publication agreement number 40050880

November - December 2014

Recreational Flyer

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

Restoring a Classic: the Beechcraft

Staggerwing

RAA
RECREATIONAL AIRCRAFT ASSOCIATION
RÉSEAU AÉRONEFS AMATEUR CANADA

From The President's Desk

Gary Wolf RAA 7379

UAV UPDATE

Christmas arrived and lots of UAV's were sold, but few buyers know that they are supposed to stay 9 km away from airfields and that they are limited to very low altitudes. Transport has produced a document to outline the responsibilities and operating limitations, but very few who buy a UAV are going to head to the TC website to read it. Most do not even know that Transport Canada exists, and the hobby shops are not taking the initiative to let the customers know the situation. In the past year there have been over fifty reported occurrences, many of them near misses like this one:

"TSB Report#A14P0100: Shortly after a KD Air PA-31, C-GPCA operating as KDC420, had departed CYVR, it reported a near miss with a UAV at approximately 1900 feet ASL. The pilot climbed to avoid the UAV. It is estimated that vertical separation was less than 100 feet when the object was passed. The flight continued to its destination and landed safely."

This situation will not stop unless someone does something, and TC appears to be satisfied that they have done their part by posting a document on their website. In this issue we have reproduced the TC chart that governs these activities. Please make a few dozen Xerox copies, drop by your local hobby shop, and ask that they give

> In the past year there have been over fifty reported occurrences [between UAVs and aircraft], many of them near misses

them out with each sale. Then go back later and check to see if they need more.

ROTAX (and others) CARB FLOAT UPDATE

In the last issue we ran an article (page 31) about a defective batch of 912 Bing carb floats that had been improperly manufactured. There is now a new batch of replacement floats available and these are identifiable by a dot on each float. Although Rotax has issued a safety bulletin they are not alone in using Bing carburetors. Jabiru and HKS also use these carburetors. Two stroke Bing carbs can also be affected as they use the same floats, and Bing is used by many engine manufacturers. Contact your engine representative to ask if yours is among the affected units.

NEW HIGHLANDER DEALER

Stirling Ultralights in Ontario is no longer an authorized dealer for Just Highlander aircraft. The CADORs show recent Highlander occurrences including one in which aileron cables were rigged oppositely, and another in which a thermoplastic elbow in the cooling system failed.

The new dealer is:

Jack Leroux
Algonquin Highland Aviation,
P.O. Box 1264,
Barry's Bay, ON. 613-639-3053
justair.highlander@gmail.com
www.algonquinhighlandaviation.com/

JABIRU ENGINE CONCERNS

In November the Australian civil aviation authority issued a warning that they had concerns about the reliability of Jabiru engines. They planned to limit their use to Day VFR with no passengers, and student pilots would not be allowed to fly solo, all due to the alleged safety record of the engines.

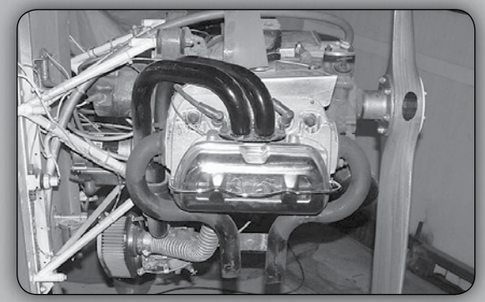
The manufacturer and Recreational Aviation Australia objected and the limitations have been eased. Passengers and students may now fly as long as they have signed an acknowledgement of the

continued on page 42

The Recreational Aircraft Association 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**

The Recreational Flyer is published bi-monthly 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

A Zenith CH-200 Goderich, 2005
On the cover: The West Coast Staggerwing. Mike Davenport Photo.

Mike Shave on the Hoover/HVX

VW Aero Engine

"When everything seems to be going against you, remember that the airplane takes off against the wind, not with it." – Henry Ford

My daughter's grandparents were born In 1931, the same year Ferdinand Porsche designed the "Volksauto" a simple "people's car", the car we know today as the VW Beetle. The brilliant Porsche also designed a small air-cooled boxer engine to go with it. The crankcase was made of a new light weight magnesium alloy. His engine also found a home in the Kubelwagen ("Bucket car") the German military jeep of the day. It was VW's most produced car during WW2. After the Germans were forced out of France they abandoned countless of their VW-powered Kubelwagens. It didn't take long for the French aero clubs to wig to the potential of Porsche's light weight air-cooled engine to power their new sport aeroplane designs. By 1950 French enthusiasts had constructed several of these new designs using a converted Kublewagen engine, among them the Druine Turbulent and the Jodel Bebe.

