects if you're close to the ground. With hundreds of square feet of wing area and a MTOW of a few hundred pounds, even relatively small gusts can be a very big deal, even when you're on the ground. And ambient winds have a lot more time to affect the wing in flight, having a much greater effect on glide angles and ground speed; and it's quite easy to encounter a wind that exceeds your forward speed. Rotor turbulence can cause collapses, and dust devils can be fatal. As a rule, you fly in benign weather. Mornings and evenings are best.

That said, once you know the rules and risks, the sport is pretty safe. You just don't go to the places you can get hurt. Much of the importance of proper training is to learn where the edges are and stay far away from them.

There is a decided lack of visual cues. There is no dashboard to reference the landing zone against. You are completely exposed.

The pendular nature of the aircraft creates situations that conventional pilots will have to adjust to. Sharp, short control inputs or the sudden application of power can create a swinging motion under the wing that must be accounted for.

Like paragliding, the super light wing loading and the pendular nature of the wing create situations that take some getting used to. But the most obvious difference is that you don't need a hill, and this creates a quantum leap in your freedom to fly. Paragliders, to have a flight of any length, need a hill or a winch to get up, and then thermals or slope lift to stay aloft. This limits them generally to hilly or mountainous regions.

Paramotors suffer no such limitation. Any flat field is a potential take off zone; you don't have to drive to hilly areas to enjoy your sport. And you are not as reliant on wind; even an otherwise perfect flying day can be ruined for a paraglider pilot if the direction of the wind relative to the hill he wants to take off of is not convenient.

You may not gobble up the miles

Photo Credit: Scout Paramotors

on a cross country flight, but you can drive it to anywhere your car can take you and explore new locales at heights (low) and speeds (really slow) that would not be advisable in a conventional aircraft.

Equipment

Obviously, a wing and a motor are essential. Kiting harnesses are helpful in learning how to handle the wing. For instrumentation, you can purchase an altimeter, a flight deck (a fabric pack that clips onto the front of your harnass and features velcro that you can attach instruments to); a GPS, Variometer, compass, and fuel gauge are all good things to have. But probably the first thing you will buy is a helmet with a radio. And helmet-mounted GoPro cameras are *de riguer* for pilots. It's cool, but you also get some amazing videos that you can share with friends and family.

Although you can use a paraglider wing with a motor, the optimal paramotor wing is a little different. To begin with, there are generally four sets of risers instead of three.

On gliding wings, the brakes stow on a set of snap clips; on paramotors there are usually magnest built into the risers.

A paramotor wing needs to account for the extra weight of the motor - typically between 50 and 65 lb, though hybrid wings (used for both purposes) tend to favour the smaller size that the pure glider would use for the simple reason that a larger wing used to paramotoring can give a lighter wing loading if you remove the motor for pure gliding. Too much wing can be dangerous.

The motor consists of the harness, frame, motor, a muffler of some sort, a gas tank cage, and propeller. The cage has netting on it to prevent objects from flying back into the prop disk; nevertheless some care must be taken to insure things (like throttle lines) don't find their way into it. A throttle cable runs forward from the motor, over the forearm and is held in the pilot's hand, which also holds one of the risers; the throttle itself is similar to the brake handle on a bicycle, with the addition of a kill switch located near your thumb position. Squeezing the handle increases power. Throttles often feature some sort of cruise control that allows the pilot to set the position of the throttle in flight so he doesn't always have to hold the throttle at a certain setting. They can be left or right handed depending on the unit. Some engines can be started in flight by pull or electrically, and it's best to never start the engine, even on the ground, without strapping it on first or at least making sure it's secure in case a throttle is stuck open. Those familiar with hand-propping conventional aircraft will appreciate the reason for this.

If you thought P-factor was an issue in your average Cessna, it takes on a whole new meaning with paramotors, mainly due to the fact that the unit and pilot are suspended beneath flexible risers. The torque of the motor can twist the pilot (and therefore his thrust line) relative to the wing's flight path, so special care must be taken concerning correct control inputs. Not a problem, but something to be aware of.

Most wings, whether for gliding or paramotoring, have reserve parachutes attached which are manually thown out of the bags, They must be repacked annually.

Handling the wing

When I first started training last summer, I was disappointed at how long we spent out in the field just practicing getting the wings off the ground and over our heads; the August winds were "switchy" and in the hot weather, wearing the full gliding harness, enduring one collapsed wing after another was an exercise in sweaty frustration. But learning to handle the wing in wind is an essential part of training, and I need to do a lot more of it.

In low winds, both paraglider and paramotor launches tend to be forward for the simple reason that you can't kite the wing if there's not enough wind to get it off the ground. If there is, a reverse launch is mandated: with your back to the wind, you kite the wing until it is overhead, then turn and begin your launch. I've found this awkward as I tend to get tangled as I try to turn around, but I'm just starting, and as paramotors tend to be flown in low wind conditions, perhaps not as pressing and issue for me. Regardless, experienced pilots make it look easy, and it's obvious that learning to kite properly is a big part of mastering the art of the reverse launch and the safe handling of the wing at any rate.

Turns are accomplished by weight shift and the use of the brake lines. Like conventional aircraft, power can be added to the paramotor to hold altitude in the turn.

Another peculiarity of paramotors is that since it's a pendular aircraft, sudden inputs can create oscillations. It's important to hold control inputs for at least 3 seconds to avoid this; sharp, short movements can create issues.

Landings are accomplished with a pull on the risers to flare the aircraft. You have to elevator to rotate for the flare; pulling on the risers increases the angle of attack like dropping the flaps.

One thing that has taken some getting used to is that if you use the brakes to adjust your descent, you may not have enough energy to flare. This has been more of an issue (at least for me) when gliding; a few times I felt I was too high and came on the brakes to steepen my descent. As a result, I had no energy left to flare with, and not a few of my landings were ignominious hands and knees affairs. S turns are a better way to adjust the glide path without losing too much airpseed.

So it's important to set yourself up. The pilot has to get out of the seat so your legs are free for running off the landing; kill the engine once you know you're going to make the field; and pull down the risers about a metre and a half off the ground for a nice flare.

One thing about having a motor is, of course, that you can reject the approach if you don't like it and do a go around. Again, the pendular nature of the aircraft requires some timing: throttle to half for 3 seconds - which will swing the pilot forward, then the smooth application to climb power. But once committed to the landing, the engine is usually shut down.

Regulations

In the United States, paramotors come under the Part 103 rules; you don't need a license to fly a paramotor and the sport is self-regulated. In Canada, the truth is a little more complex. Paragliding is self-regulated, but you need license to fly under power. Altlhough wonderfully inexpensive compared to owning a Cessna, paramotors are still considered an aircraft and must be registered as such, with an C-IXXX designation. You need a pilots' license, though there is a special rating for this class of ultralight.

You have to be 16 years old to hold a permit, and a Category 4 medical is necessary as well as 20 hours of ground school. Although there is such a thing as tandem paramotors flight training is solo from the get-go, as two place paramotors don't have dual controls(CAR 421.21) A "flight simulator" is simply a frame that a harness hangs from to allow the student to practice some of the movements needed. In flight, two way radios can keep the instructor and student in touch. You do need a student pilot permit to learn if you're not already a licensed pilot. The requirements are detailed in CAR421.19(2)*(d)*(i).

In Canada, 5 hours of flight and 30 take-offs and landings are the regulatory minimums for a pilot permit, though as with other kinds of flight training, it can take longer. The lisence obtained is an ultralight license with the qualifiction "parachutes only".

Those who already hold Recreational pilots' licenses or higher already have the right to act as PIC for a paramotor, but both Transport and common sense dictates some formal training. This really is a different kind of flying.

Glider, balloon and rotary pilots need to get the rating officially added to their license.

You do need liability insurance (not less than $100,000), and you must register a paramotor as an aircraft (CAR 606.02). You require the usual radio license if you are going to operate a 2 way aviation radio, though many pilots - especially during training use simple, store bought walkie talkies. See TP14453 for more information.

As I approach retirement, I wonder about flying on a fixed income. The relatively low cost of paramotoring, plus the purity of the experience continue to interest me. If you like open cockpit flying, this takes it to a whole new level: the wind, the smells and sensation of flight - it's real Peter Pan stuff. My hope at this point is to get a few flights under power, and see if I want to take this on as a per-manent supplement to my more conventional flying. My training has been regrettable on and off as work and life continue to interrupt. But we'll see. More, hopefully, in the next issue.

__George Gregory__ is the RAA's resident roadable aircraft nut, having caught the bug nearly 22 years ago. He holds private and commercial ratings, and is a former flight instructor. He is also the Recreational Flyer's Art Director. This puts him in the enviable position of being able to spout off about flying cars and alterative aviation whenever space allows.

President's Message / cont'd from page 10

of the aircraft or of the person on board the aircraft is endangered in any way.

Note that the former 8 hours from bottle to throttle has been increased to 12 hours. Further, although cannabis is now legal in Canada, an admission of its use will prevent a CAME from signing a medical. The decision must be made by Transport Canada's medical staff. Canadian medical certificate holders with a known diagnosis of substance abuse may be subject to no-notice drug and alcohol testing to ensure compliance with the abstinence provisions of their certificate.

DRONES

The terminology keeps changing but what we all recognize as a drone will now require a written test and a flight test for the pilot before being PIC of any drone over the weight of 250 grams. Drones must now be registered and carry registration marks. A drone over 250 grams is now an aircraft and must be operated only by a licensed pilot who is in compliance with airspace and flight regulations. Fines for an individual can range up to $3000, and for a corporation this can be $15,000. Google Transport Canada drone regulations for the full story.

Aireon

What pilots and builders need to know / by Chris Staines

For pilots around the world, the Aireon space-based aircraft surveillance system will have long term implications. If you are an amateur builder this article will attempt to illustrate how it will significantly change your equipment needs with respect to transponders and GPS receivers. The Aireon space based Automatic Dependent Surveillance-Broadcast (ADS-B) system is now in the early stages of operation with Aireon equipment on 75 Iridium satellites that have been recently been placed into orbit. Circling just under 500 miles above us, 66 are operational and 9 are kept as spares. Aireon is a Virginia, US based company with Nav Canada having the largest ownership share and 150 million dollars invested in this system. The UK, Italian, Irish and Danish air navigation authorities are currently also partners.

Iridium Satellite that carries the Aireon equipment

As most pilots are currently aware, the Federal Aviation Administration has mandated that aircraft flying in the United States must be ADS-B equipped by 2020 to fly in airspace that currently requires a mode C transponder. The aircraft must still retain the mode C capability. This requirement has been in place in some other countries for a while.

Until the arrival of Aireon, ADS-B used the position provided by an extremely reliable and accurate GPS receiver in an aircraft and relayed that information to a ground-based receiver via the aircraft's transponder, which then is used by the air traffic control system to essentially duplicate, but with much higher accuracy, the previously radar provided position information.

The Aireon satellite-based system replaces the ground-based receiver with one in a satellite almost 500 miles above the aircraft. The information from an aircraft is picked up by the satellite and relayed from the satellite to a ground-based receiver and then routed to the relevant country's air traffic control system. The obvious advantage is that the exact position of the aircraft is available beyond the reach of the limited number of ground-based radar systems, such as the vast areas of northern Canada or the heavily travelled north Atlantic Ocean airways, where the greater accuracy allows aircraft to be safely flown in closer proximity.

A typical Class 1 mode C transponder, which most general aviation aircraft have, has sufficient power to reach these orbiting satellites, however, the ADS-B system requires a type of transponder called mode S, which sends a small packet of information that includes the aircraft registration and, when connected to a relevant GPS source, position and velocity information.

The other problem with conventional mode C installations is that the antenna is on the bottom of the aircraft and the aluminum will 'shield' the signal and prevent it reaching the satellite. To get around this problem, a new type of mode S transponder was developed with a two antenna outputs, one for the bottom antenna and one for the top. These have what is called the 'diversity' option, which means they can alternately transmit to one of the two antennas. Why can't you just put an antenna 'splitter' in the single output and just feed the two antennas? Because the antennas are a distance apart, the signals are out of phase and as such will not be emitted or spread evenly.

