publication agreement number 40050880

March - April 2016

RECREATIONAL RFLYER

Recreational Aircraft Association Canada www.raa.ca
The Voice of Canadian Amateur Aircraft Builders $6.95

RAA
RECREATIONAL AIRCRAFT ASSOCIATION
RÉSEAU AÉRONEFS AMATEUR CANADA

From The President's Desk

Gary Wolf RAA 7379

Vans Rear Wing Spar Bulletin – Do Not ignore

Vans Aircraft has issued a "Before Further Flight" Service Bulletin 16-03-28 to alert pilots and builders of the possibility of rear spar cracks in all models except the RV-12.

The Bulletin describes "Cracking of wing aft spar web at the inboard aileron hinge bracket attach rivets. In addition, for RV-10 and RV-14/14A aircraft, there is a potential for cracking of the flange bends of the inboard aileron hinge brackets."

Go to the http://www.vansaircraft.com/ website for the 14 page Bulletin that describes inspections, stop drilling, and adding doublers, etc.

Rotax 912IS Stator Recall

The new Rotax 912IS engine which has electronic fuel injection must have its stator replaced. There are some twenty of these engines currently in Canada and a list of their serial numbers is available on the http://www.rotax-owner.com/ website, along with details of the exchange program. Rotax will supply a kit of parts gratis, and the old parts must be returned. Labour will be reimbursed up to a maximum of $550, and must be performed by a Rotech approved Service Facility or by a Rotech approved Independent Maintenance Technician.

A special tool is required and it will be sent out on a deposit, with the deposit being reimbursed when the tool has been returned. Details are at www.rotech.ca .

The program begins immediately and there is no expiry date. Contact sales@rotech.ca or 250-260-6299 in Vernon BC.

Help Wanted from the West

If you live in BC or Alberta you will likely have noticed that there is frequently a lack of articles from your area. It is not that there is no activity, rather that few write about it. The cost to fly someone from Ontario to gather articles several times per year is out of the question, so it falls to yourselves to do this.

RAA is asking for someone to act as a regional editor to source tech articles and lead stories from the West. Please call the office at 800-387-1028 or email to garywolf@rogers.com .

Lawrence Shaw

Many years ago Lawrence Shaw went across this country meeting with local flying and building clubs, and signing them up to form what has become your National organization. Besides this, Lawrence has built a Smith Miniplane and his own version of the Wheeler Express, both outstanding examples of what an amateur builder with determination can accomplish.

Life moves on and Lawrence is now selling his lifetime accumulation of parts and materials so that he can clean house before moving. His extensive list is in this issue's classified ads.

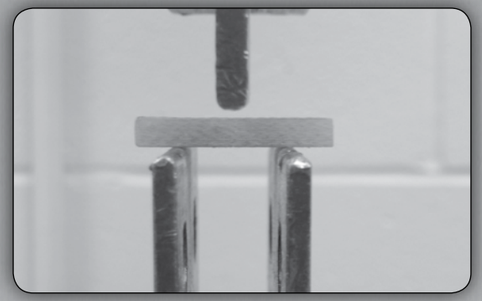
The Recreational Aircraft Association Canada

22-4881 Fountain St. North
Breslau RR2 Ontario 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.

The Recreational Flyer is published bimonthly by the Recreational Aircraft Association Publishing Company, Waterloo Airport, Breslau, ON N0B 1M0. 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. 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.

features



columns

George Gregory

An Estra 500 at Arlington, 2014
On the cover: Comco's Ikarus. Gustavo Corujo photo.

Glass or Steam?

Deciding what's best for your baby's cockpit / by JC Audet

Photo Credits: Zenair

THE MODERN COCKPIT has given way to glass panels and an assortment of electronic gizmos. Most are typically high quality designs and do the job they are supposed to do. But they are also expensive. It is very easy to spend in the order of $30,000.00 and more on the instrument panel of an Amateur Built aircraft. This can be considered relatively low cost in a Lancair Evolution, but in the typical A-B it is rather pricey. These cockpits also make use of complex technology. The integrated cockpit provides an enormous amount of information to the pilot, useful or otherwise. The cost of these systems is driven in part by the sheer number of sensors spread around the airframe, all of which have to be converted and integrated in some form of flight computer that in turn processes all this data and feeds the glass panels, according to what the pilot wants to see on that panel. As many users have come to know, any troubleshooting, repair, or maintenance action imposes a visit to your friendly avionics shop where the aircraft must be hooked up to an expensive computer to analyze the problem and make necessary adjustments. All of this takes the concept of homebuilt aircraft in a significantly different direction and into the upper spheres of the builder's budget. This article is simply a personal perspective on the relative merits of going to this new technology, and not an attempt to document what is available in integrated cockpits, their features, and their capabilities. Also, it is not meant as criticism of the builder's/owner's/pilot's choice.

Might as well admit it right away, I am not a fan of glass panels and integrated cockpits in light aircraft (A-B or store bought), or at least, in the ones that I fly. I far prefer the good old round dials, the steam gauges if you prefer. I like to fly an airplane, not an airborne computer. Many hours flying a Cirrus gave me enough arguments to support my choice, a choice I do not attempt to impose on anybody else, but nonetheless a source for good discussion. I have always enjoyed keeping abreast of the airplane market: the different types, their equipment, their price. I find it quite educational.

Over the past few years, more and more old aircraft are showing up with an updated instrument panel, i.e. a glass cockpit. The asking price reflects that upgrade and of course the seller hopes to recoup the money spent on that panel. I would much prefer to buy such an aircraft with an old panel and do the upgrade myself: at least it would be what I wanted, not somebody else's vision. I recently saw a $50K aircraft (fair market value) with a fresh upgrade worth in excess of $80K. This aircraft now costs $130K but the owner would never get close to that.

When considering these cockpits, we should look at three distinct aspects: the flight instruments, the radio stack, and the other gadgets. The world is changing, our flying environment is changing, the regulations are changing, the airspace is changing, and on, and on. What serves us best in our cockpit?

Let's first look at the radios. Not much has changed in voice communications in a long while and I honestly do not expect much change in that respect that will impact us significantly in the future. On the other hand, when it comes to navigation, a lot has changed with the widespread use of GPS and its wonderful features. The typical ground based navigation aids such as NDB, VOR, and DME that we all learned to know and love are disappearing in the name of cost savings. GPS does it all and is gradually replacing all these navaids, and quite rapidly. It seems like only the ILS might survive, and only for a limited time I'd bet. Definitely, if one needs to acquire radios and navigation equipment, the wise choice is to go for the modern NAVCOM/ILS/GPS and if you want to do IFR, then WAAS approved is the right choice. Be careful though because if you plan on flying at much higher latitudes, where it really gets cold, GPS is not so good. You will still need ADF and VOR, and DME. But granted not many Amateur Builts live up there.

The radio stack is the part of the cockpit where I readily embrace the new technology simply because it incorporates GPS. And my acceptance also applies to the transponder, as

It is very easy to spend in the order of $30,000.00 and more on the instrument panel of an Amateur Built aircraft

ADS-B is about to hit us. My current radio stack is all Narco purchased new in 1990 and still working like new. Although next time that I have to spend significant money on my radio stack, I will have no choice but to consider the new technology.

I suppose before getting into the really heavy stuff, we might as well be done with my third aspect of the cockpit: the other gadgets, or engine instruments and other instruments and indicators that pilots like to have. Some manufacturers offer sensational equipment to allow a homebuilder to have a massive amount of information at the touch of a button, and all in a very small instrument. This is an absolute space saver and a major advantage when space is at a premium, as is typically the case in our aircraft. So no contest here, modern technology is definitely a winner. But I still like my dials and needles; they look like a real airplane. In either case, we still need numerous sensors, and probes, and wires.

Now, let's spend some time on the major stuff, the great looking and expensive stuff. The operational need of airlines and military aviation for weight savings and improved efficiency and reliability drove the development of these modern avionics. If we consider the physical size of an airliner, and the number and complexity of the systems on board, and the miles of wiring, it becomes readily apparent that this new technology can bring about some very significant savings in the empty weight of the aircraft, yielding an equivalent increase in payload. The maintenance aspect of the same aircraft is realistically improved by that same technology, again yielding better dispatch reliability and reduced costs. Or consider a modern fighter aircraft like the F-18 for instance (not so new anymore, one might argue). The pilot of such a platform could not derive its necessary maneuverability and its incredible performance without this advanced technology. When we think of the many tasks the F-18 pilot has to perform at an alarming rate of speed, and the accuracy required in carrying out the mission, and so on, this technology offers a definite advantage to the user. And the same weight savings and reduced maintenance benefits also accrue in this situation. While the complexity and acquisition costs of these systems are frightening, the airlines believe that their operating costs are reduced, and in any case, these costs are passed on to the paying customer. In the case of the military, I guess it is not really an issue as much as it is a matter of national security, or

Photo: Dynon

so says the government, and the cost is passed on to the tax payer. Here comes the F-35!!!

But let's get to the type of aircraft that really interest us: our Amateur Builts. The advent of this equipment in our cockpit does evolve from the needs described above to some extent, but it is also the result of the electronics industry wanting to cash in on the desire of today's pilots to have a computer in their cockpit, with its ability to automate a multitude of functions as well as to customize the information provide on the instrument panel. That glass cockpit aircraft flies like all the ones we flew before, but the instrument panel requires study and training because of the complexity at initial use and there is no standardization in those cockpits. The old style of cockpit instrumentation is very well defined in a whole list of relevant FAR's/CAR's used in the certification process. Try to find the equivalent regulation for glass cockpit for small aircraft (Part 23). It is incredibly skimpy and ultra basic, thus the proliferation of different designs that all promise to be better than everybody else's. Essentially, they must adhere to what the regulations mandate for what flight instruments must be on board and it stops there: the basic T configuration or IFR six-pack depending on your wishes. From that point on, the designer/manufacturer pretty much has a free hand in what will be displayed and how and where. And most manufacturers allow the users to program what they want on the displays.

The number of functions available to the pilot is mind boggling, to the extent that some pilots spend their entire flight pushing buttons and being amazed at the graphics and other stuff in front of their eyes instead of enjoying the flight and the great scenery, or better yet, looking outside for traffic. The savings related to reduced weight and easier maintenance do not accrue appreciably on a small homebuilt since our aircraft are already very small and light by design and maintenance is typically easy due to the absence of very complex systems.

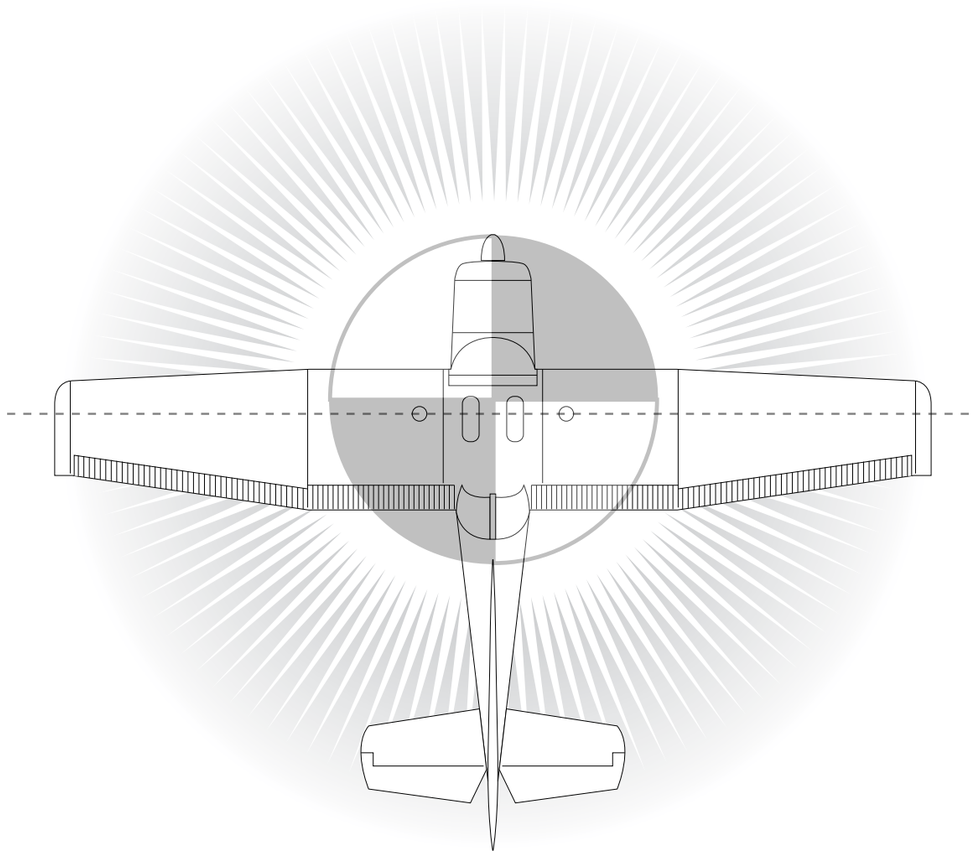
Personally, I am all for good old round dials, and needles, and all kind of things that move around and are easy to read, and understand, and maintain, and are standard across any non-glass cockpits we encounter. I prefer ''steam gauges'' as they are often referred to. With steam gauges, we do not need special training when we climb aboard a friend's homebuilt aircraft or when we visit a new flying club for the purpose of renting an aircraft. I am not anti electronics, I am pro pilotage. I do recognize their value and what they can bring into the cockpit, and I fully respect the choice of the aircraft owner/builder/flyer who chooses that route, but I will continue to spend my money (very little of it) on steam gauges. I might lose one instrument in flight, two on a really bad day, but losing my PFD would mean I lose it all. I have experienced PFD failures twice in IFR: once in cruise, once on approach. I am grateful for the good old round back-ups.