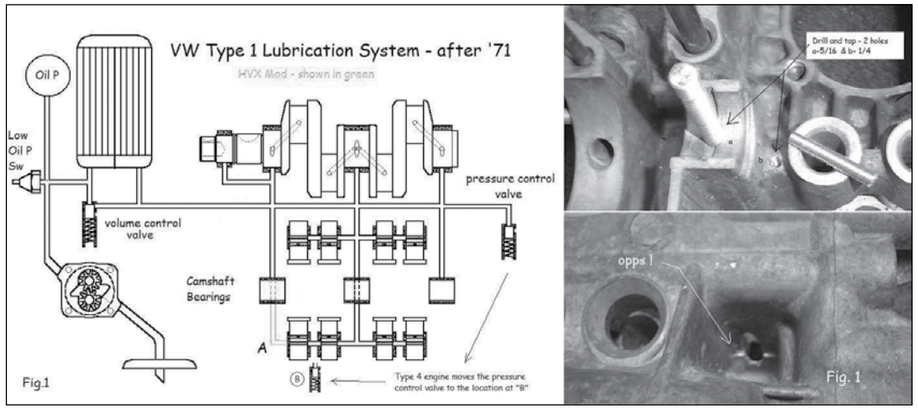
The VW engine is mated to the transmission with four handily placed bolts that allow it to be bolted directly to a firewall, obviating the need for a welded steel tube mount. A shrink fit prop flange is fitted to the end of the crankshaft that normally has a pulley to drive the generator and cooling fan. We can thank homebuilders like these for putting in place the basic architecture of most VW conversions to this day.

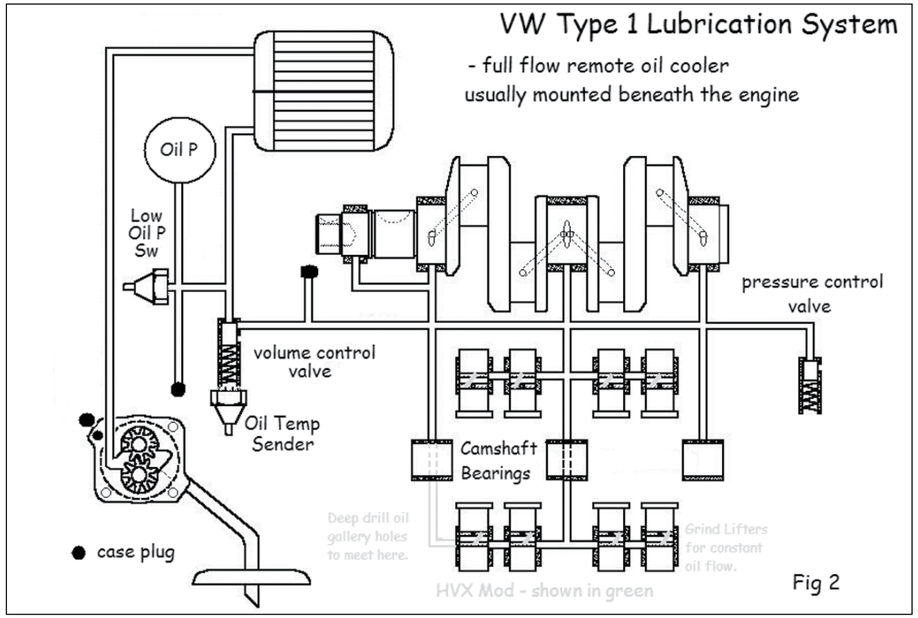
The VW engine was initially one litre, and it was gradually expanded in bore and stroke until it reached 1600cc in the Sixties. Aftermarket cylinders and crankshafts have expanded the displacement of a "Type 1" to as large as 2276cc, still using the original bore spacing. In the automotive world there has always been a strong cult following who build drag racers and off road dune buggies with turbochargers, nitrous oxide, and anything else that will produce several hundred horsepower in a short burst. In the world of homebuilt aviation we want none of this, just dogged reliability, 70-80 hp for climb and 50 hp for cruise. Over the past seven decades there have been many experts converting VW's for light sport aircraft, among them Peacock, Barker, Beckham, Horvath, Hummel, Bennett, Monnett, and Smith.

One expert who has made a study of these engines is Robert 'Bob' Hoover (no, not the aerobatic one) whose HVX mods are considered by many to be an essential part of building a VW aero engine. If you Google "Bob Hoover - HVX Mods" there is a ton of stuff on the net. Car and aero engine builders have followed Bob's HVX Mods to improve oil flow through a VW air-cooled engine. My good friend Ernie Abel would say "most folks think the VW is an air-cooled engine, but it's more of an oil cooled engine." Bob Hoover's HVX mods improve cooling by having more oil pumped through the lifters (cam followers) up the push rods and through the rocker assembly. The oil picks up heat and takes it via the sump and oil pump to the oil cooler.