With this understanding of the Aireon system we can explore our installation options, but these are unfortunately not that clear as neither Nav Canada or Transport Canada has given much guidance on when ADS-B, either ground or space based, might be required in Canada. If you plan to fly in the US, a Canadian pilot or builder has quite a complex decision process. It appears as though Canada, and the other countries that are Nav Canada's partners in Aireon, are taking a different route than that of the FAA ground-based system. While it is not yet very clear, we may have two ADS-B systems, with different transponder requirements, depending on which side of the border you are on, with a diversity transponder needed only in Canada.

At this point it is useful to exam-

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The Case of the Stolen *Sabre Jet*

Photo Credit: Airwolfhound

On the night of September 20, 1956, an F-86 Sabre Jet was cleared for a high-speed taxi test on the active runway at Williams Air Force base in Arizona. As it accelerated to take-off speed, the controller was surprised to see it lift off, then climb out into the moonlit night sky.

Tower: "Sabre 5039, state your intentions".

There was no response as the jet departed to the north-west. The controller tried again. Still, no reply. Whoever was flying had the full attention in the tower! After another unsuccessful attempt to raise the pilot, the controller contacted the supervisor, base commander and other bosses.

"You better get down here to the base. We've just lost an F-86. He's just departed and I can't raise him on the radio".

Within a very short time, the officer in charge, who was a Captain, burst into the tower. At about the same moment, the man piloting the jet finally came on the radio, calmly announced that he had taken off, and asked what they thought he should do. In the tower, the two men looked at each other in amazement. The captain spoke first. "Who is this guy?! What's going on?!"

"He's one of our maintenance guys," replied the controller.

"What the hell is he doing up there?!" said the Captain. "Why is he flying one of our Sabres?!"

The controller wished he could tell the captain to calm down, but apart from what he had already stated, he knew about as much as anyone else on the ground knew. A mechanic was supposed to run a high-speed taxi test on the jet, but he just flew away!

The captain turned his attention to the aircraft. "This is Captain Robert McCormick. I am the officer in charge. Who is the man flying the F-86 departing Williams (AFB)"?

The pilot then identified himself as George Johnson, a mechanic at the base. He quickly and calmly responded with a request for what he should do next. McCormick got his wits together and settled down, assuming the role of an instructor. From his own experience as a Sabre pilot, he directed Johnson to a level attitude at 10,000 feet, set the correct power level, and had him orbit about 10 miles out over the desert while they could work out a plan to get him back on the ground.

New Sabre pilots trained for at least a year, spending several hundred hours in the classroom, then logging dual and solo flight time with instructors. After that came 15 hours in a cockpit simulator. During the student's first flight in the single-seat fighter, an instructor flew on his wing, teaching via radio.

And then there was Airman First Class George R. Johnson, a 20-year-old mechanic who skipped those preliminary details. His actual flight time was only about two hours in a Piper Cub. On the night of his first (and only) Sabre flight, he was working on the F-86F, number 52-5039. After the engine check, Johnson called for permission to use the runway for a high-speed taxi test—a common procedure after any work on the brakes or nosewheel. The mechanics tested systems on the ground, and the pilots flew the next day to certify the aircraft.

At about the same moment, the man piloting the jet finally came on the radio, calmly announced that he had taken off, and asked what they thought he should do.

In Johnson's own words: "I knew that airplane," he said, "and I knew the numbers on various approach speeds because I knew the pilot's handbook. I knew that intimately. I had spent a lot of time studying that. I was as prepared as you could be without actually flying."

He had not intended to actually fly the Sabre that night. "It was just a high-speed taxi," Johnson recalled. "As I approached 105, I could feel the nose getting light, and I thought I would just wait a few more seconds to see if I could feel the plane getting light on the main gear. The few seconds passed, but then there wasn't enough room to stop. At that point, I was thinking about maintaining climb airspeed, and when I was in a definite climb, I retracted the landing gear. I was off and committed."

Though Johnson wasn't worried, the men on the ground were. For one thing, Johnson had no parachute. His only hope, base officials felt, was to make a survivable landing with their help. In short order, a Sabre check pilot and a maintenance supervisor, who was also a pilot, were rousted from their beds and assigned to fly two more jets up to meet Johnson and attempt to coach him to a safe landing.

The F-86F is very stable in smooth air and that night was perfect. The two experienced pilots knew that if they could get Johnson in a controlled descent of about 500 feet per minute at 140 knots, keep him lined up with the runway, there was a chance he might survive. They coached him to just relax when the aircraft smacked the runway and keep it straight.

In Johnson's words: "On their instructions, I had extended the speed brakes and landing gear, and put the wing flaps down.They had me back off the throttle at just the right time, and I touched down very smoothly, right on the runway centerline. I saw both of them accelerate and begin climbing away. One of them said 'Good boy' as I touched down."

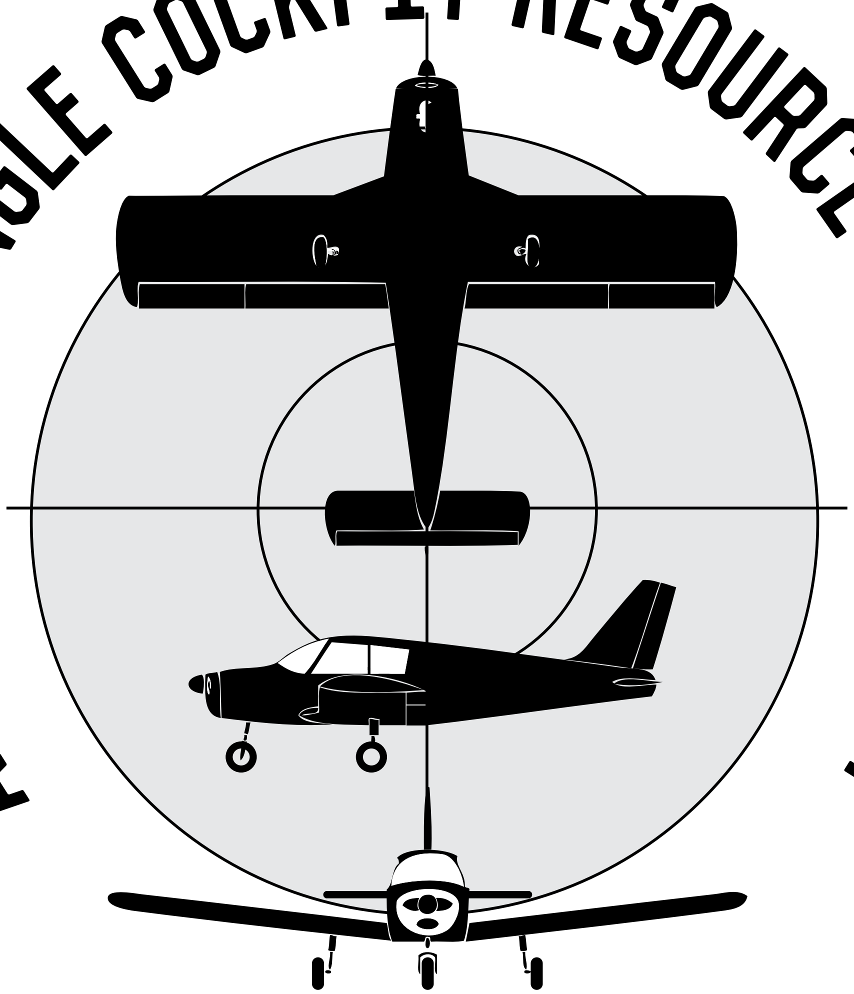
Even though he had come in faster than normal touchdown speed, Johnson had lots of experience in braking and steering the aircraft. He let the Sabre roll the length of the runway where it was brought to a stop by a cable barrier.

George Johnson had flown an F-86 for one hour and two minutes. The next morning, the base commander, came in and opened the conversation with "Well, what do we do now?" A court-martial was inevitable. The mechanic faced three charges: stealing an F-86F (valued at $217,427), causing $195.64 worth of damage to the aircraft when he hit the barrier upon landing, and flying the aircraft without proper flight orders or clearance. Ultimately, the court agreed that Johnson had not intended to steal the Sabre. He was allowed to plead guilty to a lesser charge: "wrongful appropriation". He was found guilty on the second charge of damaging the aircraft but was acquitted on the third (flying without orders or clearance) on the grounds that the regulation applied only to Air Force pilots. The trial lasted just one day. His sentence was six months in jail. He was out in five on good behavior.

The Air Force put Johnson back to work in a different maintenance squadron, and at a desk, rather than on the flightline. Four years later he was transferred to Okinawa. Following his overseas tour he was released from active duty. Johnson went on to work in the computer industry and eventually earned his pilot's license and flew cropdusters. He did not consider his Sabrejet flight a big event in his life. He has admitted, "It was kind of a dumb thing to do, but I got away with it."

***Barry Meek** is a commercial pilot who flies summer contracts for various operators in western Canada. He is a retired ambulance paramedic, mountain bike guide and broadcaster. His articles have appeared in the COPA Flight, The Aviation News Journal and the Recreational Flyer. He now resides in Vernon, B.C. and in Lake Havasu City, Arizona.*

A TALE OF SINGLE COCKPIT RESOURCE MANAGEMENT



Some people think SRM is only for airline crews or the military. But there's a lot of ways Single Cockpit Resource Managment can apply to a typical weekend pilot - even flying VFR on a Private Pilot license / by Fred Grootarz

MOST SINGLE ENGINE VFR private pilots don't pay much attention to Single Cockpit Resource Management (SRM). They generally believe that SRM (at best) is something commercial IFR pilots should be concerned about. Here is a story to demonstrate that SRM also applies to the average private VFR flying pilot.

As on most Saturdays, some of the flying buddies gather at their home base airport Burlington (CZBA) on a nice summer day morning. After a coffee and chat they decide on where to fly to that day. The weather is nice and clear in Southern Ontario and perfect for VFR flying.

Today they decide to first fly over to the nearby grass strip in Flamboro (CFC8) for breakfast and then continue on to Tillsonburg (CYTB) for lunch. After lunch they want to head straight back to Burlington (CZBA). The weather is perfect for VFR flying and the winds are calm. Since there are three airplanes going together on the trip, which all of them have done many times before, none of the three pilots see the need to file a flight plan or talk to FSS for a formal weather briefing. And, because the three pilots are flying together, they feel that there is no need to call a third party responsible person to leave a flight itinerary.

After the approx. 30 min stay in Flamboro, they are continuing their flights to Tillsonburg. The Cherokee is the last one to depart Flamboro. The pilot keeps the airplane moving for the rolling start on the grass runway. Just about at the rotation point he noticed that the door was not locked properly. Because it was a warm day, the pilot had left if a crack open during the taxi roll, so some outside air from the prop wash would blow inside to make things more comfortable inside the aluminum airplane.

He had been distracted by the taxi roll movement and was focused on the takeoff roll with one notch flaps to clear the industrial buildings on the extended path of runway Centre line. The pilot did take off with the door unlocked and knew that it was difficult and very distracting to try to close the door properly during flight when flying alone in the airplane. So he decided to continue flying like this and planned to briefly land at Brantford (CYFD), close it properly and continue on to Tillsonburg. He radioed his friend flying ahead about the very brief stop in Brantford, and that he would catch up with him in Tillsonburg.

He landed in Brantford on 23 and stopped right after the hold line at the first exit to close the door properly, turned around and took off again on 23 in less than two minutes and landed safely in Tillsonburg just behind his friend.

After a nice lunch and some chatting outside on the deck, he refueled and they all took off again for a direct flight home to Burlington.

Everything seemed to be OK during the flight, except that about 10 nm out, the pilot noticed that communication with ATC (Flight Following) gradually experienced intermittent radio cut outs, followed by finally turning black all together. Also, at this point he realized that talking on the radio was not answered by ATC, and a complete radio failure had occurred, caused by a dead battery and a nonfunctioning alternator. That's when the pilot realized he suddenly was flying 100% NORDO.