I thought my article was done and ready to send off to our magazine. On this beautiful Thanksgiving Saturday morning, Ivan Christensen invited me to join him for a flight and breakfast in his RV-10. Obviously, my wife's well laid-out plans for this beautiful morning were quickly forgotten and off I went. This was my first flight in an RV aircraft, all models considered. From my experience that morning, I agree that the RV-10 is a great performer and it definitely deserves all the praise that has been directed its way. We flew Kitchener-Waterloo (CYKF) to London (CYXU), then on to Tillsonburg (CYTB) for breakfast, and back home. When Ivan invited me to take the controls on the way to CYTB, I quickly accepted. The RV-10 is a joy to fly and Ivan let me fly it to touchdown. Ivan's RV-10 is a magnificent flying machine; as it was featured in the July-August 2014 issue of the RAA Flyer, I will not report on it. This aircraft has a glass cockpit and Ivan was pushing a lot of buttons and such. But let's put this in perspective. We did a short flight, with an RNAV approach in CYXU, on to CYTB, then an ILS approach back at CYKF, all on autopilot, except for my bit at the controls. On an airplane this fast (our flight was mostly around 160KTS), the waypoints and procedures come fast, hence the pilot must be very comfortable with the cockpit. This is obviously the case with Ivan and he handled the entire button pushing exercise with extreme ease, with lots of time to brief the approach plates, and chat about the lovely scenery, and so on. On the other hand, when one uses this aircraft for typical cross-country flights, which is what the aircraft is really designed for, the button pushing is reduced to a bit at take-off and climb, some in approach and landing, and the odd event during cruise. Back on the ground, we were joined by another RV-10 builder who is getting ready for final inspection in a few days. We all agreed that glass cockpits are great but they require the pilot to have a very good knowledge of the installation and how it works, and this requires time and practice. Ivan, a highly experienced corporate pilot, feels that he finally got really comfortable with his installation at about the 100 hour mark. And this takes on a very critical perspective when doing IFR. Our consensus was that the good old conventional cockpit with its steam instruments does not require this adaptation aspect if one flies a variety of aircraft as when renting at different flying clubs.

On Thanksgiving Monday, I went flying in my Long-EZ with its steam gauges panel. It turns out I did a very similar flight to the one Ivan and I did two days earlier. Of course, I did have to do some button pushing: tune radio frequencies, set the altimeter, set the transponder code, that's it. The major difference between my steam gauge panel and an integrated panel is where the integration happens. In a conventional panel, all the integration occurs in the mind of the pilot who then turns/pushes a knob once in a while. In the integrated cockpit, the integration occurs in the computer but only if the pilot inputs all the parameters. In other words, in both cases, the pilot receives/holds all the parameters. In one case, pilot enters these in the system to allow the system to integrate them and give the relevant info back to the pilot. In the other case, the pilot integrates the parameters in his/her mind and executes a minimal amount of actions to fly the plane according to these parameters. I love my steam instruments but I admit if I have to do a cross-country, in any condition, Ivan's aircraft is a great platform.

The number of functions available to the pilot is mind boggling

continued on page 42



The relationship between the Aerodynamic Centre of your airplane and its Centre of Gravity has *everything* to do with the safe operation of your aircraft. Here's how to know your aircraft is safe.

Where is your Aerodynamic Centre?

...and why should you care? **by Frank Gue**

THE POSITION of the aerodynamic centre of your airplane strongly influences its tolerance for changes in loading (baggage, passengers, etc.) and its stability. Therefore it is helpful for the pilot to know where it is on the aircraft compared with some standard and with other aircraft. Unfortunately not many operating handbooks discuss this. We will do so in this article.

There is an aerodynamic centre in the side view of the aircraft and another in the top view. This article will discuss the aerodynamic centre seen in the top view, because (a) it governs longitudinal stability, which is the primary requirement of every private aircraft, and (b) its side view location is determined in exactly the same way, and so need not be explained.

Think of your aircraft as an arrow. The arrow flies straight and is stable mainly because the feathers (its aerodynamic centre) are very far behind its balance point (its c.g.). That's not practical for an aircraft, but let's see what is practical.

Aerodynamic centre and centre of gravity are first cousins. Recall that in ground school we were shown how a weight-and-balance is done:

From Wiki (edited):

Center of gravity (CG) is calculated as follows:

• Determine the weight and arm (distance back from the spinner) of each weight in the aircraft (engine, pilot, etc.).

• Multiply each weight by its arm to get a moment (leverage) for each.

• Add all these moments together to get a total moment.

• Divide this total moment by the total weight of the aircraft to give an overall arm. This result is the Centre of Gravity, the imaginary point at which we say the total weight would be concentrated if it were all at one place.

We can rewrite that almost word for word using "area" instead of "weight", and we get:

Aerodynamic Centre is calculated as follows:

• Determine the area and arm (distance back from the spinner) of each area in the aircraft (nose, elevator, stabilizer, etc.).

• Multiply each area by its arm to get a moment (leverage) for each.

• Add all these moments together to get a total moment.

• Divide this total moment by the total top view area of the aircraft to give an overall arm. This result is the Aerodynamic Centre, the imaginary point at which we say the total area would be concentrated if it were all at one place.

(The propeller also contributes to this top view area through its "prop normal" effect. This is so unpredictably variable that most textbooks ignore it, so we will too. Similarly, the fuselage is usually ignored because its effect is small and a fussy formula is needed to solve for it. Both these small variables are considered to be included in the 15% of wing chord discussed below.)

Clyde Cessna knew what he was doing 90 years ago

The farther aft of the c.g. this aerodynamic centre is, the more longitudinally stable the airplane. A designer's rule of thumb is that it often is about 15% of the wing chord aft of the c.g., from which it follows that broad wings need more stabilizing than narrow wings. This now brings us to the practical use of the aerodynamic centre: The careful pilot learns how far aft his aerodynamic centre is, therefore how longitudinally stable his aircraft is, thus how tolerant it is of aft loading with baggage and people.

An eye-ball, walk-around analysis of different aircraft can use this airman's rule of thumb: a long, skinny airplane with wing aspect ratios around six to one has its aerodynamic centre well aft and is tolerant of variable loading, while a short, stubby airplane is less so.

Clyde Cessna knew what he was doing 90 years ago, as witness the hundreds of 150-looking designs that have followed his lead!

Frank Gue B.Sc; MBA; P.Eng *is a Registered Professional Engineer living in Burlington. He is a published author on factory management, education, politics, and economics. He flies a C150, which he uses better to understand the theoretical basics of flight. He uses R/C models to test outrageous designs that would be too expensive for a human to test. One result is a patented hydrofoil landing gear for waterplanes.*

LETTER TO THE EDITOR

A response to "A response to Loners".

MEMBERSHIP IN ANY AVIATION ORGANIZATION does not, in and of itself, make for safer fliers. On this point I have to find myself agreeing with Mr Hane. HOWEVER – Membership in an association such as COPA, the EAA, or RAA most definitely makes it much more likely that a flier will avail himself of the accumulated wisdom and experience of the flying community at large – and definitely makes it much easier. Particularly with home-builders, the experience of those who have gone before can be invaluable, and the chance to bounce ideas off fellow builders in a familiar and non-threatening environment makes it much more likely that important questions will be asked – and serious insight gained. Sadly, there are several recent examples of builder/fliers who have, by their nature, been unwilling to avail themselves of this wealth of experience, even while being a member of such an organization, and by not either asking for or heeding the advice of their peers, have paid with their lives. Sadly, in some cases, the lives of innocents were also lost. Their names and experiences have made front page news, as well as the "life news" page of the local section of the newspaper. I hope not to find Mr Hane's name there before his time.

There is an old saying that is applicable to these situations –and although not "politically correct" I will put it forward for the collective readership of this magazine, membership of this organization, and fliers/builders at large. Taken from a quote by Otto Von Bismark – and expanded on by a wise man I had the pleasure to learn a lot from:

The smart man learns from his own mistakes, the wise man learns from the mistakes of others, and the fool never learns, because he "never makes mistakes".

Clare Snyder

Man Was Meant to Fly

Barry Meek

"If man was meant to fly, he'd have been born with wings". How many times have we heard that from a non pilot, or from someone who's afraid to fly? Even from someone who's afraid to admit he's afraid to fly.

Clearly, man WAS meant to fly. We also swim beneath the surface of the water without having to come up for air. We travel at warp speed, see in pitch dark, observe through walls and flesh, keep warm in sub zero temperatures, listen to sounds hundreds of miles in the distance. Pretty amazing considering we begin life as tiny, helpless, unseeing, soaking wet bundles requiring absolute and total care.

But more important, we were all born with a brain. The wonders of the human brain include its ability to form and shape thoughts, ideas, concepts, and to make decisions. Undoubtedly the most complex life form on earth, the brain is man's ticket to accomplishing all we do.

Emotions are formed there as well. Emotions called anger, love, pain, and excitement are all part of this highest form of life. Without emotions, there would be no one flying, or swimming, or traveling, or doing any of the things that enhance our lives. That's because we do all these for the excitement, the emotion they create in us.

Passion springs from the enjoyment and excitement of an activity. We hear that word, passion, so often when we talk about our leisure hours. Boredom is overcome by our passions, whatever they may be, from gardening to photography, writing to making wine, and of course by airplanes and flying them.

Orville and Wilber Wright were passionate about flight. We're lucky they were! But if it weren't for them, someone else would have taken up the cause, and in any case, there's no doubt we would still be flying today. The time for flying had come. There was enough knowledge around back then to accomplish it. All that was needed was the passion and excitement to put it all together.

Many wonder, "What's next. Where do we go from here?" The futurists have their own ideas, and there's nothing more interesting than a documentary featuring their forays into the years ahead. Aviation magazines are full of what's happening and what's coming for the future of flight. For many years, navigation aids like GPS platforms were featured and talked about by everyone. Then came the glass cockpit concepts, along with electronic engine and flight monitoring equipment. Advances in engine technology share the spotlight these days. Turbines and diesels, even electric motors may well be in our future in a big way.

In just over one hundred years, we've gone from the Wright brothers to supersonic airliners, vertical flight and space travel. Even with all this progress, when you remove the cowling from your general aviation airplane, you'll find technology that's over 50 years old. The engines in the largest portion of the GA fleet are still the old Continentals and Lycomings. It's like we've taken these giant steps forward, but with the other foot we've taken only baby steps. One side hasn't kept pace with the other. A good thing or a bad thing? That's really a separate question. Many pilots feel much safer behind one of these engines than something that's newer and not yet a proven design. On the other hand, it's been asked, "How can technology that's 40 or 50 years old be as reliable as something developed in the past few years?" With new materials and procedures, manufacturers should be capable of building an even better engine.

There is no doubt that aviation, like all technologies, will continue to change and advance. It may have slowed down a tad, reached somewhat of a plateau in the last few years, but there is evidence of it taking off again. There will always be people with a terrific passion for making things better, and that includes those in the field of aviation.

Photo Credit: George Gregory

As long as we have emotions like "passion" and "excitement", this progress will continue.

Bifold Hangar Door Tuneup

Gary Wolf

OPENING THE 50 FT WIDE door of my hangar has always been easy - just push the button and hold it until the door is at the desired height. Day in and day out this has worked for the past fifteen years until last week. The door was on its way up, about 4 feet, and there was a "whump" noise when one end of the door dropped a foot and jammed. A door this size weighs some 3000 pounds so the rest of the day was spent with a forklift and several friends, letting it down inch by inch.

The cause of the failure was a surprise. Many large bifold doors have an electric motor and reduction box at the centre of the lower edge, driving two line shafts that act as windlasses to pull the cables that lift the door. The gearbox has two output shafts, one for the left line shaft and the other for the right. The output shafts and the line shafts are keyed to take the rotation of the gearbox to the line shafts. The connection between the gearbox and the driveshafts is by keyed flanges that are bolted face to face.

The key and keyways are heavily loaded and in the case of my door one of the keys had come loose and got spit out, leaving one side's line shaft without drive, not a

Top: The door is lifted by lineshaft and cables, powered by a motor and worm gear box.
Above: The cable idler pulleys are usually stamped mild steel.

Top: This is the typical wear pattern from a key that is rocking. Note the radial crack emanating from the keyway.
Above: keyed flanges take the drive from the gearbox to the lineshafts

good situation.

The flange that had lost its key was removed and an inspection showed a crack down the length of the keyway. The flange has two grub screws, one to hold the key in place and the other at 90 degrees to take up any slack in the fit between the flange hub and the line shaft. An inspection of the keyway showed that the key had been rocking and had eroded the cast iron keyway material until it got loose enough to spit the key out.

The design of a keyed shaft and flange system assumes that the key is a perfect fit in both the shaft and the flange. In the real world the key can and will rock slightly, and when this happens it chews away at the key slots. In the case of my door the key finally got loose enough to pop out, and when that happened there was no drive to that side's lineshaft. I checked the door of another hangar and saw that the keyway in one of the flanges had widened by 25% and the key was no longer clocked in line with the keyway.

I ended up replacing the flanges with new items made from steel. Mild steel is 50,000 psi tensile while cast iron can be as low as 20,000 psi. I also replaced the keys with new items but one must be careful when buying keystock. Initially I went to Princess Auto but found that all of their ¼" keystock was.002-003" undersized when measured with a set of mikes, not with a caliper. Then I bought real keystock at a machine shop supply and it was bang on .250". There is no point in beginning with parts that are already loose enough to rock in the keyway. Everything was reassembled and the door resumed working.

The mechanics of a bifold door are interesting. When the door is first being opened the load on the keyway (and the cables) is the highest. Brampton member Al Girdvainis suggests that it is a good idea to reduce the initial load on a door by momentarily turning on the switch, and immediately shutting it off. The door will then tip out a foot at the bifold hinge line, and he then resumes lifting the door.

The cables are under a heavy initial load and they are most likely to fray in the first few inches. On my door each cable runs through a hole drilled in the flange. The cable goes through the hole, makes an abrupt 90 degree turn and then wraps around the windlass drum. Unfortunately the hole is as-drilled with no attempt made to radius its edges. Al Girdvainis suggests using a dremel tool to give the hole a radius to lessen the tendency of the cable to fray. If you decide to replace some parts head toTSC Stores or other farm supply. TSC

carries all the cable, clamps, and ferrules so you might as well shop there.