The Hoover HVX mods begin with deep drilling the VW Type 1 crankcase. If you look at the stock VW oil circuit it is clear that oil delivery to the heads favours the side the oil gallery is on. The Hoover mod extends oil gallery holes to meet at "A"(see fig.1).

On some cases the magnesium casting is thin in the area near "A" and will not allow this mod to be done. Careful measuring of the case beforehand must be done or the result is a hole to the outside of the case and a lot of cursing. A few years ago someone brought to me a VW type 1 case that had such a hole drilled through. There are a lot of places on the engine where





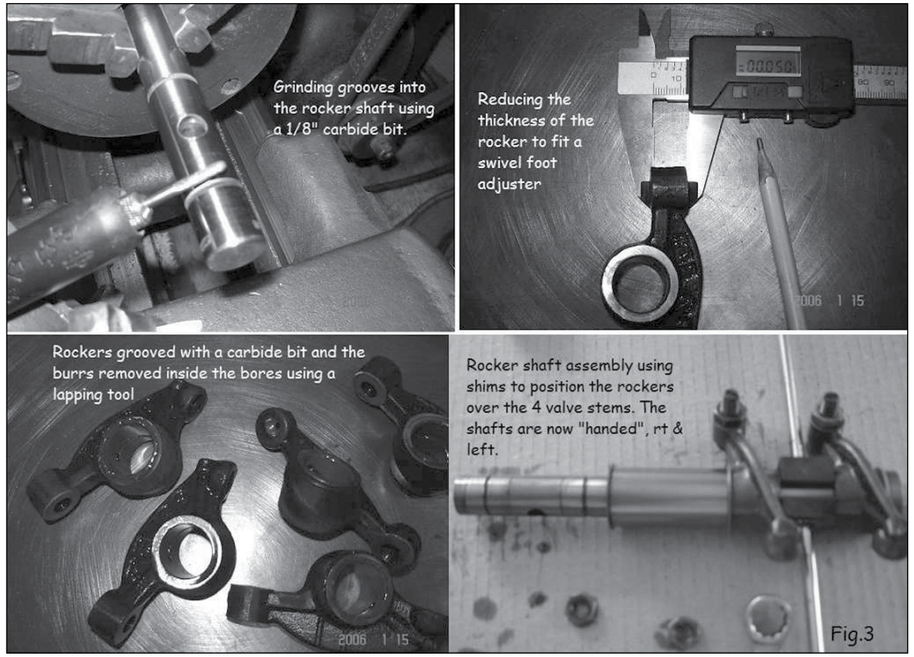
pipe plugs are tapped into the case or machined surfaces that have various accessories bolted to the engine, so why not add one more? Figure 1 (above) shows one solution to fix this problem.

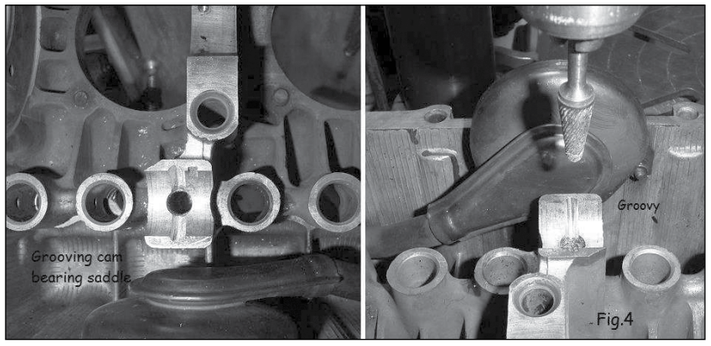
This engine could not have the HVX mod done to it at all so the "fix" involved blocking off the oil gallery and plugging the hole beneath the cam bearing. Aluminum threaded plugs were made in the lathe and holes tapped in the case to accept them. Both holes were cleaned with brake clean and a high temp Loctite thread seal applied to the threaded plugs and screwed in.

The excess metal of the threaded rods was machined off and on the outside of the case JB Weld was applied over the bit of rod protruding through to the outside world. We generally want the oil to stay in the engine.