By this time he was 4 nm out and just about over the local gravel pit, which was the unofficial reporting point for the local pilots. It also was the usual gathering point where incoming aircraft from other directions would converge, like from the Burlington Skyway Bridge and from the practice area and line up for the approach to Burlington. Fully realizing that he was totally NORDO, this was the time when he really kept his eyes outside, scanning for other possible aircraft in the vicinity on the way to Burlington.

He did have a handheld radio in his flight bag on the back seat, but figured that it would take too long to take out, connect the adaptor cable to it, and then plug it into the earphone jacks. After all, he had the airport in sight and was about to fly over mid field for the turn to enter the left downwind for 14. He figured that looking out the window and safely maneuvering into the circuit for landing was more important than to take the time to set up the handheld radio at this time. Furthermore when first realizing that the radios were dead, he was at a point just descending below the 2500 ft ring of the Toronto class C controlled airspace. Burlington is an uncontrolled airport and it is not unusual to encounter a true NORDO aircraft in the circuit now and then. He did see one airplane departing while flying overhead the field, and nobody on crosswind or on the downwind. Therefore it was safe to cross the field at circuit altitude and join the left downwind for 14. So far so good.

While on base the pilot did see an inbound airplane on the horizon approaching from the southwest in between the gap of the escarpment. Some pilots prefer this approach to avoid the often busy gravel pit. He assumed that this airplane would also approach the crossing of the midfield to basically then follow the standard circuit pattern via the left downwind for 14.

Then, while already established on final, the pilot looked once more to his right and saw how this airplane just descended below the escarpment ridge in a path that looked aligned for landing on runway 09, and not to overfly midfield as he thought that airplane would have done in the first place. He immediately realized, that if he would continue to land on 14, and the other airplane on 09, they would likely have met simultaneously at the intersection of the two runways; a collision on the runway on a clear day! So the first pilot immediately changed into the overshoot mode for a go around while the other airplane landed on 09 without incident. Because of this situation, the pilot's eyes were really outside the window during the overshoot looking for any other traffic, especially since he couldn't hear any radio communication from any other aircraft in the area. The go around and subsequent landing on 14 was uneventful, and he taxied to his hangar and called it a day. Two days later a new alternator was installed, the battery was fully recharged, and everything was back to normal for the next flight.

He immediately realized that if he would continue to land on 14, and the other airplane on 09, they would likely have met simultaneously at the intersection of the two runways; a collision on the runway on a clear day!

By now you may have guessed it: I was that Cherokee pilot with the radio failure. Later that day, some scary thoughts and conclusions crossed my mind.

I was flying a certified aircraft with two radios on board. This means in reality that any other airplane seeing me in the air or being in the vicinity would normally assume that I had a functioning radio and therefore would be able to hear radio calls and be able to make radio calls as well. Other pilots would expect the proper reaction to their radio communications. Pilots would not expect that a certified airplane like my Piper would not have a functioning radio and fly NORDO instead.

This could have led to serious misinterpretations and created a dangerous situations in the circuit and approaches, especially at an uncontrolled airport.

I am sure the other inbound airplane (it looked like another low wing airplane) did make its proper calls during the approach and would also have broadcast its intention to land on 09 instead on 14, which I would have heard and which would have given me the opportunity to react to it. Conversely the other pilot would also have heard my radio calls overhead the field and while in the circuit to land.

With regards to SRM, this story has a ton of things to learn from:

No proper weather check was done before flight.

No check for possible Notams or other restrictions.

Since no formal flight plan was filed, no flight itinerary was left with a third responsible party. Only the other two pilots knew about the flight.

Because of the rolling start on the grass runway in Flamboro, the just before takeoff check list should have been carried out with running engine before starting the taxi roll.

Attempting to close the door in flight would have been a serious distraction to the pilot and could have resulted in temporary loss of control of flight.

My instrument check(s) and scan on the return flight did not include the small gauge providing the electrical info which would have alerted me to low voltage and the alternator failure. The little gauge did have a small amber light on, indicating the trouble I was facing. Ergo: check the voltage meter gauge at the same time you check oil pressure and fuel gauges and suction gauge.

By descending into Burlington, which is below the Toronto class C airspace, my communication was just about ending with ATC on flight following when I first noticed the communication problems. Had my flight route continued along the shore line through class C past Toronto Island, I certainly would have plugged in my handheld radio to effectively communicate with ATC.

Flying unexpected NORDO in a certified airplane, especially in the circuit can have dangerous consequences. The pilot must be aware of this and thus be extra vigilant during such flight.

Looking out the window to the right for the position of the other incoming aircraft, while being on final, confirms vital visual awareness is required, especially when flying NORDO unexpected.

The last minute decision for me to overshoot and perform a go around was the only safe alternative to do under the circumstances.

My point is that SRM is not only restricted to decision making by commercial pilots, but also applies to every day VFR pilots for plenty of smaller ones which can easily escalate into larger issues if not dealt with properly (and promptly). Therefore SRM has its place in any cockpit at any time. Situational Awareness is the key to SRM. Don't ignore it. Remember: Flying is a Discipline, Safety is an Attitude.

Fly Safely!

Right: ForeFlight Map of Flight Route CZBA (Burlington) / CFC8 (Flamboro) / CYFD (Brantford / CTSB (Tillsonburg)

***Fred Grootarz** is the president of RAA Chapter 41 based in Brampton Airport. Fred does an annual tour of Ontario chapters to present Transport Canada approved recurrency seminars for RAA members.*

Fuel Consumption Insights in Light Aircraft

Chris Staines

IT IS NO SECRET that the annual hours for privately owned aircraft have declined over the last few decades. While many costs of ownership are fixed, fuel is one that is directly correlated to hours flown and this specification is one that prospective owners peruse carefully when they considering purchasing an aircraft, either amateur built or certified. The Pilot Operating Handbook of certified designs meets certain standards of accuracy regarding fuel consumption, but there is no such requirement for experimental category aircraft, and some claims require careful scrutiny.

I applied such a degree of scrutiny when reading a well-known aviation publication's description of a beautifully completed project and the claimed specifications. I had no doubt the speeds quoted were quite attainable but the stated fuel consumption of 12.2 US gallons per hour at 75% power in a 300 horsepower IO 540 Lycoming engine I knew to be thermodynamically impossible.

The engines we use to propel us are more scientifically known as heat engines. They consume fuel and a percentage of that fuel or chemical energy is converted into rotary motion. Depending on the design of the engine, only a fraction of the available energy in the fuel is available to propel our aircraft. For every horsepower of output, the engine consumes a certain amount of fuel per hour and this is known as the specific fuel consumption. Typical gasoline powered aircraft piston engines vary between a specific fuel consumption of 0.38 pounds of fuel per hour for the very efficient newly designed Rotax 912iS injected engine to around 0.45 for injected legacy Lycoming and Continental and carbureted Rotax engines. Some of the carbureted Lycoming and Continental engines are in the area of 0.5 pounds of fuel per hour per horsepower developed. There is no easy way to greatly improve the fuel efficiency of these legacy engines but paradoxically there are ways to get more miles to each gallon by changing how we fly.

As mentioned, the specific fuel consumption attained in injected Lycoming and Continental engines might be as little as 0.45 pounds of fuel per horsepower per hour when correctly leaned and maintained. At 75% power or 225 horsepower, the actual fuel consumption would therefore be slightly less than 17 gallons per hour. The implied range to dry tanks from the article was around 1000 statue miles at the stated speed and fuel burn at 8000 feet with the 52 US gallon capacity. The actual range at that speed would be in the area of 700 miles with no reserve.

My thoughts then turned to wondering what speed would allow me to travel 1000 miles on that same 52 gallons with perhaps a more realistic ½ hour reserve, knowing that drag and therefore fuel consumption roughly vary with the square of the speed of the aircraft. With this simple assumption, about 200 miles per hour would require 5 hours or 5 ½ with a minimal reserve. This 17% percent reduction in speed should reduce the drag, and by extension the horsepower and fuel burn by about 37%. This equates to around 140 horsepower and about 11 US gallons per hour. This speed makes the nonstop trip possible. These numbers are only an approximation and would need to be verified by careful flight testing, but they illustrate the range increase possible with only a modest reduction in airspeed. The time and 20 gallons of fuel saved by this lower speed would most likely result in a total journey time near the higher airspeed flight that would require a fuel stop.

This leads to another thought on flying fast. As noted above there is a relationship between fuel consumption and roughly the square of the indicated airspeed. With a normally aspirated engine under standard conditions maximum speed usually occurs at sea level with the engine developing full rated power. The output of a normally aspirated engine decreases by about 3% per thousand feet of altitude. The true airspeed increases by about 2% per thousand feet versus the indicated airspeed in a standard atmosphere.

At 8000 feet the engine in our standard atmosphere is producing about 75% of the maximum sea level output with a wide open throttle. The indicated airspeed lost is offset to some extent by the true airspeed increase versus the indicated. The actual speed seen at 75% power output will depend on the engine, propeller and airframe characteristics but at 8000 feet with a wide open throttle the true airspeed may not be not much less than the full power sea level speed. The fuel saving at this higher altitude will be in the area of about 25% less, with only a minor speed penalty. You may again have the option of avoiding a fuel stop by flying higher on a longer journey.

Returning to our original desire to go 1000 miles at 240 mph what would this require? The obvious option is a bigger fuel tank. 17 gallons for four hours plus a reserve would be almost 80 gallons. There is however another option. Attaining a true airspeed of 240mph at a higher altitude, say 15,000 feet requires an indicated airspeed of around 175 mph. The horsepower required to produce this airspeed would require a fuel burn of approximately 10 gallons per hour, giving 4 hours plus the fuel required for climbing and a reserve. While there is a fuel penalty with the long climb and the need for pilot oxygen, this might prove to be an option. As mentioned before, *There is no easy way to greatly improve the fuel efficiency of these legacy engines but paradoxically there are ways to get more miles to each gallon by changing how we fly.*

test flights would be needed to verify the theory.

Some rules of thumb for Lycoming and Continental injected engines:

Properly leaned out, the approximate horsepower produced is the fuel consumption in US gallons per hour times 13.

A 10% increase in indicated airspeed, while at the same altitude, increases the fuel consumption by just over 20%

Though the specific advantage varies with the airframe and normally aspirated engine and propeller combination, increasing your altitude will decrease the fuel consumption at a specific true airspeed, increasing the range on a longer flight and saving fuel for only a small trip time penalty.

As an example, the following numbers are derived from the 1965 Cessna 182 Pilot operating handbook and assume a 60 gallon tank and no reserve. Distances covered includes the time and fuel used in climbs.

At 2,500 feet, at 158 KTAS, the range would be 670 miles, covered in 4.2 hours

At 15,000 feet, at 150 KTAS, the range would increase to 865 miles, covered in 5.8 hours

The extra 195 miles represents a 29% increase in range for a loss of 8 knots over the trip length, and requires a climb to 15,000 feet. The oxygen needed for the pilot is considerably cheaper than Avgas on a per hour basis.

Fuel costs have increased significantly over the years and many aviators fly less for this reason. With a little planning on longer trips significant fuel and money can be saved. The GPS and fuel flow data available on many new amateur constructed aircraft would enable the development of a website by amateur built aircraft pilots that might provide the data sorely missing in the experimental arena and thereby give more accurate information to prospective owners. R

***Chris Staines** and his family have a three generation interest in aviation technology. His father was a mechanical engineer in early gas turbine design, and his son has a Masters in Aerospace engineering and works as a test pilot in the US. Chris has owned a sailplane and a Mooney, both very efficient airframes, and eighteen years ago he built the Rotax 914-powered Europa that he currently flies. At present he is building a Pereira GP-4 which he hopes will be even more efficient than his Europa which burns 5.5 US gph at 140 Knots.*

Aireon | continued from page 11

ine the Nav Canada-Aireon relationship to see if we might divine where Canada is heading. Marc Courtois is the chairman of both the Nav Canada and Aireon boards and has a long background in finance. In examining the boards of both organizations, the absence of representation from general aviation organizations is noticeable. Aireon owes a considerable amount of money to the Iridium Company, on whose satellites Aireon's equipment is riding. The Iridium Next satellite launches were heavily financed by Aireon, which in turn relies on the usage fees paid by Nav Canada and other countries for income. It would be fair to say that the Iridium organization would be delighted if more countries switched to their space-based surveillance system. One selling point would be the costs of doing so would be offset by shutting down the ground-based radar systems.