Some doors have an idler pulley attached to the header beam, with the cable running up from the windlass, around the pulley, and then back down to the base of the door. This gives a 2:1 ratio. The idler pulleys are usually just stamped steel with a low quality bearing, just balls running in the stamped steel halves. Every once in awhile I see one or two little steel balls on the floor and I know that it is time to replace that idler wheel. When I had first bought my hangar I did not know where the steel balls came from but eventually I found that a bearing had disintegrated, and the remains of the pulley were sawing through the 3/8" axle bolt. TSC Stores used to carry these pulleys but now they do not so you must chase them down on the internet or make your own. I had to do this one holiday weekend when the stores were closed so I turned one up from 4" steel bar and pressed in a real ball bearing. It has worked flawlessly for fifteen years but it is a lot quicker to buy extras and change as necessary – if you can find them.

While you are looking at your drive system you should also inspect the other loaded parts. The rollers at the bottom corners of the door bear against the front face of the hangar. When the door is shut there is no load on the rollers but as the door rises the roller load increases, and meanwhile the load on the gearbox and lineshaft is lessening. When the door is fully open there is very little load on the cables and most of the load is pressing the rollers against the I-beams. The rollers are sometimes sealed bearings and sometimes just plain steel rollers with bolts as axles. If the latter you should lubricate and check for wear. Motorcycle chain lube is a good lubricant for this.

CANADIAN OWNERS AND PILOTS ASSOCIATION

To: Nav Canada 6 Aprpil 2016
Subject: Notice of Consultation: Smithers 'TK' & 'YD' NDB

COPA National consulted with its SMEs regarding the decommissioning of the TK & YD NDB's

Facts:

• Smithers is a northern BC mountainous community that has a population 5400 with a rural catch area that increases this number.

• All serious medical issues are flown out by medevac. There are mountains in close proximity to 8603 feet.

• The departure procedures are based on an NDB track.

• There are 4 RNAV approaches and an NDB(DME)/NDB A approach.

Identified risks:

• If there is a GNSS failure of the system, the community would not have any IFR capability, particularly for emergency air services.

• In that there is a VOR in the vicinity, the enroute loss of the LF airways does not have as large an impact, but it is still a loss of existing facilities.

COPA believes that it would be a premature and possibly dangerous on the part of Nav Canada, to shut down these NDB's at Smithers for cost saving

In the event of unforeseen or catastrophic failure of the GNSS systems (due to natural phenomena, technical failures, or political influences), this would leave large portions of Canada and its isolated communities without redundant navigation aids.

COPA strongly suggests looking at developing a comprehensive national plan, in consultation with all the Canadian Associations, Transport Canada, Nav Canada and also the communities that rely on air transportation, not only for their day to day transportation needs, but also for emergency services.

In fact, in light of this Notice of consultation and the others of similar nature, COPA is asking for a moratorium on the decommissioning of traditional navigation aids, particularly at Northern and/or isolated sites similar to Smithers, until such time as there is a comprehensive long term plan relating to air navigation redundancy.

Please do not hesitate to contact me for further discussion.

Sincerely,
Bernard Gervais
President and CEO, COPA

Precipitation Near 0°Celsius

Karolina Utko

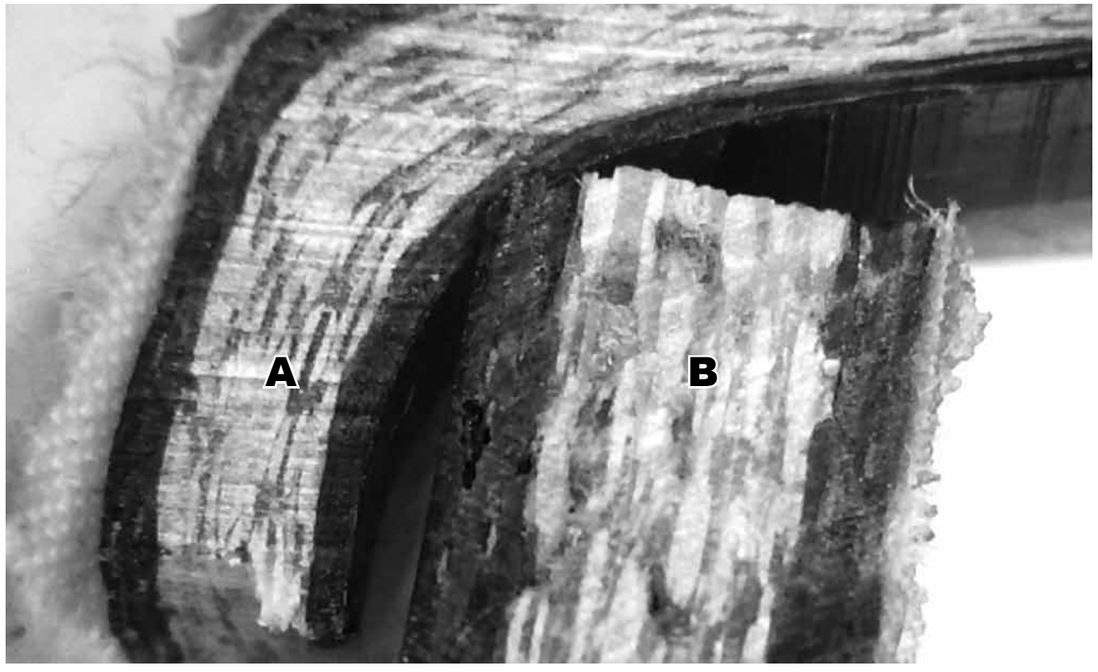
FOR THE LAST YEAR TWO YEARS I have been involved in a research study to analyze hazardous freezing precipitation from 1960 to 2012 over Prairie and Western Arctic Regions of Canada. The occurrence of freezing precipitation happens at every month of the year in Canada. With that said, in the warming climate, these hazards and associated impacts will continue to occur and it is important to understand past conditions to advance our understanding of their future likelihood. Freezing rain tends to occur as snow falls into an above-freezing inversion aloft where it melts before reaching the surface as supercooled drops. Freezing drizzle occurs through all-liquid processes within clouds at temperatures < 0°C. Ice pellets generally form if melting snowflakes fall back into a sub-freezing layer closer to the surface and have enough time to re-freeze before reaching the surface or melted snowflakes are nucleated in this sub-freezing later and are also able to freeze.

It is critical to assess when and where such precipitation occurs because of its hazardous impacts especially in aviation. Sounding analyses revealed differences in vertical atmospheric conditions associated with the different forms of freezing precipitation. Depths of melting and lower subfreezing layer were consistent with freezing precipitation profiles between 0-500m North of 60° latitude and 500-1000m South of 60° latitude. For pilots, this is important especially when flying into icing conditions on approach and final. Knowing where the inversion occurs through 0°C can help you avoid icing. Additionally, temperature differentiation can vary greatly on the ground but you can still receive icing in the air. Freezing precipitation was recorded at maximum temperature on ground of 9.6°C South of 60° latitude and minimum temperature of -15.8°C North of 60° latitude.

For those interested in further education in effects on aircraft icing I welcome you to take a free online course offered by NASA: http://aircrafticing.grc.nasa.gov

Strength and Vacuum Bagging

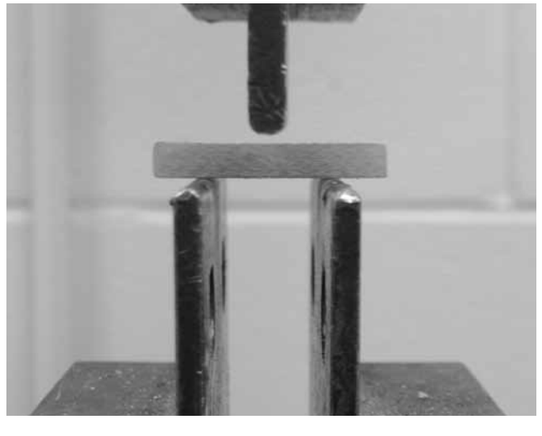
Making sure your vacuum bagged part is as strong as it's supposed to be / by JF Alexandre

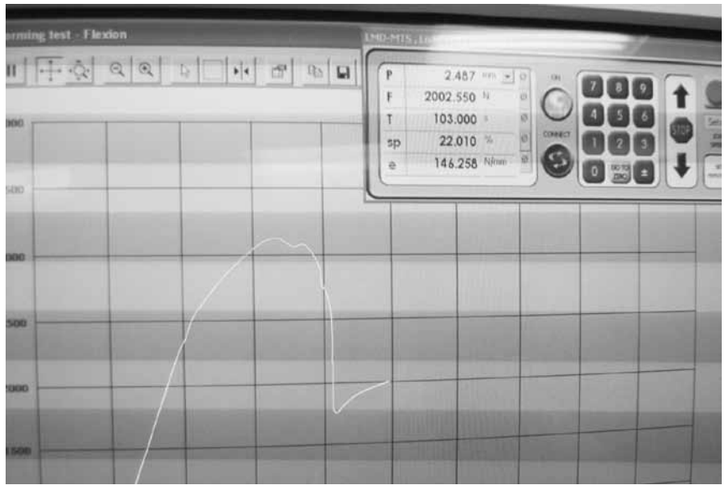


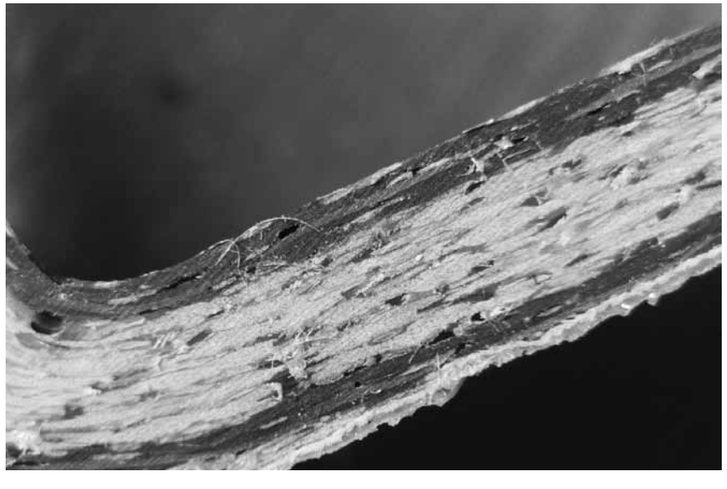
FROM MY EARLIER ARTICLE about composites, I will now deal with strength of a layup. From the photos, before you read the rest of the article, what can you really determine? Does B have more fibreglass and carbon than A, or does it have more resin in it?

In fact the way to determine the strength of the material is to test it. With the ASTM method you end up with accurate data that you can use to compare with its spec sheet. A builder can do the same at home but as the scale will be different, for most it will be useful just to compare one layup technique with another. You will still get valuable data with a simplified method.

The easier test is the ASTM D2333, which is a 3 point bend, that gives a good approximation of shear strength. The test coupon will have a length 10 times the material thickness and the width will be 5 times. This coupon should be cut out of a test sample using a wet tile cutting saw. You cannot use a hacksaw, bandsaw, or dremel - cutting the coupon dry will heat the resin and transform the edge into a glassy state that can easily be broken. This will not accurately represent the strength of your layup.







Opposite top: which one do you think is stronger? Both parts have the same layup with 2 carbons sandwiching 4 layers of glass. Opposite: a 3 point bend gives a good idea of the material's shear strength. Top: Testing showed the thicker sample, which actually had more resin (and therefore weighed more) was not as strong. Above, the thinner, lighter sample has more fibre in it and was nearly twice as strong as the thicker one. It had a higher fibre fraction.

With regard to fibre ratio, the more fibre you have the better.

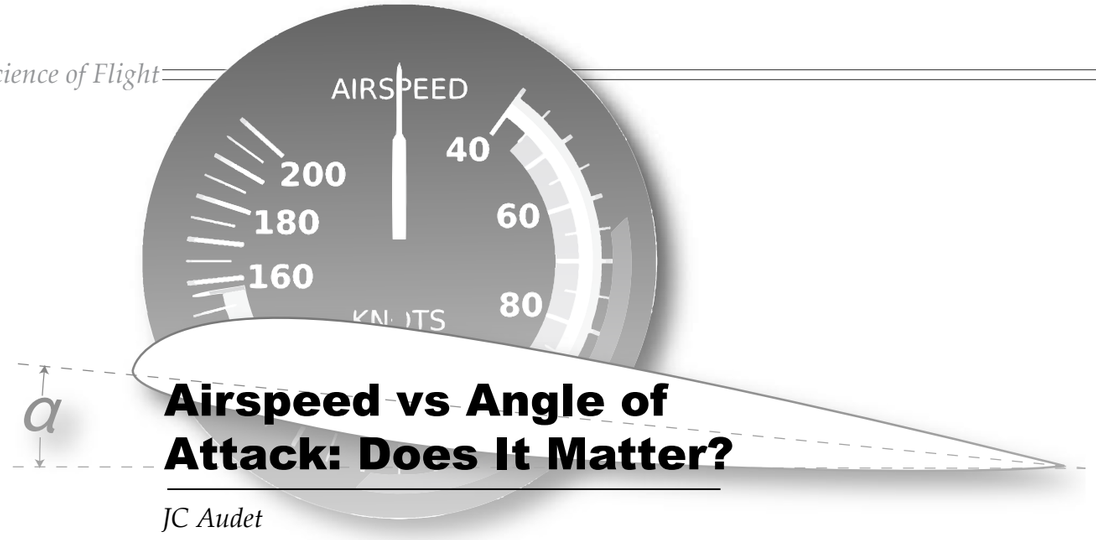
With just a simple setup you can compare an existing airplane layup and test to see how you can make your own the same strength, a kind if reverse engineering. You can use a load cell or a fish scale to pull at the centre of the part, using a lever arrangement to apply the load. Make sure you increase the load slowly and always at the same rate.