I think most Canadian pilots were offended when the threatened privatization of navigation services in the US caused opponents of this action to make unflattering remarks about Nav Canada. While Nav Canada has centralized services and reduced costs, they have invested heavily in equipment and training. I have generally found Nav Canada personnel to be exceptional and very focused on safety, which is Nav Canada's primary mission statement focus. The other Nav Canada focusses are on keeping costs low and improving operational efficiency by utilizing 'innovative technology and the effective delivery of service', a quote from their website. This might explain the Aireon investment.

Mr. Marc Courtois has an exemplary record of supporting charitable organizations. One would hope the boards of these two organizations recognizes that approximately 85% of Canadian aircraft are privately owned and that these aircraft are paid for with limited after-tax dollars. The costs associated with the avionics upgrades to meet a satellite-based surveillance system effectively mean that many of these aircraft might be deregistered or sold into the US. Canada would be poorer in many ways for this loss.

Looking at all these factors, and in light of the current silence from Nav Canada and Transport Canada, it seems very plausible that the Aireon system will be introduced in stages into our low altitude general aviation world as ground-based radar installations are shutdown. It is already a requirement in the far north and at higher altitudes. It is interesting to note that while the FAA plans to retain a skeletal system of VORs as a GPS backup, Nav Canada plans to remove all VORs in Canada and move entirely to GPS as a sole source for navigation.

So, let us now look at two scenarios for installation options.

In the first case we have a certified aircraft that will be flying to the US in 2020 and beyond. The quick and easy solution is a US compliant ADS-B installation which is essentially set up for a ground-based surveillance system. I would be very careful when purchasing equipment with the sole thought of meeting the US ADS-B mandate as some equipment, such as the uAvionix skyBeacon, utilizes a UAT transmitter operating on 978

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Home Stretch

Chapter 85's Cruzer Completed

Bill Bird

WITH THE CRUZER BEING substantially completed at the end of October 2018, the RAA Chapter 85 group building the aircraft focused their weekly work sessions on the testing and detailing required to prepare the project for the final MD-RA inspection.

November 2018 will be remembered as the month of measuring fuel. Fuel tank unusable fuel amounts, fuel tank fuel levels and fuel flow rates all needed to be recorded and judged to be suitable. On a cold day, the Cruzer was moved outdoors and the fuel testing began.

The tank drains were removed and all fuel in the aircraft was drained. Then fuel was added to a tank until flow appeared at the carburetor. This was checked with the aircraft sitting level as well as with the nose raised to what we'd determined was the greatest nose up angle we thought could be encountered during normal flight. From this test, it was

Feature

Eric Klassen uses a precision compass to help guide the alignment of the Cruzer during the compass swing checking and recording. Below, Recording levels as each fuel tank is slowly filled.

confirmed that minimum useable fuel should be calculated when the nose was raised.

Then various fuel flow tests were carried out. With the nose of the aircraft elevated, fuel again was drained at the gascolator and at the carburetor to establish the point of no flow of any fuel in the tanks. While doing this, it was determined that there was good flow from the tanks to the gascolator so any major restriction in the flow was downstream from that location. Then fuel was added to the tanks in increasing amounts and then flow rate was timed and measured at the carburetor. Peter Lenger recorded the results and as it was a true group project, we did a good Keystone Cops imitation of climbing up and down ladders, pouring fuel between various sized fuel containers, looking at stop watches, and turning selectors on and off while simultaneously shouting conflicting information at Peter while using a mix of measurement units including gallons, litres, fluid ounces and millilitres. Peter seemed to keep it all straight.

In the end, it was determined that when the aircraft was nose up and a sufficient amount of fuel was added to a tank, fuel flow stabilized at a rate above 100% of what would be needed at maximum engine power, but didn't reach the 150% of max required. Adding additional fuel to the tank didn't substantially increase flow rate. When the fuel pump was used, fuel flow was well above the 150%. Results from left and right hand tanks were similar.

This was a dilemma, for as best as we could understand, the static 150% flow rate was a requirement for the aircraft. What followed was a few weeks of testing to determine ways to achieve this flow rate and this involved much e-mail discussion between club members as to the pros and cons of various possible solutions. What was found was that the size of the fuel pump inlet and outlet was the source of the flow restriction. Eventually, it was decided that the most direct solution was to remove the fuel pump from the system. Testing had shown that with the fuel pump bypassed and with the nose raised and at low wing tank fuel levels, we did have more than the 150% flow requirement at the carburetor. This was designed to be a gravity fuel feed system after all. Knowing that thousands of high wing Cessna's powered by Continental O-200 engines have flown successfully without any fuel pump in the system we reluctantly went to a pump free design and the fuel pump was completely removed (however, all of the wiring for the pump was left in place in order to easily allow re-installation of a better pump at some future time if need be).

Once all of the fittings, hoses, etc. for the fuel system revision were sourced and installed, the builders group spent more cold days outside checking and double checking the unusable fuel amount for each tank (because of a slight difference between the tanks and also because an accurate weight was needed for final weight and balance numbers). Then each wing tank was slowly filled and levels recorded to provide the data needed to determine total useable fuel. Based on theses measures, a fuel level dip stick for the tanks was fabricated.

While this was going on, Eric Munzer and Cyril Henderson did an engine run to confirm that the engine continued to show good oil pressure.

Radio checks were performed which showed that the radio installation needed further work and a quick taxi took place (the first time the aircraft had moved under its own power!). Sebastien Seykora worked at installing the probes need for the engine monitor and was often present to check that the Dynon Skyview was operating properly and that its software was up to date. In the course of these checks, it was found that the wing tank fuel senders weren't communicating with the Dynon. After some hours of investigation, it was determined that further wiring work was required to finish the installation (remediation work completed by Eric Munzer). Sebastien then completed the Dynon fuel gauge calibration.

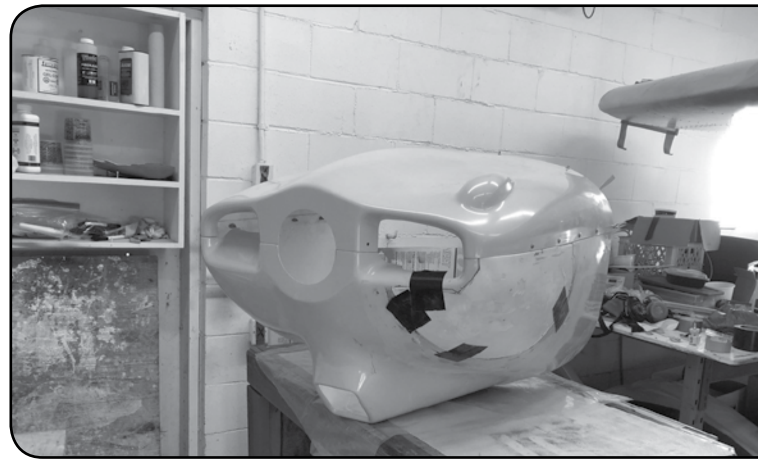
By now, mid December had arrived. It was felt that the aircraft was getting close to being ready for final inspection. There remained a few other details to complete and the entire aircraft needed a careful going over, so it was decided to temporarily move the Cruzer back into the RAA maintenance hangar.

From then until February, the group worked on the last items. One of the radio problems appeared to be caused by the panel opening for the radio being slightly too small causing the radio to not fully slide back and properly engage the antenna connection on the mounting tray. Eric Munzer spent some time filing and refitting which solved the radio connection issues. The engine primer wasn't working properly so Cyril spent some time repairing this and improving other engine plumbing. Peter Lenger did checking and detailing work including the shimming and trimming needed to make the doors seal better. Tim Saxton was sometimes present and provided advice and an extra set of hands. Sebastien generated operational check lists and provided training on how to use the Dynon. Peter Whittaker worked on assembling all of the paper work which was needed to be in place prior to final inspec-

tion. Mark Garner installed placards. Small details such as final attachment of brake lines to the main landing gear, ordering additional camloc studs, and polishing out blemishes on the cockpit plexiglass were attended to. Peter Murphy was now working on his own C-150 restoration project in the maintenance hangar, but was always willing to help or lend tools when asked.

It was found that the lower cowl was rubbing on the left front cylinder valve cover. Shawn Connelly took on the responsibility of modifying the cowl to provide extra clearance. I assisted. The cowl was built out, a fibreglass mold was made and a new fibreglass piece was cast to be added to the existing cowl. It seemed bold to cut a big hole in our expensive cowl, but in the end, the cowl reshaping and refinishing was successful. By the time we completed the work, Shawn and I had learned enough about fibreglassing that our next time at it would go much smoother.

By early February, Peter Whittaker was comfortable enough with the state of the project that he scheduled an end of February date for the final inspection. One of the last items required was to perform a compass swing on the aircraft. However, winter had decided to arrive at the airpark. So on a cold day, a path had to be shovelled out through the snow and onto the apron so that the aircraft could be positioned away from metal objects or electrical interference. We had been loaned a hand held precision compass to determine compass heading bearings. The warm hangar was abandoned and the aircraft was pushed into place. The aircraft was swung until the precision compass indicated that the nose of the plane was pointing to magnetic north. (The compass apps in our smart phones also agreed with the directions indicated by the precision compass and were used as a confirming backup). We discussed a safety plan, with Eric Munzer operating the aircraft and checking the Dynon compass indications, John Macready was in the passenger seat to record the aircraft magnetic compass readings, Peter Lenger listening with a hand held radio, Eric Klassen directing the alignment of the aircraft using the precision compass, and the remainder of us swung the aircraft around as directed by Eric Klassen's hand signals while



Top: After using the mould to form the piece to be added to the cowl, Bill Bird uses the oscillating cutter to trim the piece to size. Centre: Trial fitting the cowl sections before fibreglassing the new piece in place. Bottom: Making the mould to form the piece to be used to re-shape a portion of the lower engine cowl. Shawn Connelly mixing fibreglass resin.

Update: The Cruzer Flies!

The RAA Chapter 85 Zenith 750 Cruzer completed a successful test flight May 13 out of the Delta Heritage Air Park. Once insurance for the aircraft was confirmed as being in place, Sebastien was able to confirm that he felt today was suitable for an attempt at a flight. Sebastien was at the field a little bit after 10 am this morning and a number of the members who had been involved as volunteer builders also arrived to assist.

Sebastien updated the software for the Dynon Skyview and then several hours were spent examining the aircraft and also correcting some small problems. This included Cyril and Peter Lenger making a quick flight to Pitt Meadows Airport to pick up some needed items.

By mid afternoon, Sebastien was satisfied that a flight could be attempt. After an aborted first attempt to investigate a radio issue, Sebastien lined up and was in the air just after 3 pm. Some photos will be included below and a link to a YouTube video of the the in cockpit portion of the flight can be viewed at: https://youtu.be/KGmXHuN8pSs

The flight turned up a few items which will need to be addressed before the next flight. As can be seen on the video, Boundary Bay tower was having difficulty picking up the Cruzer's transponder and engine temps were high which will require checking and improving engine baffling and air flow. Sebastien reported that the aircraft flew well and no things like oil leaks were in evidence post flight.

Overall, it was a very successful first flight. The members who were the volunteer builders and who put in hundreds of hours of work over the last three and a half years are to be congratulated. Thanks also to Sebastien Sekora for managing all the issues leading up to the test program and then performing the first flight. Thanks also to Micheal Heintz and Zenair Canada for the attention which they have given to the Chapter and project. Look for a detailed writeup next issue!

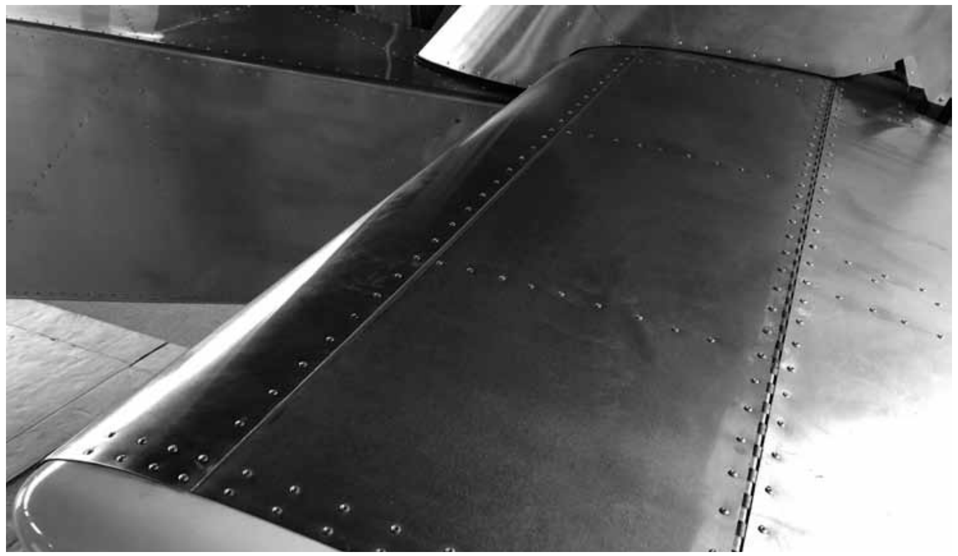
being mindful to remain clear of the aircraft propeller.

As expected, this was an odd activity. The Dynon uses GPS and if set up properly, would have no deviation. However, regulations require the check so when ready, Eric started the aircraft (confirmed that it was making oil pressure), checked the Dynon compass and set the whiskey compass to north. The group then swung the aircraft to east, south, and west, with Eric checking the Dynon and John recording whiskey compass readings. When the Dynon readings were confirmed as accurate, the aircraft was re-swung through 30 degree intervals and the whiskey compass deviations recorded at each heading. Meanwhile, the spinning propeller was somehow avoided by all.

During the cold days, another project was also completed. It had been noticed that the large tires on the Zenith combined with the slight upslope of the entrance to the RAA main hangar meant that it would be extremely difficult for one person to push the aircraft back into the hangar. Eric Klassen and Peter Lenger spent some time designing and mounting an electric winch to the hangar wall which can be used by one person to pull the aircraft into position.

As test flying time seemed to be approaching, Sebastien was authorized by the group to be the person in charge of arranging and managing the test flight program. Sebastien began the necessary planning.

February 23, 2019 was the day set for the aircraft final inspection. Jim Asprey from MD-RA arrived in the morning and first went through the assembled paperwork with Peter Whittaker to see that everything required was on hand and completed prior to moving on to looking at the actual aircraft. Jim then spent a couple hours looking at and into all of the corners of the airplane and developing a snag list of items he wanted improved or corrected. Once he had listed an item on his inspection form, the build crew present could immediately start working on rectifying the problem. When the correction work was completed, Jim would check and if satisfied, would have the people who did the work make a signed entry on the



The builders checking and draining fuel from the gasolator on the Zenith 750 Cruzer. Eric Munser and John MaCready look on to help. Opposite: top, Eric Klassen and Peter Murphy checking the size and fit of a newly made doubler skin. Opposite below, the doubler skins installed on the leading edge of the Cruzer horizontal stabilizer as well as other riveting strengthening completed.

inspection form stating what was done. Jim would then sign that item off. If there was any question about whether something should be in place, Jim would consult the Zenith blueprints to check whether what he was seeing was conforming to the design as engineered. If it was built as indicated, he accepted that as the build authority. By mid afternoon, all of the snags were corrected.

The aircraft was then taken outside and run up. This confirmed that the aircraft engine could start. But most of the attention was on whether the required VFR instruments and things like the throttle behaved problem free. Once the engine was shut down, the aircraft was positioned back into its long term home in the main RAA hangar. Jim Asprey asked to see the Zenith specifications showing the expected degrees of movement of the elevator, rudder, ailerons, and flaps and watched while we confirmed that everything was within specification and that the rigging worked properly when surfaces were being deflected.

With that, Jim said he was satisfied and then gathered up all of the paperwork and his inspection notes to take back to MD-RA so that his work could be checked and inspected by the person above him in the organization.

At that point we'd hoped we were done with inspection issues. However, within a few days, MD-RA came back with a couple more items they wanted changed. The main change was that a recent Zenith Service Bulletin advised that the horizontal stabilizer should be strengthened. The builders group had some discussion about how to address this problem. One of the fixes approved by Zenith involved putting

Top: Sebastien Seykora training members on the use and functions of the cockpit Dynon Skyview. Centre, Peter Whittaker displays the Cruzeer's paperwork; Bottom, Applying placards, including those required to be in place during the test flying phase. Mark Garner doing the positioning.

a doubler skin on the leading edge of the stabilizer as well as extending the hinge for the elevator. This is the route which the builders decided to take and over several Saturdays in March, this improvement was completed. Stabilizer rivets were drilled out, the rivet ends which had fallen into the interior of the stabilizer were fished out with magnets (very tedious), and new doubler skins were formed, drilled and then riveted into the stabilizer leading edge. The elevator hinge was extended to full span of the stabilizer.

While this was going on, it was noted that the upper cowl didn't provide sufficient clearance for the right front spark plug wiring. A blister was purchased from Zenith and fibreglassed into the cowl.

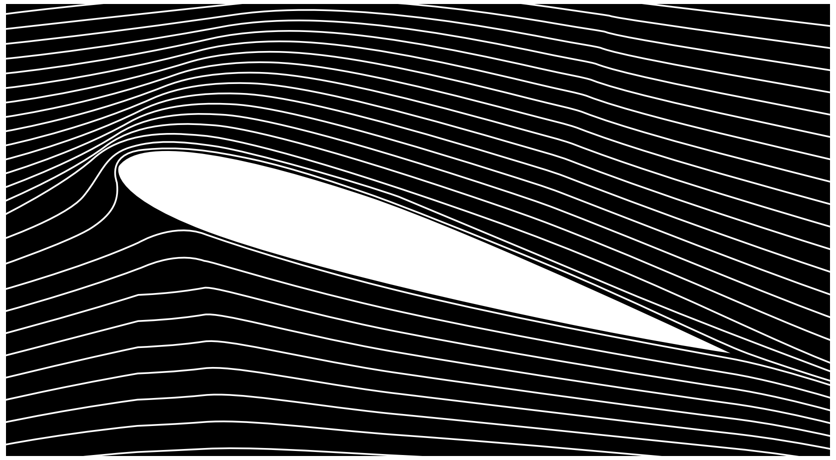
During some of the previous run ups, it had been found that the engine wasn't running as smoothly as expected. While the other work was going on, this was also investigated. A problem with a lead to a spark plug was located and Cyril saw to it that all the plugs were pulled and cleaned. Sebastien did a bore scope check of the cylinders (which turned up no major problem). The aircraft was taken out for a final run up which confirmed that the engine was running now cleanly and also that the adjustable propeller seemed to be set properly and was allowing the engine to make the appropriate static maximum rpm. The engine was shut down and the oil changed (the removed filter being cut open and examined for metal). The hope is that this will be the last time the engine needs to be started prior to the beginning of actual flying. The new electric winch was successful in pulling the aircraft back into the hangar.

Flight insurance is being put into place. The ELT has been certified. The Cruzer now is only waiting for MD-RA to sign off on the last work and the issuing of the CofA. Then the first flight will happen and the 25 hour test flying program can begin. R

__Bill Bird__ is a private pilot and makes his home in Vancouver. His original training was in fine arts but needing to make a living, his career was spent in the horticultural industry, originally running his own company and then as a manager with a Crown Corporation. Recently retired, his current activity schedule make him wonder how he ever previously had the time to go to work.

Airfoil Selection

Bill Husa



Recently there has been a rash of activity relating to the selection or design of wing airfoils. In this article, I will attempt to clarify some of the issues associated with the airfoil selection process, especially as it relates to the general aviation and homebuilt arena. In short, it seems that too much effort is being spent on the selection of sections and that the criteria used are not always realistic or applicable to the small airplane.

About fifteen years ago I had the good fortune to work with a chief aerodynamicist who some years back was the lead for the A-4 Skyhawk program. One day, when I was trying to make a bit more than I should have of selecting an airfoil, he related to me the following story.

During the wing design phase of the Skyhawk development, a junior engineer was assigned the task of designing the airfoil section for the delta planform. After about four weeks of no reports, the lead engineer went to visit the wind tunnel where this individual was working, only to find him almost buried in reams of computer output and hand calculations, as he was trying to tweak the last bit of infinitesimal performance from the wind tunnel model.

Somewhat upset by the engineer's lack of progress and understanding of the problem, the chief engineer replaced the highly optimized model in the tunnel with a piece of one-inch plywood. The wood was cut to the same planform shape as the "optimized" wing and the leading edges were rounded. No other embellishments or refinements were incorporated. The plywood was then instrumented in the same way as the original model and run through the same test scenarios.

The results were enlightening in that all the plywood values were, for all practical purposes, virtually identical to that of the highly optimized model. The exercise was done in order to show the junior engineer (and later myself) that the choice of airfoil in many applications is not all that critical and for the most part is not worth the expense of starting from scratch.

Granted, the example uses a delta planform which is not very sensitive to airfoil shape, but over the years I've found that the same argument holds true for many applications in the general aviation arena, especially for the smaller, light aircraft most commonly encountered in the homebuilt industry. Our company (Orion Technologies) designs aircraft for this sector of the market. We have file folders big enough to choke a mule, stuffed full of various airfoil shapes and design reports, in addition to publications and papers dealing with the subject. Out of all that data how many have we used over the last fifteen years or so? Maybe seven or eight.

Since much has been written about airfoils and their characteristics, I'll try to approach the question of selection from a different, more practical perspective.

First, what does an airfoil do? When built into a wing planform it keeps your airplane airborne, right? Right. Will any practical airfoil do that? Yes. So what's the big deal in selecting one that works for you?

To start with, you must have an idea of what you want your airplane to do, how it should perform, and how it should handle. You should also know how a particular airfoil affects the various aspects of your airplane's design. To help with the process, I have assembled a table, which compares some the more critical characteristics of some of the more common airfoils used for small aircraft. These are the initial values that are needed in order to make a logical selection.

The numbers represent the airfoils' two-dimensional values: pitching moment coefficient; maximum lift coefficient (unflapped); and lift-to-drag ratios for three different lift coefficient values.

The first value, pitching moment coefficient about the aerodynamic center (where the value does not vary with the change in angle of attack), is a function of the pressure distribution (camber line) along the chord. In general, you can see that the higher the maximum lift coefficient of the section, the higher its pitching moment. During cruise, the horizontal tail must provide necessary down lift in order to balance the nose down tendency

This was the primary reason for the development of the GAW, the NLF, and the LS series of airfoils. These high lift sections enable larger airplanes to have smaller, high aspect ratio wings. The high maximum lift coefficient enables them to maneuver without the risk of stalling. For example, assuming a smaller wing was installed using an older airfoil: The benefits of high Cl cruise would still be realized but, if the cruise lift coefficient is .4, and the maximum CL of the wing is 1.0, then, for a given airspeed the aircraft would stall if a maneuver in excess of 2.5 G's was attempted. Using a section with a maximum Cl of 2.0 gives the aircraft a potential maneuver capability of almost 5 G's (minus losses due to three dimensional effects of course).

Due to their high pitching moments, however, these new airfoils were not meant to be used on the smaller, private airplanes.

You can of course install a small wing on your airplane if you want to, but you may run into a few problems

...the chief engineer replaced the highly optimized model in the tunnel with a piece of one-inch plywood. The results were enlightening in that all the plywood values were, for all practical purposes, virtually identical to that of the highly optimized model.

such as where do you put the fuel or the landing gear? Assuming the span is about the same as your original wing, the fuel volume will be proportional to the square of the chord, this means that if you put on a smaller, high aspect ratio wing, say one-half the average chord of the original wing, you will end up with one-fourth the fuel volume. Due to this consideration and others (structural and landing speed requirements, for example), smaller aircraft generally have larger wings than considered optimum for cruise. Taking this information and looking at the table, you will notice that for the most part these new airfoils do not have good "l/d" ratios at low wing loads – even an old Clark Y (2412) in many cases has better performance and handling characteristics.