Back to our earlier question, both parts have the same layup with 2 carbons each side of 4 layers of glass. B is far heavier because it has more resin. On a short beam test the B part gave about 1290 N, but by being lighter and thinner the A part gave nearly 2000 N.

The reasonable explanation is that the fibre ratio (fibre fraction) is higher than A, and if you look closely at B you can see some air voids.

Both parts were made by infusion but the B part got an air leak into the bag during the cure, which dropped the vacuum level to around 15 inHg. The same part redone as A got a full cure at 29.96 in Hg with no leaks. We can conclude that while vacuum bagging is always better than nothing, a higher vacuum is always preferable.

With regard to fibre ratio, the more fibre you have the better. If you wish to have a part with good stiffness to resist deformation, as in the wing walk area, this will improve the resistance to buckling. A proper panel designed for this application would be even better, even if it ended up being the same thickness as B.



Airspeed vs Angle of Attack: Does It Matter?

JC Audet

DO I FLY AIRSPEED or angle of attack? Does it really matter? This topic of discussion has suddenly taken on much importance with the recent advent of the Angle Of Attack or AOA Indicator. You can look up Aircraft Spruce, or several other stores or aviation magazine to view the offerings and prices. One thing I got early in military flight training and never forgot is this:

Attitude + Power = Performance

The simple interpretation of this axiom is that if the pilot uses the appropriate aircraft attitude with a suitable power setting, the aircraft will do what the pilot wants. In practical terms, the attitude defines the airspeed and the power setting defines the altitude. And its corollary is Attitude – Power – Trim (APT) used for climbing (and PAT for descending). We were taught that to transition from normal cruise to a stabilized climb at a specific airspeed, the pilot first must set the attitude appropriate to the desired climbing airspeed and wait for the aircraft to settle at that airspeed. The aircraft will initially start climbing as it trades speed for altitude. When the desired climbing airspeed is achieved, the pilot must add power and finally trim out the aircraft. Remember we are talking small trainers here, not jet fighters, although the same concept still applies. As we gain experience, we all get to disregard this nice, carefully orchestrated technique and we just pull the nose up and apply power all in one motion, and eventually trim as we proceed to climb. The aim of this description is not to provide a lesson in flying but rather to draw attention to the relationship between airspeed and angle of attack "α" (Alpha from the Greek alphabet). I go back to the days when we had α, α Transducers, and α Indicators. Eventually, α was replaced by AOA (Angle Of Attack) in modern aircraft documentation. With the arrival of the F-18 in my world, I had to change to AOA, AOA Vanes, AOA Transducers, and AOA Indicators. I always suspected that the American design teams on the F-18 and the new generations of fighters had naturally all transitioned to the computer for their daily work and since the symbol α is not on the keyboard, they could not figure out where to get it, so here comes another acronym. Or maybe they just don't know about Greek.

Consciously or not, we always fly the AOA as this is what defines our speed. Granted, none of us thinks of selecting a particular AOA, we simply decide what speed we want to fly and set the nose (or AOA) accordingly. Then we set power as we need to control altitude. This is what we were all taught on our way to our private license and we all use, consciously or not, that technique in our flying today, because it works. We also learned about stalls, how to recognize them and how to properly recover from a stall. The major problem here is that most of us put that behind us once we have our license. This is sad as this is something that we should practice regularly for obvious reasons.

Lately, I happened to have several discussions on that latest cockpit gadget: the Angle Of Attack (AOA) indicator. The relevant marketing hype has convinced numerous pilots that this is an absolute requirement for safe flight. Granted, this AOA indicator will give you good reliable information on how your angle of attack is doing. This, of course, is true, providing it is a good design and it has been properly installed. And this information is useful providing you know what to do with it. We all learned to climb at a given airspeed, we cruise at predetermined airspeed, and we approach and land at specific speeds. And we also stall at a given airspeed, an airspeed which varies depending on the weight of the aircraft and the maneuvering we are performing, like a high bank angle for instance. Well guess what: all those speeds are directly dependent on the angle of attack we are using at any particular moment. But we stall at the Critical Angle of Attack which is constant for the particular wing section you have on your aircraft, regardless of weight or maneuvering, because it is part of the design of that wing section. From a practical perspective, we all fly according to the speed shown on the ASI because this is what we learned, this is the instrument we all have, it is meaningful, and it is easy to interpret. But in fact, we are flying the angle of attack which defines our speed as shown on the ASI. In other words, we all have sort of an AOA indicator via the ASI. If you fly any type of small/light aircraft, I would strongly suggest that you invest time in knowing your aircraft very well, in understanding its capabilities and features, and above all, in understanding the behavior of your aircraft leading up to stalls, including accelerated stalls. I definitely recommend that under these circumstances, your eyes should be outside with a regular look at your ASI, instead of monitoring a small display about AOA.

Consciously or not, we always fly the AOA as this is what defines our speed.

So what is the purpose of another thing to look at on the panel and be concerned with? Well, if most of your flying involves high load factors, extreme maneuvering, or high bank angles with heavy loads, one of these AOA indicators might be useful. If you are flying a heavy transport aircraft, or a fighter, the AOA is probably necessary. These larger heavier aircraft, particularly fighters, have been using these AOA indicators for a long time. Their pilots also rely on their ASI for all aspects of their flying, except typically when they come in for landing. In order to slow down, they have to increase the angle attack as confirmed by their ASI. These aircraft are large and heavy (airliners) or have a small thin wing designed for extreme high speeds (fighter) and they do not like slow flight. Due to their weight or configuration, their moment of inertia takes over quite rapidly (more so with a fighter) and getting too close to the Critical Angle of Attack can quickly lead to an unrecoverable situation which could prove to be catastrophic when close to the ground. Thus, in many of these aircraft, the pilot needs more than just the ASI, hence the importance of the AOA indicator.

The AOA indicator for small aircraft is not a bad thing in and by itself. The avionics industry, in its constant need for generating more revenues, is expertly marketing this device, as an absolutely necessary safety item. Each owner/pilot is responsible to decide if his/her airplane needs this instrument and again, I respect that choice. I would prefer to see this pilot invest more time in knowing and understanding his/her airplane, particularly at the edge of its flight envelope, where the wing is approaching the critical angle of attack. I honestly feel this would be a much better insurance policy.

JC Audet *has a MSc in Physics and BEducation and is a former military pilot also qualified as an Aerospace Engineer. He has worked for Bombardier Aerospace, Fairchild-Dornier and worked with Israeli Aircraft Industries in Tel-Aviv. Upon returning to Canada, JC did some consulting work with the Air Force and Transport Canada before accepting the responsibilities of Program Manager and System Engineering Manager with CAE in Montreal. He later formed his own company to design, test, and certify special purpose aircraft modifications. JC is currently the Chief Flight Operations and Chief Test Pilot at CMC Electronics, a manufacturer of communication and navigation equipment for airline and the military transport aircraft. He holds an Airline Transport Pilot License and has accumulated more than 1000 flying hours as a Flight Instructor.*

Riveted Joints

by Chris Heintz

as printed in the Slipstream Newsletter

I was researching some rivet information for my Sonex, when I came upon a good article by Chris Heintz. I have included the first part in this issue, the second part will be in the May issue, I hope you find it useful. – Slipstream Ed.

AIRCRAFT RAW MATERIALS come in different but limited sizes due to manufacturing limitations as well as economical distribution. The designer has to choose materials which are available, can be transported to the manufacturing facility (even the homebuilder's basement or garage), can be cut to required sizes with the minimum tools, and can be handled without causing too many rejects due to mishandling ... and still end up with an aircraft of appreciable size, adequate strength and good looks. Aircraft can't just be made out of one big sheet of material and "wrapped together." Rather, various parts have to be formed out of different types of material and joined together. Each of those parts carries a load and the fastener that brings these parts together has to carry the load from one part to the other. If we have, for example, 1,000 lbs. to be carried over from one skin to another, we can choose various ways of achieving this (see figure 1).

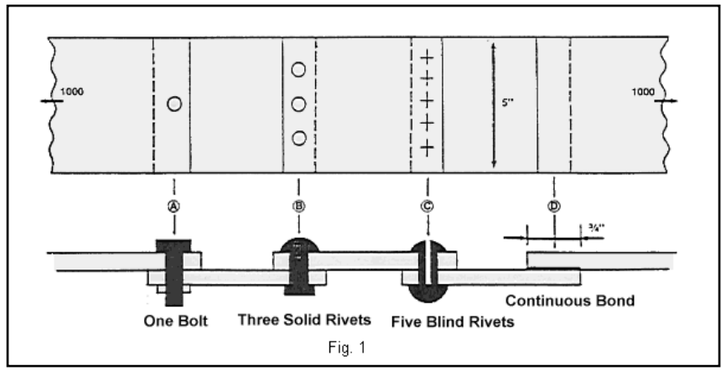


Fig. 1

The designer of an aircraft chooses the solutions best adapted to the materials used - a continuous joint with wood and composites, a single bolt or heavy (thick) fittings with steel; or riveted joints on relatively light gauge materials and/or when the joints are long (to avoid the weight penalty of many steel bolts).

For over 50 years, riveted aluminum structures have been very successful, and are found to varying degrees on virtually all aircraft (whether the complete airframe or just an instrument panel). They do not fail under static or repeated loads and they do not corrode if the rivets are well chosen and properly set.

How to set the rivets correctly can be learned quite easily and should be explained by the designer when he sells drawings or kits to build an aluminum aircraft. The choice of rivets is very simple: only 2017 alloy rivets are commercially readily available (these are the "AD" rivets mentioned in earlier columns). They have good corrosion resistance and are compatible with 2024 and 6061 materials.

Now, let's look at why they are also a good structural fastener. (See figure 2). First the hole is drilled slightly oversized (via the use of number drills) so that the rivet can easily be introduced after deburring (see Figure 2, item E).

Note that the drawing also indicates correct rivet size depending on the total metal thickness, called the "grip'. Then the rivet is squeezed (compression is achieved by a rivet 'gun" and a "bucking bar". The pneumatic gun hammers on one side while the bucking bar, which is simply a heavy chunk of steel, provides the reaction on the other.)

When the rivet shank is compressed, its diameter grows until the hole is completely filled. (See Figure 2, item F). When we further compress the rivet it can only grow further outside the hole and thus the formed head is shaped (see Figure 2, item G), which also gives a correct formed head dimension. Note that a visual inspection of the rivet will immediately tell you if the rivet is good or if it has to be drilled out and replaced.

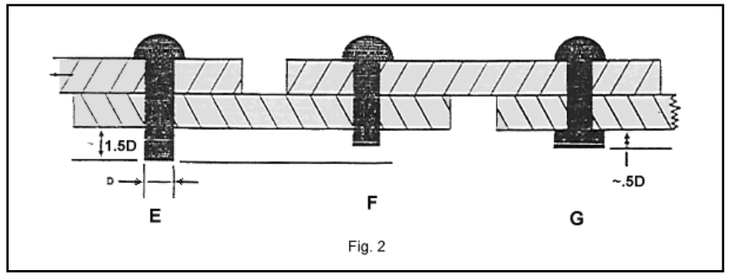


Fig. 2

Such easy inspection is obviously not possible on a bonded or glued joint, which can cause such joints to be less reliable.

Next, let's look at what makes the set rivet (AD rivet) a good fastener.

1. First, AD rivets are manufactured with adequate quality control which guarantees you the correct alloy (when you mix bonding cement or resins. you are responsible!)

2. The rivet fills the hole completely so that no relative motion is possible.

3. The original as well as the formed head both rest both very well and the parts having been compressed into place. This makes for a snug and sealed joint which will prevent any water from creeping under the heads and corroding underneath.

Also very important is the fact that the heads squeeze assembled parts tightly together and when the loads are applied (see arrows on Figure 2), part of the load is transmitted from one sheet to the other by friction. It just happens in aircraft (this is not the case with racing cars) that the part of the load transmitted by friction corresponds to the high frequency engine loads which would otherwise fatigue the rivet (or require an overdesign of the rivet joint which is done in racing cars where the engine vibration loads are much larger with respect to the static loads). As mentioned, solid riveting when correctly done is an excellent fastener - both reliable and durable. But it also has some drawbacks:

1. You need special equipment (you'll need to buy an air compressor, rivet gun(s), rivet snaps and bucking bars);

2. You need some expertise and prior practice (you'll need a good teacher for this - errors can be costly in more ways than one);

3. It is noisy (your family and neighbors may object to your setting rivets in your basement or garage after 10 p.m. or on Sunday morning . . . and that is just when you have the time for it);

4. You need access to both sides of the parts to be assembled (and this is obviously not always easy or possible: How will you get the bucking bar inside an aileron of a small aircraft?). You'll often need a helper to "buck" the rivet on the other side, or have long skinny arms and/or a full assortment of bucking bars.

So another solution has been devised - blind rivets, which have none of the above-mentioned disadvantages. Blind rivets, often incorrectly referred to as "pop" rivets, have been used on aircraft since the production of the DC-3 (the tubular 'Chobert' rivets). In the next article we will discuss the good and also the questionable qualities of blind rivets in more detail.

***Chris Heintz** is the designer of numerous homebuilt and kit plane designs and was involved with the design of the Concorde. In 1999 he was inducted into EAA's Hall of Fame.*

Gustavo Corujo photo.

Comco's Affordable Fly-Away Comes to Canada

Comco Ikarus 2

EUROPE'S MOST POPULAR light plane has landed in Canada. The German-manufactured Comco Ikarus is the most popular light plane in Europe with thousands sold since 1995, and it is now available from Sportplane Inc. of Brantford Ontario. .

In Germany the design standards are very strict, with a maximum gross weight of 990 pounds, so to be able to carry two full sized adults requires a competent designer and careful fabrication methods. Designer Hans Gygax had already designed a full range of ultralight aircraft when twenty years ago he came forth with his Ikarus. He wanted a real airplane that would use the Rotax 912 series engines to advantage, and the plane had to be roomy, quiet, and quick, with landing gear robust enough that European flight schools could use it from grass strips. Twenty years later, it is fair to say that he has achieved his goal. The Ikarus dealer network now spans the globe, from China, Russia, Europe, and the UK, to South Africa, Brazil, and now Canada.