A secondary, but as important, feature of the "l/d" ratio is the airplane's climb performance. During ascent, the wing is flying at a lower speed and therefore at a higher lift coefficient. The rate of climb is a function of the excess horsepower available so, the lower the drag, the more power is available to gain altitude. Maximizing the "l/d" characteristics of the wing is an important component of this relationship. If you examine the database for the majority of the standard airfoils, you can see that the sections generally have a low drag count for only a small range of lift coefficient values. To maximize climb performance it is preferred that the low drag range or "bucket" (not to be confused with the laminar bucket) extends over the widest possible extent of lift coefficients.

Examining several conventional sections, one can predict how each will behave in a climb situation. Looking at the cd/cl plot of the standard Clark Y (2412), we can see that the drag curve flattens out on the bottom and extends over a substantial range of lift coefficient values. The plot is rather flat from cl values of -.15 to about .5. After this point, the drag curve rises relatively gradually. From a climb performance perspective, this would make the airfoil behave well on lightly loaded wings where the climb lift coefficient would not exceed about .6.

If we examine the 23012 section, it too has a relatively flat drag curve, extending from a cl value of .13 to just about .8. There is a sharp drag rise below a lift coefficient of .13 but on the opposite end, the curve again rises gradually as on the 2412. This section would therefore be applicable to a wing with a somewhat higher loading than in the previous case.

A more demonstrative example of performance degradation is the rather popular 64-415 section, used on several production aircraft including the Grumman Yankee, the Twin Commanchee, DHC Beaver, and the Barracuda, among others. The low drag characteristics extend only over a narrow range of lift coefficients (.15 to .6). At the extremes of this range, the plot increases sharply, doubling the drag values in only three lift counts (.6 to .9).

Currently, we commonly use the family of sections developed for light aircraft by Harry Riblett. To compare the characteristics of this family of airfoils, we can examine one we used recently, the 35A415. First, the low drag range is relatively extensive, covering lift coefficient values from .05 to nearly 1.0. The drag curve then climbs gradually, rather than increasing in a nearly vertical jump. This results in a very benign performance envelope with little penalty for higher climb attitude lift coefficients. Coupled with good lift characteristics and a gentle stall, this airfoil would be excellent for a variety of airplanes and performance envelopes.

Now a bit more on handling. A number of airfoils get an additional amount of lift by having a cusp located near the trailing edge (rear loaded airfoil). This works well for generating lift but it does two things which are not as desirable; first of all it gives the airfoil a higher pitching moment coefficient; second, it makes control surfaces feel heavy, making the airplane seem somewhat sluggish or heavy-handed. Both things can be fixed but with some penalties.

The most common way to counter the pitching moment is to reflex the flap trailing edge up a few degrees, thus changing the aft loaded characteristics of the section. One problem though, by reflexing the flap you have also reduced the lift (for a constant angle of attack) that section generates. Since the section is still basically the same, the drag level is also the same, so what you have done in the end is created an airfoil with a much lower "l/d". Furthermore, if you reflexed the flap and not the aileron, you have reduced the lift carried at the root. This action increases the loading at the tip, thus causing an outboard loaded wing, which may be more susceptible to tip stall.

The second fix that is often used is to fill in the cusp. This does a good job of reducing control forces but, as mentioned in the previous paragraph, it also reduces the lift generated for a given angle of attack. The bottom line is, if you have to modify the section (or wing) geometry in order to make the airplane fly right, you have chosen the wrong airfoil. On the other hand however, if you already have the airfoil set and tooled, it is cheaper to make these quick fixes than to retool for a different section. At that point however, don't complain if the airplane does not perform as well as you expect.

Now a bit about laminar airfoils. Contrary to some opinions, laminar airfoils are good sections, applicable to many classes of airplanes. The idea that a laminar section stops flying when it is wet or contaminated with bugs is false. All the contamination does is trip the boundary layer from laminar to turbulent a little earlier along the chord than normal. This results in a small increase in drag and a slight change in the center of pressure position.

In canard aircraft this change of center of pressure position causes increased stick forces, sometimes to the point where the pilot has a hard time pulling back hard enough to keep the nose up. The airfoil however does not stop flying; it's just that the control system has insufficient lever authority to counteract this shift of pressure.

As far as performance is concerned, a dirty laminar section will generally have a lower drag count than a turbulent airfoil with the same amount of contamination. In the case of published data, the numbers for contaminated airfoils (standard roughness) are not realistic to the operation of most small aircraft, unless of course you plan on flying through a swarm of locusts. The roughing medium used for the wind tunnel analysis is equivalent to about forty grit sandpaper, far from what most private airplanes see in actual service.

So, after all this what do I recommend? For most low speed applications, say, less than 130 mph, you probably do not need anything fancier than the good old standbys, the 2412, the 4412, even the 23012 if you can tolerate a somewhat sharper stall. All are very predictable sections and due to their large leading edge radii, work very well with most flap

In short, the selection of the right airfoil is important and depends on the part of the flight envelope the designer wishes to enhance. Almost anything will fly, given sufficient power, stability and luck.

configurations. If you need more thickness for structural reasons or fuel capacity, you can use the 15% versions, maybe even 18% at the root. Twelve to fifteen percent thick sections will yield the highest "l/d" values for wing loading up to about 20 psf; 18%, however, is still O.K. and gives you a lighter structure along with more fuel capacity.

Above 130 mph, I start looking at the laminar sections. My favorite has been the 747A315, which I have used with great success on several configurations. Although it does not have a high unflapped Cl, it does have a very low pitching moment, good stall characteristics, and some of the lowest drag numbers in the table. It also doesn't seem to have the leading edge separation tendencies of the more classical laminar sections like the 63- to 66- series.

For application of laminar sections, I would recommend picking up a copy of Harry Riblett's publication "GA Airfoils". In it is a good write-up on the history and characteristics of the sections and some excellent suggestions for modification, which make the shapes more suitable for general aviation applications. Today, we tend to use these sections more than any others in our work.

If you plan to go over about 350 mph, careful consideration has to be given to the wing design and airfoil selection process. At these speeds, compressibility becomes a factor, the best examples of which were the effects encountered by the P-38 in WW-II. As the airplane picked up speed (in a dive), the relative airflow over the wing approached the speed of sound, at which point the center of pressure shifted aft (at subsonic speeds the center of pressure is around the quarter chord; supersonically it is at about the 50% chord). This rearward Cp motion increased the nose down pitching moment while at the same time increasing the control forces required Airfoil Section Characteristics Two dimensional properties only

The accompanying table format (next page) provides probably the clearest comparison of the listed airfoils. Looking at the numbers we can quickly examine the values and trends, and determine which section would be best for an anticipated flight envelope. The chart can also be used to establish performance comparisons between aircraft.

About ten years ago, when the kit of the Questair Venture was becoming popular, Stoddard-Hamilton (Glasair) was desperately trying to figure out why the Questair configuration was so much more efficient than their Glasair III. It was not uncommon for the new aircraft to easily outdistance the Glasair, on substantially less horsepower. In an industry where an extra mile per hour can result in bragging rights and a few extra sales, this difference in performance was hurting some of the company's projected sales figures.

Looking at the published performance and geometry figures for both aircraft (Jane's 1993 – 1994) and extrapolating, where necessary to get the sea level values, we can determine the lift coefficients for each of the aircrafts' cruise condition. For the Questair Venture this yields a value of .208. If we look at the above table (the Questair use a 23015 at the root and a 23010 at the tip) and approximate the performance with the 23012 section, we see that the "l/d" comes to 33.55.

For the Glasair, the same calculation yields a cruise lift coefficient value of .13. The aircraft used the LS(1)-0413 section so for the same flight condition, its wing generates an "l/d" value of 16.56, or less than half of the Venture. To compound the problem, to counter the heavy stick forces of the selected airfoil, early in the development the company filled in the trailing edge cusp, thus decreasing the lift performance further. In short, this was a terrible selection on the part of the original designer.

Please note: the above example is a simplification. For calculating the effects of a new design one must examine the three dimensional characteristics of the wing in question, converting the applicable data to account for the finite wing geometry. Two-dimensional data is rarely accurate for an actual wing. The example was given only for discussion purposes.

In short, the selection of the right airfoil is important and depends on the part of the flight envelope the designer wishes to enhance. Almost anything will fly, given sufficient power, stability and luck. The trick is to make it fly well. Airfoil selection is an important part of this process but there is nothing magic about it, nor does it need to be expensive. Call around, some designers might even be able to give you ideas for candidate sections for free. Good luck. ₰

Reynold's Number = 6,000,000 Lift coefficient values for l/d characteristics: .1, .4, .6
Cl = .1 Cl = .4 Cl = .6

0009	.0057	.0060	.0068	0.0	17.54	66.67	88.23	1.32
0010-34	.0043	.0065	.0076	0.0	23.26	61.53	78.94	.75
0012	.0058	.0066	.0076	0.0	17.24	60.61	78.94	1.59
1412	.0058	.0060	.0068	-.025	17.24	66.67	88.23	1.57
2412	.0065	.0061	.0071	-.04	15.38	65.57	84.50	1.69
4412	.0064	.0063	.0062	-.09	15.63	63.49	96.77	1.64
23012	.0061	.0063	.0065	-.013	16.39	63.49	92.31	1.76
63-212	.0045	.0045	.0063	-.035	22.22	88.89	95.24	1.58
63-412	.0056	.0048	.0052	-.075	17.85	83.33	115.38	1.73
63-415	.0052	.0052	.0055	-.07	19.23	76.92	109.09	1.64
64-412	.0059	.0046	.0051	-.073	16.94	86.96	117.64	1.67
64-415	.0052	.0050	.0051	-.07	19.23	80.00	117.64	1.60
64A212	.0046	.0045	.0072	-.04	21.74	88.89	83.33	1.50
64A215	.0045	.0048	.0071	-.037	22.22	83.33	84.50	1.50
65-212	.0040	.0051	.0072	-.035	25.0	78.43	83.33	1.46
65-412	.0055	.0042	.0053	-.07	18.18	95.23	113.21	1.61
65-415	.0046	.0042	.0045	-.068	21.74	95.23	133.33	1.58
66-212	.0033	.0056	.0076	-.03	30.30	71.43	78.94	1.45
66-415	.0057	.0039	.0042	-.074	17.54	102.56	142.85	1.57
747A315	.0050	.0044	.0048	-.012	20.00	90.90	125.00	1.36
747A415	.0063	.0044	.0048	-.03	15.87	90.90	125.00	1.42
GAW-2	.0072	.0055	.0070	-.10	13.89	72.73	85.71	2.04
NLF(1)-0215F	.0074	.0064	.0046	-.13	13.51	62.50	130.40	1.72
NLF(1)-0416	.0063	.0058	.0053	-.10	15.87	68.96	113.21	1.87
LS(1)-0413	.0085	.0080	.0080	-.11	11.76	50.00	75.00	2.07
GA(PC)-1	.0073	.0073	.0072	-.045	13.70	54.79	83.33	1.80

The following are a sample of Harry Riblett's sections for general aviation:

GA30-312	.0060	.0060	.0070	-.055	16.67	66.67	85.71	1.59
GA30-315	.0065	.0070	.0075	-.055	15.38	57.14	80.00	1.67
GA30-412	.0065	.0065	.0070	-.07	15.38	61.53	85.71	1.70
GA30-415	.0070	.0070	.0075	-.07	14.28	57.14	80.00	1.80
GA35-312	.0060	.0055	.0060	-.055	16.67	72.72	100.00	1.58
GA35-315	.0060	.0060	.0065	-.055	16.67	66.67	92.30	1.70
GA35-412	.0070	.0055	.0060	-.072	14.28	72.72	100.00	1.65
GA35-415	.0060	.0060	.0065	-.073	16.67	66.67	92.30	1.82
GA37-312	.0060	.0055	.0055	-.06	16.67	72.72	109.09	1.54
GA37-315	.0055	.0055	.0055	-.06	18.18	72.72	109.09	1.68
GA37-412	.0070	.0052	.0055	-.072	14.28	76.92	109.09	1.61
GA37-415	.0065	.0058	.0058	-.072	15.38	68.96	103.44	1.78

***Bill Husa** lives in the Pacific Northwest and has contributed articles to various aviation publications including the Recreational Flyer over the years.*

RAA Chapters and Meetings Across Canada

The following is a list of active RAA Chapters. New members and other interested people are encouraged to contact chapter presidents to confirm meetings as places and times may vary.

ATLANTIC REGION

HAVELOCK NB: Weekly Sunday morning get together year round, all aviation enthusiasts welcome. Havelock Flying Club - 25 mi west of Moncton. Contact Sterling Goddard 506-856-2211 sterling_goddard@hotmail.com

QUEBEC REGION

COTE NORD (BAIE COMEAU): Meeting times to be advised. Contact Pres. Gabriel Chouinard, 418-296-6180.
LES AILES FERMONTOISES (FERMONT): First Sunday 7:30 pm at 24 Iberville, Fermont. Contact Pres. Serge Mihelic, 418-287-3340.
MONTREAL (LONGUEUIL): Chapter 415, Meeting in French second Wednesday at 8 pm, at CEGEP Edouard Montpetit 5555 Place de la Savane, St. Hubert, PQ. Contact president Normand Rioux at n.rioux1@videotron.ca or J-F Alexandre info@raa415.ca
OUATOUAIS/GATINEAU: Every Saturday 9:00 am to noon at the restaurant l9Aileron in the airport terminal. Contact Ms N.C. Kroft, Gatineau Airport, 819-669-0164.
ASSOC DES CONSTRUCTUERS D'AVIONS EXPERIMENTAUX DE QUEBEC (QUEBEC): Third Monday 7:30 pm at Les Ailes Quebecoises, Quebec City Airport.
ASSOC AEROSPORTIVE DE RIMOUSKI: First Saturday at 9:00 am, La Cage aux Sports, Rimouski. Contact Pres. Bruno Albert, 418-735-5324.
ASSOC DES PILOTES ET CONSTRUCTEURS DU SAGUENAY-LAC ST JEAN: Third Wednesday 7:00 pm at Exact Air, St Honore Airport, CYRC. Contact Marc Tremblay, 418-548-3660
SHERBROOKE LES FAUCHEURS de MARGUERITES. Contact Real Paquette 819-878-3998 lesfaucheurs@hotmail.com

ONTARIO

BARRIE/ORILLIA CHAPTER 4th Monday of the month at 6:00 PM at the Lake Simcoe Regional Airport for the months of June, July & August (BBQ nights) For other months contact Dave Evans at david.evans2@sympatico.ca or 705 728 8742
COBDEN: Third Thursday of the month at the Cobden airfield clubhouse 20:00 hrs. Contact Bob McDonald 613-432-8496 or bobkim.mcdonald@gmail.com
COLLINGWOOD AND DISTRICT; The Collingwood and District RAA, Chapter 4904, meets every first Thursday of every. month, at 7:30 PM except July and August, at the Collingwood Airport or at off-site locations as projects dictate. The January meeting is a club banquet held at a local establishment. For more information contact Pres. Skip Reeves 705-429-5154
FLAMBOROUGH: Second Thursday 8:00 pm at Flamborough Airpark. Contact Pres. Karl Wettlaufer 905 876-2551 or lazykfarm@sympatico.ca
KENT FLYING MACHINES: First Tuesday 7:00 pm at various locations. Contact President Paul Perry 519-351-6251 pkperry@teksavvy.com
KITCHENER-WATERLOO. Meetings are on the second Monday of each month at 7:30pm upstairs at the Air Cadet building at CYKF except during the summer months when we have fly-ins instead.
Please contact Dan Oldridge at kwraa@execulink.com for more information or visit our newly expanded website at http://www.kwraa.net/.
LONDON/ST. THOMAS: First Tuesday 7:30 p.m. At the Air Force Association building at the London Airport. Contact President Roy Rader 519-349-2641
MIDLAND/HURONIA
Meetings: first Tuesday of each month, 7:30 pm, at the Huronia Airport terminal building (CYEE). Contacts: President Rob MacDonald - 705-549-1964, Secretary Ray McNally - 705-717-2399, e-mail - raamidland@gmail.com E-mail – raa.midland@gmail.com .
NIAGARA REGION: Regular meetings occur the second Monday of every month at 7:30pm in the CARES building at St. Catharines Airport (CYSN). During the summer months though, June-September, meetings take place the second Monday of those months at 5:30pm in Hangar #4 at Welland Airport (CNQ3). Contact Elizabeth Murphy at murphage@cogeco.ca, www.raaniagara.ca
OSHAWA DISTRICT: Last Monday at 7:30 p.m. at Oshawa Executive Airport air terminal, ground floor, 1200 Airport Boulevard. Contact President: Jim Morrison, 289-675-0660, jamesmorrison190@msn.com Website raaoshawa.blogspot.ca
OTTAWA/RIDEAU: Kars, Ont. 1st Tuesday. Contact: Secretary, Bill Reed 613-858-7333 bill@ncf.ca
SAUGEEN: Third Saturday for breakfast at Hanover Airport. President: Barry Tschirhart P.O. Box 1238 27 Ridout Street Walkerton, Ontario. Home: 519-881-0305 Cell: 519-881-6020. Meetings are held every second Tuesday evening, at 7:30pm. Location(s) Saugeen Municipal Airport, Kincardine or Port Elgin. All interested pilots are welcome. Email: barry.tschirhart@bell.net
YQG AMATEUR AVIATION GROUP (WINDSOR): Forth Monday, 7:30 pm Windsor Flying Club, Airport Road, Contact: Kris Browne e_kris_browne@hotmail.com
SCARBOROUGH/MARKHAM: Third Thursday 7:30 pm Buttonville Airport, Buttonville Flying Clubhouse. Contact Bob Stobie 416-497-2808 bstobie@pathcom.com
TORONTO: First Monday 7:30 pm at Hangar 41 on north end of Brampton Airport. Contact: President Fred Grootarz - Tel: (905) 212-9333, Cell: (647) 290-9170; e-mail: fred@acronav.com
TORONTO ROTORCRAFT CLUB: Meets 3rd. Friday except July, August, December and holiday weekends at 7:30 pm Etobicoke Civic Centre, 399 The West Mall (at Burnhamthorpe), Toronto. Contact Jerry Forest, Pres. 416 244-4122 or gyro_jerry@hotmail.com.
WIARTON: Bruce Peninsula Chapter #51 breakfast meetings start at 8:30am on the second Saturday of each month in the Gallery of Early CanadianFlight/Roof Top Cafe at Wiarton-Keppel Airport. As there are sometime changes, contact Brian Reis at 519-534-4090 or earlycanflight@symptico.ca

MANITOBA

BRANDON: Brandon Chapter RAA meets on the second Monday of each month at the Commonwealth Air Training Plan Museum at 7:30 PM except in the months of July and August. Contact Pres. John Robinson 204-728-1240.
WINNIPEG: Winnipeg Area Chapter: Third Thursday, 7:30 pm RAA Hangar, Lyncrest Airport or other location as arranged. Contact President Ben Toenders at 204-895-8779 or email raa@mts.net. No meetings June, July & Aug. RAA Winnipeg info also available at Springfield Flying Center website at http://www.lyncrest.org/sfcraac.html.

SASKATCHEWAN

Chapter 4901 North Saskatchewan. Meetings: Second Tuesday of the month 7:30pm Prairie Partners Aero Club Martensville, Sk. info at www.raa4901.com. Brian Caithcart is the chapter president. Contact email: president@raa4901.com.

ALBERTA

CALGARY chapter meets every 4th Monday each month with exception of holiday Mondays and July & August. Meetings from 19:00-21:00 are held at the Southern Alberta Institute of Technologies (SAIT) Training Hangar at the Calgary Airport. Join us for builder discussions, site visits, tech. tips, fly out weekends and more. Contact President Dennis Fox dennis77fox@gmail.com 403-443-8434 or Secretary Bruce Flach o2fly@yahoo.ca
EDMONTON HOMEBUILT AIRCRAFT ASSOCIATION: meets second Monday - Sept. to June. Contact Pres. Roger Smeland - 780-466-9196 or Jim Gallinger 780-242 5424. Website www.ehaa.ca
GRANDE PRAIRIE: Third Tuesday, (September to April), 7:30, 2nd floor boardroom of the Grande Prairie Terminal Building. Summer events on an informal schedule. For more information contact Lee Merlo at 780-518-4254 or e-mail arniesusanmeyer@gmail.com

BRITISH COLUMBIA

DUNCAN: Second Tuesday 7 pm members homes (rotating basis). Contact Pres. Howard Rolston, 250-246-3756.
OKANAGAN VALLEY: First Thursday of every month except July and August (no meetings) at the Mekong Restaurant.1030 Harvey Ave. Dinner at 6:00pm, meeting at 7:30pm Contact President, Cameron Bottrill 250-309-4171 email: Outintheair@yahoo.ca
QUESNEL: First Monday/Month 7:00 p.m. at Old Terminal Building, CYQZ Airport. Contact President Jerry Van Halderen 250-249-5151 email: jjwvanhalderen@shaw.ca
SUNCOAST RAA CHAPTER 580: Second Sunday 13:30 pm Sechelt Airport Clubhouse, sometimes members homes. Contact Pres. Gene Hogan, 604-886-7645
CHAPTER 85 RAA (DELTA): First Tuesday 7:30pm, Delta Heritage Airpark RAA Clubhouse. 4103-104th Street, Delta. Contact President Alex Mackay mackay@physics.ubc.ca. Website www.raa85.ca.
VANCOUVER ISLAND AVIATION SOCIETY (VICTORIA): Third Monday 7:30 pm Victoria Flying Club Lounge. Contact Pres. Roger Damico, 250-744-7472.
THOMPSON VALLEY SPORT AIRCRAFT CLUB: Second Thursday of the month 7:30 pm Knutsford Club, contact President Darren Watt 250-573-3036
ALASKA HIGHWAY: meetings held every third Thursday of every month (except July & August) at the Taylor Fire Hall at 7:30 p.m. For more information call Gerry at 250-782-4707 or Heath at 250-785-4758.

Chapter executives, *please advise of changes as they occur. For further information regarding chapter activities contact RAA Canada, Waterloo Airport, Breslau ON N0B 1M0 Telephone: 519-648-3030 Member's Toll Free line: 1-800-387-1028*

Emails can be sent to President Gary Wolf at: **garywolf@rogers.com** *and George Gregory at* **gregdesign@telus.net.**

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To submit or delete a classified ad, please send to raa@raa.ca and place "RAA ad" in the subject line.

The Recreational Flyer is pleased to offer you colour advertising within the magazine. Previously limited to the back cover, we have added 4 new colour pages which will be available with limited space for your advertising needs. Our rates for both black and white and colour ads remain very competitive and you reach a captive and qualified audience. Emails can be sent to President Gary Wolf at: garywolf@rogers.com and George Gregory at gregdesign@telus.net

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Recreational Aircraft Association Canada
President: Gary Wolf / Treasurer: Wayne Hadath

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The Recreational Flyer is devoted to the aerospace sciences. The intention of the magazine is to promote education and safety through its members to the general public. Material in the Flyer is contributed by aerospace engineers, designers, builders and restorers of aviation devices and vehicles, used in an amateur capacity, as well as by other interested persons, publications and organizations. Contributions to the Recreational Flyer are voluntary and without remuneration. Opinions expressed in articles and letters do not necessarily reflect those of the Recreational Aircraft Association Canada. Accuracy of the material presented is solely the responsibility of the author or contributor. The Recreational Aircraft Association Canada does not guarantee or endorse any product offered through articles or advertising. The Flyer and its publisher welcomes constructive criticism and reports of inferior merchandise or services offered through advertising in the publication.