For many pilots who want what boaters would call a "daysailer," the magic combination is two comfortable seats, an easy100 mph cruise, and four gallons per hour. In the fifties there were many planes that purported to achieve this but there were always compromises. First off people were skinny back then and fuel was cheap. A 39" wide Cessna 150 cockpit was adequate, 95 mph was close enough, and 4-1/2 gph of 100LL was affordable. The world is much different now. Few pilots weigh 175 pounds, and 100LL costs $8.00 per gallon (plus HST) so a two hour flight in a Cessna 150 means that the passenger will probably be scrunched against his door while the old Continental noisily burns up nearly $80.

Left, two tubes brace the top corners of the bulkhead to the boom tube, with a bellcrank for the elevator pushrods mounted between. The battery is at the far end - its weight and position are critical for weight and balance. Right, the fabricated cross member and the 8" boom tube are the main fuselage structure

By comparison the Ikarus C42 more than meets the daysailer requirement. The cockpit is 48" wide and it will cruise happily and quietly at over 100 mph, while burning under 4 gph of auto fuel that currently sells for less than five dollars per gallon.

The Wing

The construction of the Ikarus wing pays great attention to weight saving. The wing is a tubular aluminum ladder with three compression struts at the root, the tip, and at the lift strut attach point. The wing covering is a sewn sock made from a Kevlar/polyester/mylar woven fabric that is used on the Goodyear Blimp. At each rib station are upper and lower chordwise sewn pockets into which are fitted formed aluminum tubes. These have thermoplastic end fittings that locate the rib tubes against the large diameter spars. There are no vertical or diagonal members joining the upper and lower ribs, just the shrunk in place fabric to hold everything together. Zippers near the wingtips quickly allow an inspection of the structure and the aileron pushrods and bellcranks.

By itself a ladder wing has little torsional rigidity so each wing has a V lift strut with jury struts. I had expected that in flight the wing might have been flexible but even at 120 mph it was rigid. The 31 ft. span wing has a 2412 semi symmetrical airfoil with 135 square feet of area, and a chord of 52". The resulting 7:1 aspect ratio and the clean airfoil combine to give an 11:1 glide ratio.

The flaps and ailerons have large diameter tubes as their leading edges, and small diameter tubes as ribs and perimeter. Hinged on clevises, these controls are covered in the same fabric as the wings, and at the gaps the wing skin and aileron/flap skins meet in a line of Velcro to provide a perfect gap seal. The flap leading edge tubes meet at the centerline of the aircraft and are directly actuated by a servo acting on the bellcrank.

Comco Ikarus offers a wing fold option but it is the type that has a stub spar, allowing the wings to be unbolted and rotated to be positioned alongside the fuselage. This almost the same work as removing the wings, but it saves the need for wing racks on the trailer or in the hangar. In this country where hangarage is usually affordable this type of wing fold has little advantage, so the test plane did not have the option of folding.

The Fuselage

The real genius of the Ikarus is the simple (patented) fuselage design, made possible by the light weight of the wings.

Although the plane looks as if it has a composite fuselage, what you see does not handle any of the flight or landing loads. The actual structure is an 8 inch diameter aluminum tube that runs from the engine to the tailpost, with all loads fed into this

Gap seals are by overlapped velcroed fabric, simple and effective

tube. The engine mount attaches to it at the north end and the tail attaches to it at the south. Immediately behind the seats is a formed aluminum crossmember that has a half round cutout, and this is firmly fastened to the fuselage tube. The landing gear pivots from the centre of this crossmember and the suspension and lift strut loads are fed into the crossmember's ends.

Attached to the top of the crossmember is a trapezoidal bulkhead built from aluminum tubes, with a diagonal tube to give lateral rigidity. Both the bulkhead and the crossmember are braced by four triangulating tubes that fasten to the 8" fuselage tube well down its length.

The top corners of the trapezoid are the attach points for the rear spars. A triangular structure made from steel runs forward from the top of the bulkhead to meet the front wing spars at the centerline of aircraft. This triangle is braced

Although the plane looks as if it has a composite fuselage, what you see does not handle any of the flight or landing loads.

vertically by a 2" tube that runs down to the 8" fuselage tube.

Tail

The empennage is framed in bent aluminum tubing and covered in the same fabric as the wing, with a velcroed line as gap seal. The vertical fin is braced to the stab by a pair of streamlined tubes, and the rudder is actuated by cables, while the elevator operates by a pushrod with a rod bearing at the horn. The rudder has a small fixed trim tab while the elevator has a hinged tab actuated by a servo.

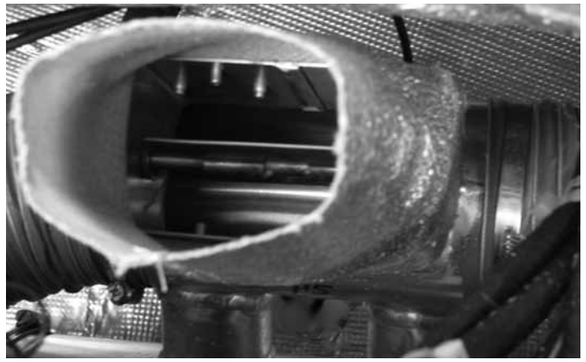
Landing Gear

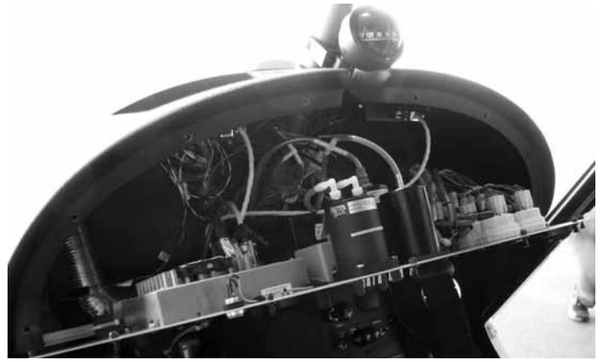
The tricycle landing gear is very light, with swing arms made of aluminum, pivoting from the bottom of the 8" fuselage tube. Fore and aft location is by trailing arms, also pivoting from the centre of the fuselage tube, and suspension is by air pressure oleos. A plane that meets the German 990 pound category requirements must pay great attention to the weight of its components. A spring aluminum gear would be cleaner but a lot heavier, and with the attention Ikarus gives to fairing everything there is little drag penalty. The track of the main gear 63", reasonable for a plane that has a low landing speed. Brakes are hydraulic on the main gear, both actuated by one motorcycle lever on the control stick, and the wheels are 4.00 x 5 with Swedish Trelleborg tires.

Firewall Forward

The engine compartment and cowlings of the Ikarus are well engineered. Most light aircraft in this category use the Rotax 912 series engines, and the water and oil hoses tend to provide a lot of clutter. There is only so much that can be done to clean this up but Comco has dispensed with

The tail components are made from aluminum tube, visible through the fabric. Battery access is through the removable panel on the right hand side. Centre, a Rotax engine compartment is always busy, this one slight less so because of the oil/water heat exchanger. Bottom, The inset panel allows good sightlines while landing, with space for all necessary VFR instruments





Two stainless tubes feed hot air from the muff to the plenum. A butterfly spans the oval cold air intake to determine whether the engine will receive cold or hot air.
The panel hinges down for full access without any gymnastics Below, three steel tubes converge at the junction of the front spars, with a vertical tube running down to the 8" fuselage tube

the oil cooler and instead uses a heat exchanger so that the water rad also cools the oil, resulting in oil and water temperatures that move in unison. The rad is front and centre in a duct that keeps the temperatures in the green, even in climb, and a cable actuated butterfly can be used to block airflow on cold days.

The Ikarus has a particularly quiet exhaust system that employs a large volume silencer canister behind the engine, with a tailpipe exiting at the lower right corner of the cowling. Germany has very strict noise standards and the result is a low pitched exhaust that will offend no one. The standard is so tight that in Europe even a change of propeller or its pitch must prove conformity with the regulation. To say that the Ikarus is quiet is an understatement.

Surrounding the stainless silencer canister is a heat muff that feeds heated air to the intake air tract. A NACA duct on the top of the cowling feeds ambient air to a butterfly-controlled plenum that has two Scat hoses, one leading to each carburetor. The carbs always receive some heat from the muff but it is largely diluted by the incoming ambient air. Closing the intake plenum's butterfly results in the engine receiving only the hot air from the heat muff, a very effective and simple way of handling the issue of carb heat.

The composite cowlings are smooth and well fitted, shrink wrapped around the 912S engine, with quick camloc fasteners to remove the top section. A small door allows a check of coolant and oil before every flight without having to remove the cowling.

Cabin

The cabin is spacious and comfort-

March - April 2016

Feature

Left: The trapezoidal bulkhead with a diagonal tube take the wracking loads to the crossmember. Above: The elevator pushrod has rod bearings throughout. The bluff rear end of the fuselage is necessitated by the 8" diameter boom tube.

able, with good headroom. A six footer fits perfectly, with six or seven inches of space above his head. Neither the pedals or the seats are adjustable but even a 6'3" pilot has adequate legroom, and a pilot under 5'9" can place a cushion behind his back. The centre stick is well placed, and as well as the brake lever it holds the elevator trim switch and the PTT. The wraparound lexan windshield drops well down on the fuselage side with good sightlines at the edges, for a better view of the ground when landing. Because the fiberglass bodywork is non structural the doorposts are not the cabanes, so they can be very slim. The curved doors are top hinged with air spring cylinders to hold them open. The large side windows and two oval roof windows provide good sightlines in the circuit without the heat that comes with a completely clear cabin top. The cabin temperature is regulated by two fresh air vents and an effective muff heater. The test flight was on a 50F day and we were comfortable, even when at altitude.

Getting in and out of the Ikarus is made easy by the large door cutout and the fact that the lift struts attach behind the seats. This is not one of those planes that require the pilot to reach down to pull up his foot, while his knee is against his ear. The high back seats are fiberglass covered in black material, with well shaped cushions, and the padded central armrest provides a comfortable arm position for flight.

Behind the seats is a padded fabric bulkhead cover with a Velcro release to gain limited access to the luggage area. There is also some storage available under the seats, and a laptop fits easily. The two throttle levers have hinged shafts so that they may be lowered while getting in and out of the plane, and so that a passenger will not inadvertently take control. The test plane had the optional electric flap actuator that has an unusual feature. There are three positions, and if the pilot lowers the flaps below the allowable airspeed the indicator light flashes and the flap automatically retracts to the previous position. Manual flaps with an overhead actuator are standard but the electric one is so much nicer.

The panel is low for good sightlines over the nose, and large enough to hold everything necessary for day VFR. Analogue instruments are standard but the test plane added a Dynon Skyview that provided much more. Even with that there is extra space for pilots who want more toys. One nice feature is that the panel is bottom hinged and lies down flat for inspections and maintenance – no need to get upside down in the hellhole at annual time. All controls are readily accessible from either seat.

Behind the cabin is the luggage compartment, accessible by removing the left side panel. While there is a lot of space and enough payload for suitcases, there is no dedicated place for them. Some sort of floor with a net or a box would make the luggage space more useful for trips.

Immediately behind the passenger seat is a 65 litre clear polyethylene fuel tank. This is behind the CG but it is so close that it has little effect. The battery is at the tail and it has a lot of effect on CG, so when it needs replacement the owner must ensure that the new one is the same weight, or else take steps to correct the CG. A removable panel in the top of the tailcone can be used for the ballistic parachute that keeps wives happy, but this plane preferred to be flown by its pilot.

With its fuel burn of under 4 gph the Ikarus has a range of 400 miles, and fillups with mogas cost less than half of what the Cessna owner was paying.

The Test Flight

After the usual walkaround and fluid checks the usual next step with a Rotax is to ensure that the mags are off and then hand prop half a dozen blades to chase the oil from the crankcase to the remote sump. We climbed in and the engine started immediately and I remarked how quiet it was, a combination of the effective engine silencer and the three blade 68" Warp Drive prop.

The takeoff roll was brief, perhaps 300 ft, surprising because we had 90 pounds of fuel and two 200 pound crew, plus a laptop and camera. There was still enough payload for over 50 pounds of luggage.

We rotated at 50 mph and then maintained 5000 rpms for a 75 mph climb in the zone. Once out of the zone we increased the climb angle to maintain a 66 mph airspeed and a solid 1000 fpm rate of climb.

Cruise at 4200 rpms was 92 mph, and at 4800 rpms it was 104 mph, a very relaxed rpm for a 912S Rotax. Increasing to 5000 rpms raised the cruise to 110 mph. (By comparison a 701 with the same crew needs that rpm to maintain level flight at 70-75 mph.) Top speed at 5400 rpms was just over 120 mph. (Vne is 138 mph) We then reduced rpms to just above idle and raised the nose for a stall but it never broke – all we could get was a mush and a resumption of level flight.

The stick forces were light to moderate, not twitchy but light enough not to be fatiguing. Roll and pitch stick forces were equal and the plane showed positive stability in both axes. (This is a requirement for AULA but some manufacturers ignore it.) There was no noticeable adverse yaw and with feet flat on the floor the ball got only half out of the cage. The electric trim worked well and it was possible to maintain altitude or to produce a consistent cruise climb or descent using only trim. The rudder had good authority, and a cross control produced an impressive rate of descent. In level flight it was possible to leave the stick alone and fly on rudder - the rudder induces roll so with trim and rudder the plane flew well enough to leave the hands free for map work (remember maps?) or checking the CFS. The British authorities require that a light plane be controllable with one major control disabled, and the Ikarus meets their requirement handily.

Returning to the circuit we reduced rpms to 4200 and 92 mph. On base we were at 3600 rpms and 75 mph. losing 300 fpm. Dropping the flaps one notch at 68 mph increased the descent another 300 fpm. We tried the second notch but we were too hot so the flap load sensor prevented this and returned to the first notch, while admonishing us with a flashing red light.