E.A.A. BIPLANE, Ron Riley's first home-built, airframe only, includes cowlings, motor mount, flying wires from Acro 1, N.O.S. canopy, fabric & other covering materials, wood etc. Dismantled," sold as is, where is" $3500. G Trimble 519 461 1665 ijtrimble@gmail.com

FOR SALE - Four lengths of spar grade sitka spruce. 7/8" x 6 1/4" rough, x 20 ft. This will plane down to 3/4" x 6". Located in Kenora, Ontario. I will box and wrap and carry to a shipping depot. Buyer pays shipping, or my ship costs will be added to purchase price. Cost for this material, planed, at Aircraft Spruce Canada is $14/ft, I am selling for $600 CDN. Call 807-468-4764, or email pjohnson@kmts.ca.

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PARTIAL KIT for Zenair CH 640 See my Facebook photo album for progress (George Lowes). I've lost my medical. See Zenair web page for specs. http://www.zenair640.info/standard-ch-640-kits.html Kits List Price in $US: Rudder Tail 590.00, Tail (Manual Trim) 1,995.00, Wings 7,995.00, Fuel System 1,495.00, Extended Range Auxiliary Fuel Tanks 2 X 46 USgal 900.00, Nav/Strobe/Position Lights (Incandescent NOT LED) 828.00. Total List Price 13,803.00 $US. Many air tools are also available. $10,000 OBO. George Lowes 705-843-0826

BX-1000 Black Max brakes, wheels and tires. 6 inches, axles 5/8" Brand new. 575.00 OBO. Lmistor@hotmail.com 289 838-9588, 905 469-2198

MARANDA Amateur Built for sale. I lost my medical and can't fly. Last flew in June 2018. Yearly inspection has not been renewed. Just disassembled first week of Sept and stored in building. Flew average 20 to 25 hours yearly and was kept in a hanger. Low time on Leavens rebuilt engine and metal seaplane propeller. Asking $12000 OBO to set up a viewing or info please call 705-941-8033 or email billdonig@hotmail.com

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KINGFISHER AMPHIBIAN PROJECT, Fuselage on Gear, Plans, Motor mount, Fuel Tank, 4130 Steel Tail Group Parts Completed, Internals of fuselage varnished. External covered in a layer of fibreglass. Value somewhere in the $2000 range but would prefer to trade for Geo Tracker, Suzuki, etc. in good running condition. 780-832-9750, arnie5149@yahoo dot com.

MJ5 SIROCCO PROJECT, serial #003. The aircraft is 75% built. The fuselage is all finished with the canopy fitted. The ailerons, rudder, elevators, horizontal/vertical stabilizers all built. All the ribs for the wings are done but the Box spar needs to be built to finish the wings (all spar material included). All the work is absolutely best quality. I have no time to finish this and hence would like to pass it on to someone who has. I have invested over 5000 $ in materials but I have no time to finish.. My loss your gain... $1950 takes it all away. Wiese Laurent 604 989 4805

"The Sky's The Limit!" $68,000 This Advanced UL 2011 Zenith CH750 Ultra-light is the perfect plane for going fishing, camping, gold panning, or for exploring anywhere off the beaten path! Jabiru 3300 engine, Sensenich propeller, Lowrance avionics, dual throttles, strobe lights and much more! Like new..less than 200 hours...always kept in a hangar. • Contact Bill W. Quin, Owner - located Fruitvale, BC Canada • Telephone: 250 367 7425 . 250 921 5524

1978 AMF-S14 MARANDA. Woody & fabric with Lycoming O-290-D2B, 920 TTSN, ICOM 210 radio, transponder. Same owners 18+ years. $25,000 obo www.MarandaForSale.com 905-884-8598 Peter

THATCHER CX-4 all aluminum single seat tractor sports plane (looks like a Chipmunk) with Hummel 2180 VW engine dual ignition, Zenith carb and Ed Sterba prop. Comm radio and MGL avionics mgl-e-1 and alt-3. Built in 2015 but ground looped. Damage to fin, fuselage, left wing and undercarriage and I do not have the time or energy to repair so I am willing to sell for $8000, essentially the price of the engine. Don at dnatt45@gmail.com 705-246-2000

GN-1 AIRCAMPER for sale; asking $7000.00 CND O.B.O. wood frame ,65hp Continental engine, no electrics, cruises at 75 mph, Sensenich wood prop, one front gas tank 40 gal. and one center wing tank about 15 gal. It is registered as a BULA C-IOVC. always hangared. Need to sell to make room in T hanger for other aircraft project. harvey.rule@bell.net , 613-739-5562 or 613-797-5568

WANTED - LYCOMING 360 running engine or core for rebuilding, will consider carbureted or injected. bwelfred@rogers.com (Ontario)

Zenith 250 TW Lycoming0320 160Hp TTAF 870 870 SMOH valcom 760 Transponder Propeller is sensenich aluminum, fuel 41 gals US with tip tanks, Radio is Valcom 760 ch. overall condition 7/10 20,000 CDN Dollars or best offer Wally (705) 328 1724

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The Recreational Flyer is only as good as the content supplied to us.
We rely on the input from members who are willing to share their expertise, stories, completed projects and what their chapters are doing.
Contact George Gregory at gregdesign@telus. net or Gary Wolf at garywolf@rogers.com.
Send your contributions in today!

Classifieds On The Internet:
http://tvsac.net/BS1.html - more ads from our Kamloops chapter

Across Canada *RAA Chapters in Action*

RAA/COPA Midland - Huronia

At the May meeting we had eight guests - Joe Gallant and Tim Deaves, representing the Barrie chapter of the CVMG (Canadian Vintage Motorcycle Group), and Albert Streef from Port Severn as well as 5 university students currently doing a summer work term at Zenair. The order of minutes were changed slightly to accommodate the CVMG guests.

Plans for the Fly-In/Motorcycle Swap meet were discussed.

A COPA for Kids event was discussed for June 15, and 6 pilots have signed up.

An Aeronca Chief project is in the works; Adam has reported contact with the registered owner who is willing to transfer ownership. The Zenith 601 Builders' group continues to meet in Bob's hangar, Thursday evenings from 6:30-9pm.

The Northern Region Fly-In will be happening July 13. See the RAA website for more details (raa.ca).

Discussions at the June meeting focused on the upcoming June 16, COPA For Kids event and the July 13, RAA Northern Regional Fly-In (NRFI). As sometimes happens, the C4K event was rained out and have been rescheduled to September 7. Hopefully, the weather will be more cooperative for the NRFI.

Chapter 85 Vancouver

The RAA Chapter 85 Zenith 750 Cruzer completed a successful test flight this afternoon out of the Delta Heritage Air Park. Once insurance for the aircraft was confirmed as being in place, Sebastien was able to confirm that he felt today was suitable for an attempt at a flight. Sebastien was at the field a little bit after 10 am this morning and a number of the members who had been involved as volunteer builders also arrived to assist.

Sebastien updated the software for the Dynon Skyview and then several hours were spent examining the aircraft and also correcting some small problems. This included Cyril and Peter Lenger making a quick flight to Pitt Meadows Airport to pick up some needed items.

By mid afternoon, Sebastien was satisfied that a flight could be attempt. After an aborted first attempt to investigate a radio issue, Sebastien lined up and was in the air just after 3 pm. Some photos will be included below and a link to a YouTube video of the the in cockpit portion of the flight can be viewed at: https://youtu.be/KGmX-HuN8pSs

The flight turned up a few items which will need to be addressed before the next flight. As can be seen on the video, Boundary Bay tower was having difficulty picking up the Cruzer's transponder and engine temps were high which will require checking and improving engine baffling and air flow. Sebastien reported that the aircraft flew well and no things like oil leaks were in evidence post flight.

Overall, it was a very successful first flight. The members who were the volunteer builders and who put in hundreds of hours of work over the last three and a half years are to be congratulated. Thanks also to Sebastien Sekora for managing all the issues leading up to the test program and then performing the first flight. Thanks also to Micheal Hientz and Zenair Canada for the attention which they have given to the Chapter and project.

London St Thomas

At the April meeting, the club was treated to a very informative presentation by world class, glider pilot Gudrun Haas. Before emigrating to Canada, Gudrun grew up in Germany where she learned to fly glider, starting at the age of 14. She was introduced to glider flying by her father. Gudrun took us through her flying career from novice pilot to international competitor, flying for Germany in international competitions. Throughout her presentation, she stressed the importance of flying with safety and within your personal limits. Pressure to compete, or finish must never overrule safety.

Gudrun shared with us pictures and videos of many of the aircraft that she has owned and flown in. Gliders ranges from 300 to 800 Kg weight, and wingspans from 15 – 30 metres! Her video of her glider skimming along a ridge line, high in the Alps was breathtaking. It seemed that her wingtips were only meters away from the rockface.

One story that she shared that stuck with me was her description of driving to an international competition in Slovakia. She towed her 9-metre-long trailer with a Volkswagen minibus with a 37hp motor! She indicated that the motor had little compression, so going up mountains towing the trailer was a slow trip! One can imagine the dedication and passion it must take to tow your glider, along with your support team across countries, all while maintaining a full-time job.

Some interesting things that I picked up. Gliders ballast with water to help increase penetration in the wind and speed. Water is often dumped just prior to landing to show off and present well for pictures. Glider wings flex to incredible angles! Gliders will often reflex their flaps to a negative angle to increase speed. It is possible to do cross country flying without a GPS (Gudrun spoke about spending many hours researching routes, alternate airports and locating areas for potential lift when planning cross country flights using topographical maps, travel books and airport guides). Motors in aircraft are known as "fuel to noise converters".

Aireon / continued from page 21

MHz and that is not going to be usable in Canada if we adopt ADS-B. It seems fairly obvious that Canada will go with the 1090MHz operating frequency that is mandated by ICAO. It might have been just a coincidence but Garmin, in March of this year, announced the GTX 335D and GTX 345D, which are Mode S transponders with the diversity option. The problem for the certified aircraft owner is that the installation of these diversity transponders and the associated extra antenna will cost well over $10,000, which may approach half the value of the aircraft, and will be many times the cost of some US compliant ground-based ADS-B installations with one antenna. There is no easy answer here and many who have installed equipment to meet the US mandate may face further retrofit expenses to fly in Canada with the Aireon system. For those who have not yet installed equipment, an announcement from Nav Canada or Transport Canada, on their pending requirements, would be welcome.

The second option involves an amateur builder. If building a metal airplane, at least installing the coaxial cable and support structure for the top antenna, before 'closing up', probably makes a lot of sense. If flights into the US are planned, a tough financial choice about transponder choice looms, but should probably be postponed until the very end of the building process as competition might drive diversity transponder costs down. Aircraft built of carbon fiber are essentially in the same category.

For someone building a wood or fiberglass airframe things get a little more interesting as these structures are transparent to the radio frequencies that the transponder operates at. While it is possible that the Transport Canada requirements might specify a diversity transponder, a single antenna, located in the vertical stabilizer or tail cone would be just as effective. This coupled to a mode S transponder and GPS source would make the most sense. Trig makes a remote head unit that includes the encoder at a reasonable price. They also sell a GPS position source for amateur built aircraft that meets the current requirements for an ADS-B installation and is again reasonably priced.

I suspect for many pilots that do not plan on visiting the US, the best option is to wait and see what the requirements for ADS-B in Canada might be. If your mode C transponder fails in a composite (noncarbon fiber) or wood amateur built, purchasing a mode S transponder as a replacement makes sense.

Part of my reason for writing this article is the hope that someone at Transport Canada or Nav Canada might read it and perhaps share their plans for general aviation in this area.

__Chris Staines__ and his family have a three generation interest in aviation technology. His father was a mechanical engineer in early gas turbine design, and his son has a Masters in Aerospace engineering and works as a test pilot in the US. Chris has owned a sailplane and a Mooney, both very efficient airframes, and eighteen years ago he built the Rotax 914-powered Europa that he currently flies. At present he is building a Pereira GP-4 which he hopes will be even more efficient than his Europa which burns 5.5 US gph at 140 Knots.


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