Over the fence the airspeed was 65 mph and the touchdown was at 44 mph. With the low cowl line and the sightlines between the panel and the windshield there was no problem with seeing the runway. We could have landed slower but at this speed the rollout was only a few hundred feet so why bother?

I was impressed by the performance and the cross country capabilities of the Ikarus. The importer and a friend made a trip to PEI last summer in company of a four seat Cessna.

the Ikarus is perfect for a pilot who waited until his fifties or sixties to get a license, and does not want to spend a couple of years building a plane.

They cruised at the same speed and the Ikarus crew was more comfortable because of its quiet cabin. With its fuel burn of under 4 gph the Ikarus has a range of 400 miles, and fillups with mogas cost less than half of what the Cessna owner was paying.

In this country the Ikarus is registered in the Advanced Ultralight (AULA) category. The category limit is 1232 pounds and the Ikarus with its 1180 pound gross fits in nicely. With an empty weight of 630 pounds there are 550 pounds for crew, fuel, luggage, and odds and ends. This is a very useful plane and it has the advantage that it can be flown on the PP-UL Ultralight Permit with a self declared Class 4 medical, albeit without a passenger. If the PP-UL holder takes extra training for a passenger endorsement and gets a doctor to sign his medical he can then take his Granny for rides. Current Rec Permit and Private pilots can of course fly this plane with a passenger.

Besides appealing to a graduating Ultralight pilot, the Ikarus is perfect for a pilot who waited until his fifties or sixties to get a license, and does not want to spend a couple of years building a plane. In this country the Ikarus comes fully built with only the wings and tail to bolt on. The plane is ready to fly the same day it is unpacked. The current price is $85K CDN plus about $4K for shipping from Germany to Brantford Ontario where Sportplane Inc. has its headquarters. At first gasp the price might seem high but if you look around you will find that new 2 stroke around-the-patch ultralights can cost two-thirds that price, and a factory assembled 912S Kitfox will cost $125K US. Even a quickbuild Sonex with a VW conversion will approach $65K CDN and you still have to spend a year or more doing assembly and fitting, then panel and paint. This is what it costs in the real world these days.

The Ikarus is an engineered and factory built real airplane that has great flight qualities and useful cross country capabilities. There is a good reason that in Germany it was the best selling aircraft of 2015.

Contacts:
Ikarus Flight Centre 416-712-5399 519-222-7368
info@sportplaneinc.ca
www.ikarus.ca

With the wide doorway and the rear mounted lift strut, even an old curmudgeon can get in and out easily.

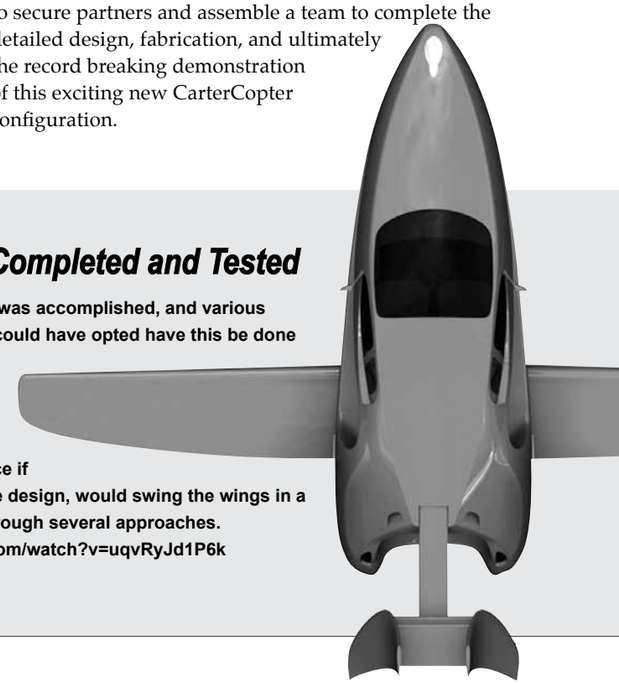
CARTER AVIATION ANNOUNCES RECORD BREAKING CARTERCOPTER

April 8, 2016 (Wichita Falls, Texas) – Carter Aviation Technologies, LLC (Carter) is moving forward with securing partners to begin production of CarterCopters at a variety of size classes. In the meantime, Carter has developed a configuration that can break the rotorcraft world records for speed, range, and altitude – records that have been unbroken for half a century. "We had this concept on the boards for several years and decided it was time to move forward," explained Jay Carter. "We expect to achieve speeds in excess of 400 kts, distances greater than 2,000 nm, and altitudes of over 50,000 ft." To achieve this performance, Carter will employ **two Honeywell TFE731-20 turbofans** coupled with its Slowed Rotor / Compound (SR/CTM) technologies. The installed power from these turbofans will also give the aircraft the ability to break the time to climb record for rotorcraft.

This configuration will make an ideal VTOL Business Jet that could provide point to point transportation for up to 6 passengers and cruise at 400+ kts for up to 2,000 miles. Carter envisions this aircraft once demonstrated will open up other possibilities for other variants both larger and smaller with different mission profiles – downtown city to city transportation, point to point cargo and humanitarian support for developed as well as undeveloped countries, Medevac, UAVs, diesel powered SR/C aircraft driving Carter scimitar props for extreme efficiencies, etc.

"Our slowed rotor technology allows the aircraft to fly at 525 mph (450 kts) without the rotor advancing tip speed exceeding Mach 0.95," pronounces Jay. "The slowed rotor (no variable speed transmission required) reduces the rotational drag so dramatically that the rotor drag becomes only about 10% of the total aircraft drag – basically a function of the rotor wetted area." This drag reduction is a function of the rpm ratio cubed – dropping the rotor rpm from 300 to 100 reduces the rotational drag by a factor of 27. Carter intends to demonstrate not only record breaking performance, but also continue to demonstrate other critical features such as unparalleled safety with an auto-rotating high inertia rotor that acts as a built in parachute that can operate at any altitude or speed and extremely quiet cruise flight performance, something lacking at various levels in today's conventional rotorcraft fleet.

"Everyone likes the idea of high speed and long range with exceptional cruise efficiencies, but one of the little known features of a CarterCopter is ride quality in cruise flight," described Jay. "With a tall tilting mast supported with flexible supports, the rotor loads are essentially isolated from the fuselage. What this means to the crew and passengers is a jet smooth ride, which is dramatically improved over today's helicopters." Carter is now formulating business plans to secure partners and assemble a team to complete the detailed design, fabrication, and ultimately the record breaking demonstration of this exciting new CarterCopter configuration.



Roadable Aircraft News

Switchblade Wing Stowage Mechanism Completed and Tested

The testing and perfecting of the powered wing swing mechanism was accomplished, and various videos have been posted about it on YouTube and Face Book. We could have opted have this be done manually, but since the tail will be moved electrically, we wanted to provide the same for the wings. It really does make things easier, and James Bond would have wanted it that way.
There was quite a bit more to perfecting the wing swing than simply hooking it up and turning the switch. It would have been nice if it were that easy, but to produce something that employed a simple design, would swing the wings in a reliable manner, and would be easy to maintain, we had to work through several approaches.
A video of the mechanism can be viewed at https://www.youtube.com/watch?v=uqvRyJd1P6k

George Neal, 97, Pioneer Airman, Passes Away in Toronto

APRIL 6, 2016 It was with great sadness that Canada's Aviation Hall of Fame learned of the passing of George Arthur Neal, peacefully on April 4, 2016 in North York, Ontario, at the home where he was born and lived all his life. Born on November 21, 1918, George was the son of the late John and Kate (Dennis) Neal. He is survived by his sisters Evelyn LoPatriello and Doris Mundinger and many nieces and nephews. He is predeceased by siblings Kathleen Neal, (2007) and John Neal (1994).

"We have lost a pioneer in Canadian aviation," said Tom Appleton, Chairman of Canada's Aviation Hall of Fame. "On behalf of the Hall, we extend our most sincere condolences to George Neal's family and friends."

George was the winner in 1989 of Canada's most prestigious aviation award, the Trans-Canada (McKee) Trophy, and inducted as a Member of Canada's Aviation Hall of Fame in 1995 at a ceremony held in Edmonton, Alberta.

Neal learned to fly at the Toronto Flying Club in 1935 and earned his Private Pilot's License in 1936. From 1937 to 1941 he was employed at de Havilland Aircraft of Canada (DHC). In 1941 he enlisted in the Royal Canadian Air Force (RCAF) and was posted to No. 10 Air Observers School in Chatham, New Brunswick, where he became a Flight Commander, Chief Test Pilot and Assistant Maintenance Superintendent.

In 1946 he rejoined DHC where he would be employed for the next 37 years. His first job was in the engine shop, and in 1947 he was transferred to the flying staff as a full time pilot and took over the development testing of the new DHC-1 Chipmunk trainer. He became Chief Test Pilot in 1948 and, with the introduction of the British de Havilland Vampire jet into service in the RCAF, Neal became one of the first civilian pilots in Canada to become jet qualified. He did a considerable amount of demonstration and development testing of this aircraft across the country and the world.

The flight testing of the DHC-2 Beaver, first flown by Russ Bannock, was completed by Neal in 1948. This included the certification testing required to obtain a Civil Type Approval. His convincing demonstration of the short take-off and landing (STOL) features of the Beaver led to sales throughout the world, and has become one of the most famous Canadian aircraft.

On December 12, 1951, he piloted the first flight of the DHC-3 Otter, and over the next two years undertook the testing necessary for certification in the original land-plane configuration, and later in the float and ski-plane versions.

The first flight of the prototype Caribou was flown by Neal on July 30, 1958. Toward the end of the Caribou test program, during high speed trials, a modified version developed aerodynamic flutter. After the loss of part of the tail surface, it became unmanageable, and Neal and the accompanying Department of Transport test pilot were forced to abandon the aircraft. Neal's attention to detail before he bailed out prevented fire following the crash, and enabled a clear study of the cause of the flutter.

In the 1950s he procured a copy of the original drawings for the Sop-with Pup Great War fighter and built an award-winning flying replica of the aircraft, now on display at the Canada Aviation & Space Museum, at Rockcliffe Airport in Ottawa.

Neal was Chief Pilot for the National Aviation Museum until 1991, when their program of flying the vintage aircraft collection ended. He flew the Sopwith Pup, Avro 504K, and Nieuport 17, which are in the museum's collection, and rebuilt a Hawker Hind for the museum. He accumulated more than 15,000 hours on over 100 different aircraft types during his lifelong passion for aviation.

In 1999, George was commemorated by the Royal Canadian Mint, with a $20.00 coin with his profile and the DHC-6 Twin Otter on the reverse and the Queen on the obverse.

George continued flying until 2015, when he flew his personal DHC-1 Chipmunk from Brampton Airport in Toronto, for display at the 43rd Annual Induction Gala of Canada's Aviation Hall of Fame. This flight was recorded and earned George recognition by Guinness World Records as the oldest active licensed pilot, and flying his own aircraft at 96 years and 194 days as of June 2, 2015.

At George's request he has been cremated and a private family internment has taken place at Westminster Cemetery. A memorial service is being organized with the help of volunteers from Canada's Aviation Hall of Fame.

Messages and memories may be sent to memoriesgeorgeneal@gmail.com. FMI:
Tom Appleton tom@tomappleton.ca
Credit: Canada's Aviation Hall of Fame

UPCOMING

London-St. Thomas RAA Fly-in
June 4th – Mark Matthy's Field

COPA Flight 90, Fly-In Breakfast/ COPA for Kids
June 9, Bonnyville, AB 7:30-11

Innisfall Annual Fly-In Breakfast
June 9, Innisfail, AB (EM4): 8:00 a.m. to 12 noon.

Air and Auto Extravaganza at Wiarton Airport
Saturday June 11, 2016, Rain date Sunday, June 12. Wiarton Keppel International Airport (CYW). 50+ Aircraft Exhibitors including antique, military, corpoate, SAR and recreational. Car and motorcycle exhibits, and a Hangar Village Market with over 70 vendors. There will be live music, food vendors and face painting and clowns for the kids. For more info contact Peter Ceponis at 416-388-4193 or email pdceponis@rogers.com

Brampton CNC3—6:30 pm Monday Night BBQs begin!
Mon. June 13, Brampton CNC3—6:30 pm Monday Night BBQs begin! Every Monday night to Sept. 3rd. Join us for our Legendary Monday Night summer BBQ. Going strong into our 11th season. Burgers, sausage, and all fresh trimmings. Nominal cost. RAA-TR Hangar, north end of Brampton airport. Pres. Pres. Fred Grootarz, 905 212-9333, fred@arcronav.com; V.P. Alain Ouellet, 416-709-2020, aouellet@icecanada.com

Cardston 7th Annual Fly-In Breakfast.
June 15, Cardston, AB : Breakfast from 0800 - 1030.

Fathers' Day Morinville Fly-In
June 16 at Mike Poworoznik's, Morinville -- look on Google Maps for Edmonton-Morinville Aerodrome

COPA Dunvegan Flight 174, Fathers Day Fly-in Breakfast
June 16, Fairview

Arlington, WA Fly-In
Arlington Municiapl Airport July 7-9, 201. Drive in or fly in, camping available. For more information call 360-435-5857 email: info@arlingtonflyin.org

RAA Midland/Huronia Northern Regional Fly-In
July 9, 2016, Midland/Huronia, ON, CYEE, Unicom 122.85: Annual RAA Northern Regional Fly-In (NRFI) hosted by the Midland chapter. A Transport Canada seminar is scheduled for 10:00. Zenair factory and the Midland Model Railway Association, both located on the field, will hold coincident open houses. Antique/Classic cars and motorcycles will also be on display. Breakfast and lunch will be available at the picnic pavilion. For further information please contact Rob MacDonald at 705-549-1964, Ray McNally at 705-717-2399, Midland airport at 705-526-8086 or raa.midland@gmail.com.

Vulcan Flying Club 37th Annual Fly-in Breakfast
July 21, Vulcan, 0800 - 1100

Airventure 2016
July 25-31 - Air Venture Oshkosh in Wisconsin

Joe English Memorial Fly-In Pancake Breakfast
July 27, Cayley, 8:00 - 10:00

Edmonton 3rd annual COPA for Kids
August 10, Edmonton, AB.

Westlock, AB Fly-in Breakfast
Aug 11 Airspace closed at 11:15 a.m. for airshow.

UPAC Convention
August 19-21 Lubitz Field, Plattsville ON

Canadian International Air Show
Sept 3-5 - CNE Grounds

Brampton CNC3 Grand Finale Monday Night BBQ
Mon. Sept. 5 Brampton CNC3—6:30 pm Grand Finale, Monday Night BBQ. The last Monday night BBQ of the season. One of the largest turn-outs. Burgers, sausage, and all fresh trimmings. Nominal cost. RAA-TR Hangar, north end of Brampton airport CNC3. Pres. Pres. Fred Grootarz, 905 212-9333, fred@arcronav.com ; V.P. Alain Ouellet, 416-709-2020, aouellet@icecanada.com

Brampton CNC3--Christmas Dinner
Sat. Dec. 10, Brampton CNC3--Christmas Dinner, Cocktails @ 6pm, Dinner @ 7pm The Do-Not-Miss event of the year. Held annually in the Wings restaurant. This is the occasion at which Completion, and First Flight awards are presented, among other recognition awards, followed by a key-note speaker. Pres. Pres. Fred Grootarz, 905 212-9333, fred@arcronav.com ; V.P. Alain Ouellet, 416-709-2020,aouellet@icecanada.com

3D Printing for Amateur-Built Aircraft?

George Gregory

REMEMBER STAR TREK? The original series ran for a scant 3 seasons back in the mid 1960's but has spawned a franchise that continues to this day. "Trekkie" has become part of modern lingua.

One of the featured technologies was the replicator. In the series, it's usually found in the galley, making food and drinks that make months in deep space a little less onerous. But it's a technology - now called 3D printing - that is beginning to become reality in the manufacturing world, and it's poised to impact the aviation world in a huge way.

Sometimes called "The Internet of Things", it promises a sea change in the way manufacturing is done; it's been around for nearly 20 years but is now coming into its own as a mass manufacturing technology. Originally showing promise as a way to create prototypes, 3D printing is now moving into its own as a manufacturing process, and companies are springing up that offer custom services using this process. This makes economic sense because expensive tooling can be avoided; files that can be used to print hundreds or thousands of physical items can also be used to print a single example. The printer may be pricey but can make any part that the programmer desires, and it doesn't care how complex the shape is; that is determined at the designer's desk, not at the point of output. It creates exciting new ways of making an imagined part into a physical, serviceable component. Imagine downloading a file for a complex landing gear assembly and creating it on the same machine that just output spar brackets or an elevator horn.

And the parts can be exquisitely optimized. Not only does the process show promise in how quickly parts can be made, the parts can be output to a much more precise standard, eliminating under or over-building. Stress analysis is done as the part is developed on the computer desktop. This promises to make aircraft lighter while maintaining the requisite strength. And such optimization could mean faster and cheaper since material and the tooling costs are largely eliminated from the equation.

Typically, the designer would use a 3D design app like Blender, SketchUP (both come in free versions) or SolidWorks to create a shape that could then be sent to a printer for output. At a glance, programs like SolidWorks, with its ability to do stress analysis would be the darling of the aircraft set. And of course it's expensive.

I am not an engineer, but I have little doubt that people a lot smarter than me are figuring out ways to make this work; the manufacturing world is buzzing with the possibilities, which are breathtaking for manufacturing in general, but also for the world of the homebuilder.

The process uses a heat source to melt a metal powder - titanium, stainless steel, brass, bronze, and others - as the printer lays them down in in layers to create complex shapes. It looks like earlier iterations of the technology used a binding agent of some sort, but now lasers and other heat sources are actually being used to fuse the materials together to make a solid metal part.

ASTM is already developing a working standard, WK6188, addressing powder bed fusion AM methods for 3D metal printing, and there are a number of other standards that have been created to address different aspects of the process. Companies are springing up offering their services, and consumer-level units (probably not aircraft component capable) are already available. While ones able to create aircraft quality components out of metal may cost more the technology will undoubtably cheapen as it finds widespread use.

Remember when laser printers cost tens of thousands of dollars? Now inkjet printer are practically given away at Best Buy and London Drugs.

General Electric and Airbus are close to marketing parts and GE is already using 3D printing to create parts for jet engines. Even SpaceX recently revealed 3D printed rocket engine parts. In fact, this is where the technology really excites. A 3D printer on the International Space Station would enable the astronauts to create their own tools after a simple upload from Houston.

One really interesting site is makerplane.org. The site states: “The mission of MakerPlane is to create innovative and game-changing aircraft, avionics and related systems and the transformational manufacturing processes to build them. As a result of this aim, aircraft can be built with consistent, repeatable and highly accurate processes which create safer flying at lower cost. ” They continue, "Basically we are designing an aircraft that can be built on a computer controlled mill at home, or at a makerspace which is easy to assemble and quick to build. The plans and instructions will be available for free to anyone that wants them!". It's open source aviation. It looks to me like they are not going to create an entire aircraft out of a printer, but they are as a point of doctrine trying to use these new technologies wherever they can to create easier, more accurate aircraft. It will be interesting to see what comes out of this group in the months and years to come. CNC can be used to create foam cores for Rutan style composites; hardpoints, brackets could, to my thinking, be printed.

John McGinness is using CNC to create the molds for his gamechanging Synergy kitplane. While the really remarkable thing about this design is the aircraft itself - which could just as well be built in a more traditional fashion - he is using whatever technology he can to bring this aircraft to the public sooner rather than later.

Perhaps at some point we will see businesses spring up that are offering 3D output to the amateur-built aircraft community. As long as there have been homebuilt airplanes, there have been cottage industries - some of which became full fledged suppliers in their own right - that offered components for popular designs to the amateur built community. But now the possibility of downloading a specific file to a supplier and getting a finished part back is becoming a reality. A new kind of business, one that will perhaps change the way we build airplanes. Maybe someday the printers will become cheap enough to enable individual builders own one of their own. What sort of innovation in design might that sort of access create? We live in exciting times.

There are numerous places online that can give more information on the process. Here's a few to check out:

http://makerplane.org
http://synergyaircraft.com
http://www.designnews.com/author.asp?doc_id=274578&
http://abt.cm/1sHOV98
http://abt.cm/1qYKDcc

I've seen this before. During my 35 years in the print industry, and I've seen how the automation of tasks has reduced the labour involved even as it increased the reach and power of designers; in fact, this magazine is an example. It's designed in British Columbia, but the print files are sent over the internet first to RAA HQ for proofing and then to the print shop, which is located in Orillia ON.

We live in a post-manufacturing age, and what happened in my industry is coming now to other parts of the factory floor. Bad news if you're in an affected trade; but for innovators and people bringing new products to the world, it's just plain wonderful.

Back to the original replicator from Star Trek: yes, they are experimenting with edible products too. The Fab@Home printer, available now, can work with materials from peanut butter to processed cheese. But can it do Klingon cuisine?

George Gregory *is the RAA's resident roadable aircraft nut, having caught the bug nearly 20 years ago. He holds private, commercial ratings and is a former flight instructor. He's also the Recreational Flyer's Art Director, which puts him in the enviable position of being able to spout off about flying cars or any thing else he thinks is cool whenever space allows.*

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 NRIOUX@lapresse.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. President - Grantley Este 613 432 0797 este@compmore.net

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

EXETER: Second Monday 7:30 pm at Summers-Sexsmith Airfield, Winters-Exeter Legion. Contact Pres. Ron Helm, ron.helm@sympatico.ca 519 235-2644

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 Phil Hicks p.hicks@tvdsb.on.ca 519-452-0986

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: Second Monday at 5:30 pm in the orange hangar at Niagara Central Airport June to September. Contact Pres. Elizabeth Murphy at murphage@cogeco.ca , www.raaniagara.ca

OSHAWA DISTRICT: Last Monday at 7:30 PM at the Oshawa Airport, South side, 420 Wing RCAF Assoc. Contact President: Jim Morrison ,905 434 5638 jamesmorrison190@msn.com

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 19:00-22:00 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 Bob White 403-472-1035 pittsflyer111b@gmail.com

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

ABBOTSFORD: Third Wednesday 7:30 pm Abbotsford Flying Club, Abbotsford Airport. Contact President, John Vlake 604-820-9088 email javlakeca@yahoo.ca

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 250-558-5551 moneypit@uniserve.net

QUESNEL: First Monday/ Month 7:00 p.m. at Old Terminal Building, CYQZ Airport. Contact President Jerry Van Halderen 250-249-5151 email: jjvanhalderen@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 Peter Whittaker pwhitt@telus.net 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.**

Classifieds

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

Deadline for submissions is the first of the month preceding date of issue.

Artwork: Rates apply to camera ready artwork. Digital files are preferred and should be sent as email and in .txt format, PDF, JPEG, MS WORD, Photoshop or other common file types. Advertising is payable prior to printing of magazine unless other arrangements have been made. Payment is in Canadian funds. 10% Discount applies to one year (6 issues) insertion paid in advance. Commercial Classified ad rates 1/8 page minimum.

Advertising Policy: The Recreational Flyer Publisher reserves the right to refuse any or all advertising for any reason stated or unstated.

The Recreational Aircraft Association Canada does not assume responsibility for advertisements, but does exercise care to restrict advertising to responsible, reliable individuals.

Please note: Ads running more than 3 issues must be renewed to guarantee continued display in the magazine.

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

Recreational Flyer Magazine

Registration Mail Publication No. 09869

Contributing Editors: Gary Wolf, Don Dutton, George Gregory, Wayne Hadath, Tom Martin
Art Director and Layout: George Gregory.
Printed by Rose Printing Orillia, ON

The Recreational Flyer is published bi-monthly by the Recreational Aircraft Association Publishing Company, RAA Canada 22-4881 Fountain St. North Breslau RR2 Ontario N0B 1M0 . Toll Free line: 1-800-387 1028

Purchased separately, membership in RAA Canada is $35.00 per year, subscription to Rec Flyer is $35.00 per year; subscribers are elegible for reduced membership fees of $15.00 per year. Rec Flyer to have a single issue price is $6.95.

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.

STINSON 108-3 with heavy case 165 hp Franklin. Airframe 2365 hrs, and recovered in 2005. Engine 998 hrs. Float kit. Two props, one fine for climb and one coarse for cruise. $24000 Quesnel BC. 250-991-7958

KR 2 TRIGEAR 2180cc Great Plains VW. 3.5 gph @ 130 mph Cruise. TTAF/TTE 54hr. int/ext 10/10 This is a nice cross country plane that trims well and is very economical to fly. $15000 call Ray Larson 905 892-6389

SENSENICH PROPELLER M76 AM-2-54 with Saber bolts and includes spinner. $800 CDN OBO. Conical style motor mount up to 150 hp but from unknown plane. $350 OBO Gary Johnson 705-879-4696 Kindsay ON

LYCOMING IO-540 A1A5 wetsump; this is a certified engine with logs, includes injectors and 2 mags, timed out at 1200 hrs but running condition. No starter or alternator or ring gear. Great core for rebuilding. $6000 OBO 519-331-9760

REBUILT GROB 102 GLIDER, all fibreglass, modified to motorglider with Rotax engine, 190 hours, flew from Lindsay Airport. Trailer is included. Please contact Ronald Lohr (519) 824-9230 for more information.

New Aero Vee 2180 cc VW engine, assembled but never run. Baffle kit, oil press & temp sensors, prop plate, carb filter, oil cooler, exaust pipes, CHT sensors, 36 mm socket. . Landed cost was 12K CDN when our dollar was higher. I am asking 9K CDN. . I am getting too old and tired to finish the project. Don 519 372 1383 . we3kingers@yahoo.ca

Lycoming O-235 dismantled for inspection. One mag, no carb, includes ring gear but missing bellhousing. $900 millfly@sympatico.ca 519-822-6693

Full Lotus 1220 floats with new aluminum stiffener tubes, $800. EDO 1400 certified floats asking $10K. 519-2898-5792

Acro Sport 2 project for sale,close to first inspection, O-320 motor fresh rebuild, wings on plane. For more info contact morrisonpeter42@gmail.com for pictures and price, good deal lots of work done.

"CLEANING OUT THE HANGAR" Best Offer: New Fly Baby fuselage and vertical tail/rudder. Thorpe 18 fuselage, gas tank, lots of small parts and front landing gear. Complete EAA Bi-Plane with 0290 wood prop, always been hangared, not flown in years. Benson Gyrocopter complete, very nice rotor blades, always stored in Hanger, Continental 65Call or email for photos and information 705-653-4525 davidcarlaw@prototyperesearch.com

FLY-IN RESIDENCE/SHOP/HANGARS • $729,000 • FOR SALE BY OWNER • Private S.W. ON 2000 x 85' grass strip and dream home on 50 acres. 3000 sq ft four+ bedrooms, two baths. Modern, efficient 27 year old three story home with attached 2 car

garage. 4 beds, 2 renovated bathrooms and brand new dream kitchen with granite counter tops. Wood stove, 1500 sq' drive-in shop w/attached office. Deep well, two ponds. 35 acres crop annually rented to neighbour pays taxes. 15 acres hardwood wood lot with groomed trails. 25 min. S.W. of London at N42.78 W81.6 See http://www.cleco.ca/gallery2/v/Brandywine for more info • Contact J. Davis, Owner - located Appin, ON Canada • Telephone: 519-868-0447 • jwd3ca@gmail.com

FOR SALE: CONTINENTAL A75-8 ENGINE.APPROX 30 HOURS SMOH $ 8500 contact: Pat pjb@ornithopter-pilot.com

SPRING CLEANING ! Starduster, SA100 250 Hrs. Lycoming O290D2 chrome cylinders, stits, dacron fab. $15,000.

PIPER TOMAHAWK 1982, AFTT 14055 Reconditioned, ENGTT 2475 on condition crank and cam reserviced with bearings, Top overhaul , repainted, new interior panels, Sterling Spar STC, new life now 19,000 Hrs. $25,000.00 .

Hartzell prop HCE2YR-1BF, hub DK1077, Blades F8477-4, removed for upgrade to 3 blade on IO540, last overhaul 600hrs. TT1200hrs. passed all AD'sAnd SB's. $2,500.

O200 L/H muffler (CESSNA) rebuilt by Acorn Welding. $450. 28 VDC voltage regulators, 2 ea. Kelly Aerospace, P/NVR500-0101 (Cessna 337)$150. ea.

Piper Pitot static tester adapter,P/N PS56620M2-4-4, with hoses and case. $650.

From the back of the Hangar.

24 volt starter, electro System p/n MHJ-4003SR, o'haul/2000. $350.00

24 volt starter prestolite, p/n MHJ-4003S serviceable. $300.00

24 volt alternator Delco Remy 50 amp. p/n 1100747 $300.00 Oil filter adapter kit Mod. BC700 for all Lycoming 235, 320, 360, 540, 720. $500.00

Cessna 172 nose cap cowling p/n 0552019-new. $100.00 Stabilator tip fairing p/n GF95620-07 Piper PA-200/220 $150.00 McCauley Propeller p/n 1A101GCM6948 bolt pattern 4 3/8in. $800.00 Prop spinner 10in.dia,. 12in. tall bolt pattern 4 1/2in $125.00

Cantact len Kennedy 506-622-0105, cell 506-623-8162 email - lenpat@nb.sympatico.ca Miramichi NB .

MOVING AND CLEANING OUT:

Continental A65-8 with logs, #1166018. TT930, 130 STOH - $3000. 4 cylinder BMW motorcycle engine - $150

Project, a McDonald S21,single seat all metal low wing. 1st inspection done. No engine, $1000 Metal prop for Continental with 43 hrs, 74 x 45. $600 Bendix mag, 4 cyl. New style. $495 A-B project Aeronca S-7EC. Complete overhaul of airframe 2010, Lycoming O-290-G 125 hp with 90 hrs. Zero time metal 74-52 prop. 1500 Federal skis and 1800 PK floats.600-6 wheels. Intercon and ICOM radio, xponder, cyl temp and exh temp gauges. Make an offer. Beechcraft LH landing gear assy - $100 Beechcraft RH landing gear assy - $100 Lycoming oil pan 150 hp rear mount carb TO 320 81A One set NEW 500-5 wheels and brakes $600

2 used Goodyear brake wheel cylinders, complete with axle. $375 600-6 4 ply tires (used) 6 available, $20 ea. 600-6 6 ply tires (used) 6 available $25 ea. Lycoming O-435 case and crank assy, complete with mags $500 Lycoming O-435 prop hub for splined shaft $50 Hartzell 76" adjustable prop, fits Lyc O-435 $100

Stinson 10A LH and RH gearlegs complete with tires and brakes. Both $400 Pair of NEW Cleveland wheels and brakes, 500-5 with 1-1/4" axle $650 Prop governor McCauley 762092, $50

NEW aerobatic carb, Ellison EFS-4, serial # 1061, $500 NEW, 3 pieces 600-6 x 15 tires 6 ply, $150 each Aluminum shrinker and stretcher, $40 each 2 available, 600-6 4 ply Goodyear wheels, brake cylinder and discs, $450 pair

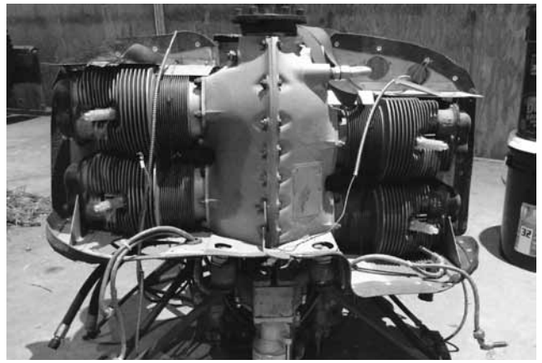
Piper nosebowl mould for fibreglass, $90 8 x 3 tailwheel assy $250 4" tailwheel assy $350 Lycoming GPU 4 cyl O-290G 125 hp, no mags $400

Differential cylinder tester $50 400 running ft of square tubing 5/8" .035, $200 the lot 50 running ft of square tubing 7/8 x .035, $25 the lot

Several Lyc O-290 cylinders and several Franklin 350 cylinders, Make an offer Stinson 10A fuselage static display only, $100 Fleet Canuck fuselage static display only, $160 Jodel D11 fuselage and wings, static display only, $200 1 set seaplane floats-to-fuselage rigging, J3 Cub to EFO 1400, $500 Contact Lawrence Shaw, Orillia Ontario. Phone/fax 705-325-8017

Zenith 300 project - all new drawings, and most welded parts are finished. The ribs and spars are all ready, and the tailplane and centre section bulkheads have been built. There is enough sheet metal to complete the aircraft. Buy it and just start putting it together. $5000 OBO.
519-843-2221 (Ontario)

Ads run for a maximum three issues depending on space available and then must be renewed for continued display. Please direct all classified inquiries and ad cancellations to: garywolf@rogers.com and place "RAA ad" in the subject line.



Chapter 85 Vancouver

Chapter 85 held its annual awards banquet on Saturday March 26th at the Delta Town & Country Inn. A great Baron of Beef dinner was served by the Town & Country staff and then members and guests were treated to a presentation by Bill Yearwood from Transport Canada. Bill gave a colourful presentation on several aviation incidents which were examples of how a serious event can result from a string of minor events or omissions. This was a good message for everyone with the start of the flying season just around the corner. Apart from a list of regular awards, members of the 750 Cruzer building project were recognized. A 50/50 draw was also held and the proceeds went to the 750 Cruzer engine fund.

The 750 Cruzer building project made some significant advances with the acquisition of a used Continental O-200 which is in flight ready condition after being removed from the previous owners plane in Williams Lake, BC. The engine came with a ground adjustable Whirlwind propeller, spinner and a collection of exhaust system and cylinder spare parts. Gerard van Dijk and Cyril Henderson made the trek to Williams Lake, performed an initial engine inspection, and returned with the engine in a long day on the road. The Cruzer project has progressed to being almost ready for a pre-cover inspection by MDRA and James Aspley has been appointed as the inspector. The forward fuselage has been joined to the rear fuselage with work continuing on the main landing gear installation and fabrication of the flaperons.

The second Sunday in April was Chapter 85's turn to run the monthly pancake breakfast at Delta Heritage Airpark. Several new members volunteered with the breakfast and good weather helped to bring out a large turnout with close to 80 breakfasts being served (Figure 4). José Font kind-

Above, right: some Beavers came to visit the chapter's project. Top left, the 0-200 that has been selected for use with the Cruzer. Left, the chapter's monthly Pancake Breakfast is always a hit. Here two visitors watch at the counter while Pink the airport cat poses for the photographer.

Across Canada

RAA Chapters in Action

Above: Some of the work crew in one of the locations where the chapter is working on the project. Right, some Air Cadets dropped by to help with and see the project. Initiative like this involves young people and demonstrates the ability ordinary people have to construct and fly their own aircraft.

ly made an emergency trip for extra eggs and made it back when there were 2 eggs left to go. Twice a year, usually in May and October, Chapter 85 hosts meetings at the round house for Vancouver Metro Parks where Parks conduct their management meeting for the airpark. This year the meeting was held on May 5th with local farmers and airpark tenants represented. There were no major problems or complaints other than about powered hang gliders or parachutes flying at low level along the Boundary Bay dike road. One flight incident was recorded where an ultra-light lost power on departing the airpark and landed in an adjacent farmers filed. Gerard van Dijk was able to tow him back to the airpark with the tractor. There was no damage to the ultralight or its pilot and passenger.

Upcoming events will be an airpark cleanup day on Saturday, May 28th for all airpark tenants. This is in preparation for the Annual Delta Airpark Fly-In, this year scheduled for Saturday, July 2nd . These events will be covered in the next message from the President. Until then, aviate safely and enjoy scenic flights.

RAA Midland

There is ongoing progress on the chapter's Zenith. Here's a few updates:

Sat. Feb. 20/16
Look at plans, decide what is required, get our parts sorted out so they are used for the correct procedure, work on right main spar and right rear spar.
Thur. Feb.25/16
we have 2 small left wing fuel tanks and one large fuel tank with a dent. Pressure test fuel tanks..all ok. Work on main and rear spar.
Saturday, Feb. 27/16
Ray, Don, Jim, and Ian finish buck riveting right wing. Start aligning and installing nose ribs.
Brian and Adam drill and cleco doubler on rear spar.
Thursday, Mar. 3/16 and Saturday,

continued on page 42

Chapter / continued from page 41

March 5/16....no notes but we had fun!!
Thursday, Mar. 10/16
Had two guests join us this evening.. Tyler and his father Tom. Discussed engine choices, and talked about steam/2016 instruments or glass for the panel. Jim going to take one of our 2 small right tanks and change the fittings to make it a left tank. More work on right rear spar and put more nose ribs on right main spar. Had Tyler try out the air riveter.
Saturday, March 12/2016
More discussion on engines, Chinese round instruments, and propellers..metal or wood. What instruments we need and who may have some. Ian talked to Vince at Midland Instruments re used instruments.. he has none. Ian and Garry talked to John Dion about engine choices. More work on spars.

RAA London - St. Thomas
The chapter met at 427 Wing RCAF Association, 2155 Crumlin Road, London Airport
Present: Eric Bartlett, Bob Buchanan, Gus Cameron, Len Fallowfield and guest Frank, Howard Faulkner, Phil Hicks, Daryl Kings, Serge Lavoie, Stan McClure, Hans Schroeder, Herman Siemons, Mike Stoddard, Ray Taylor, Jim Tyler, Bill Weir
Call to Order: The meeting was called to order by Eric Bartlett at 7:40 pm.
Minutes: The January meeting minutes were approved as published in the Slipstream upon a motion by Len, seconded by Bob.
Business arising from the minutes:
- Bob Buchanan will continue as Membership Officer. Bill Wier will assist where possible.
- Denny Knott has asked to step down as a member of the Executive due to upcoming extensive travel plans. We need nominations and/or a volunteer from the group to join the Executive.
- Gus inquired as to the status of "Director" positions. Executive has located the Club constitution and is reviewing. There are a number of things that need cleaning up (including the Club name).
New Business: None
Reports:
Treasurer: No report.
Membership: Bob reported that paid membership stands at 20 to date.
Member Project Reports:
- Serge discussed his Super Cub project and recent progress.
The Business portion of the meeting was concluded at 7:55 pm.
The Program this evening was a viewing of the 1938 classic World War I flying movie, The Dawn Patrol, starring Erroll Flynn, Basil Rathbone and a young David Niven. Suffice it to say, no one left early – the film (and the flying) was riveting.
April Meeting:
Angus McKenzie will be speaking about float flying the de Havilland DHC-2 Beaver. Come join us, we will be visited by our friends from Chatham. 7:30 p.m., 427 Wing.
Coming Events: April 13th - COPA Flight 7 – Transport Canada Safety Seminar, Navy Club, 1420 Lougar St. Sarnia, ON M7A 5N4 April 24th - Hanover Rust Remover May 3rd –London – St. Thomas RAA – 427 Wing May 28th – Kent Flying Machines – Chatham –Fly-In and Safety Seminar. Breakfast 8:00 to 10:00. Transport Canada seminar @ 10:00. For more info call 1-519-798-3286.
June 4th – London-St. Thomas RAA Fly-in – Mark Matthy's Field

---

Glass or Steam / continued from page 7

My intention with this article is to start a healthy debate on integrated cockpits versus good old steam gauge cockpits. Many of our home-builder friends are debating which to choose and asking the manufacturer/vendor is not the right place to go for help in finalizing such a decision. I believe our magazine could be a great source of information based on actual experience if we could get this debate going, where builders/owners/pilots would share with the group their cockpit design, what equipment they chose and why. How does it perform, how satisfied are they, what would they do differently? I am convinced this could help those in the process of building or contemplating upgrading their cockpit before big money is committed.

EVERYTHING FOR AIRPLANES!

AIRCRAFT SPRUCE IS YOUR ONE STOP SHOP FOR PARTS & PILOT SUPPLIES - SINCE 1965

BUILDING MATERIALS & KITS

Composite Materials • Covering Supplies
Electrical • Hardware • Metals & Plastics
Tools • Wood Products • Kits & Plans

AIRCRAFT PARTS

Airframe Parts • Electrical • Engine Parts
Landing Gear • Hardware

AVIONICS & INSTRUMENTS

GPS • EFIS • Panel Transceivers
Audio Panels • Attitude Indicators

PILOT SUPPLIES

iPad/iPhone & Android • Apps • Mounts
Flight Bags • GPS Accessories

BRANTFORD MUNICIPAL AIRPORT DAY!

SATURDAY, JUNE 25, 2016 • 9:00 AM - 10:00 PM

FREE ADMISSION • Hot Rod Kings & Vintage Wings With Piston Pushers
Car Club & Aircraft Spruce • Brantford Municipal Airport, Canada

AIRCRAFT SPRUCE TRANSPORT CANADA APPROVED
ASK FOR YOUR STAMP!

Store Hours:
Monday - Friday 8:00am to 5:00pm • Saturday 8:00am to 3:00pm

FREE CATALOG!

AIRCRAFT SPRUCE CANADA (CYFD)
150 Aviation Avenue, Brantford Municipal Airport
Brantford, ON N3T 5L7
Ph: (519) 759-5017 • (877) 795-2278

Aircraft Spruce SINCE 1965 & Specialty Co.

www.aircraftspruce.ca