I have done the Hoover HVX mods to a few engines including two of my own because it seemed like a good idea at the time. I believe the HVX mods are well thought out, however it occurs to me now that the dozens of German engineers who worked on perfecting this little engine to operate in climates all around the world didn't anticipate someone like Bob wanting to push the limits of the engine. Bob's criticism of the VW oil system in the first few paragraphs of his blog point out that when the engine is "hot rodded," running in excess of 5000 rpm, the oil system is inadequate. The engine was not designed to be run like this and lately I have begun to realize the Wolfsberg engineers didn't include these "mods" in the millions of engines they produced because they weren't necessary. After all, it only required drilling two slightly deeper holes and grinding some grooves. The engineers fulfilled the original design requirements. For example: the VW air-cooled engine in my '69 van was routinely run at wide-open-throttle, 3400 rpm, 70 mph on the 401. On a hot day the oil temp would max out at 230 F. I don't know of another road vehicle that operates as my van did at or near full throttle for hours on end, and as it turns out is identical to the RPM and oil temp readings of the VW aero engine in my plane. It may be that those who are operating a VW with a Valley re-drive turning at a much higher cruise Rpm will need the HVX mods to get the cooling that the mods are supposed to afford. This article is based on my own experience with direct drive tractor installations.

The second HVX mod involves modifying the solid lifters by grinding three evenly spaced angled slots to join the upper and lower grooves. The original design allows oil to move through the lifter into the push rod only when the lifter is close to maximum cam lift, or about 8% of the time. By adding grooves the oil can be delivered up to the head 100% of the time from all eight lifters. An unobstructed oil pump is capable of





pumping 50 L/min. An engine with new bearings has little room for oil to squeeze through any gaps in the entire system. It takes power to drive an oil pump, so adding a high volume oil pump to any VW engine robs power it could have used to turn the prop. With a positive displacement gear pump in a running engine, oil pressure builds and forces the oil control pistons against springs, moving the pistons beyond vent holes to spew excess oil back into the case. For a VW engine 10 psi/1000 rpm is enough pressure to provide the crankshaft with oil to keep it happy. Most direct drive VW aero engines run at 3000 rpm in cruise and most have oil pressures of more than 40 psi at that rpm. At this pressure the small oil gallery feeding oil to the lifters flows at least 4 to 6 L/min. If more oil is allowed to move through the system to the heads that have the HVX mods it won't be long before the level of oil in the sump is below the level of the pickup tube of the oil pump. The pump cavitates, trying to suck oil into the system, and the oil pressure needle on the panel starts to wobble back and forth. The result is foaming oil and loss of efficiency in the oil system.

Some engine builders install drains in the heads to provide another route for the oil to get back to the sump. I read in an article that to understand what was going on under the valve covers the author put plastic windows onto a set of valve covers and discovered that with the HVX mods after a few minutes of run time the entire cavity was filled with oil.

When I first built my engine I drilled vent holes into the back top of the valve covers to vent crankcase pressure to a firewall mounted oil separator. I flew a few circuits and when I landed and got out, the entire bottom of the fuselage was coated in oil. I use 10w40 oil in the summer and it was just over 140 F when I took off. The oil being delivered to the heads to provide cooling couldn't drain back to the sump fast enough through the pushrod tubes, and instead found a convenient drain through the vent pipe. This overflowed the oil separator, ran down the firewall and covered the bottom of the plane. (by the way, the best stuff for getting oil off the bottom of a fuselage is handfuls of sawdust cupped on rags that you can then wipe across the spill while laying on your back, hopefully with your head upwind.)

The holes in the heads were plugged but I still had a few in mine. Perhaps if a sump were added beneath an extended pick up tube the oil pump would get a more reliable and steady supply of oil. Even after this mod the oil pressure gauge still fluctuated. It was during this time that the guys in the hangar got used to seeing the engine off the nose of my plane. The trouble with trying to do it right the first time is that you depend on someone else to provide the knowledge base to give you the confidence that what you are doing is right. At least it worked for them and they sounded (in articles like this) like they knew what they were doing. It was time to have another look at the oil system and why didn't the stock VW engine have this trouble? What change did I make that caused the oil pressure to fluctuate?

Some aero engine builders take the entire output of the oil pump and pass it through the oil cooler first as shown in Fig.2. With this set up the volume control valve loses its main function in controlling the oil to the oil cooler. In the stock oil system (see fig.1) the control valve diverts oil away from the oil cooler until the oil is thin enough with heat that the spring can push the piston back up to divert the now warm oil through the oil cooler. In the car the VW engine not only has this clever quick oil warming control, it also employs a devise to control dampers in the path of cooling air to the heads and cylinders. Most VW Aero engines do not have any control over the air coming into the cowl which is one reason why it takes time to warm up.

The third HVX mod makes a clear path for the oil to move through the rocker, around the rocker shaft and out swivel feet over the valve stems. In order to do this the shaft and the rockers need grooves cut in strategic locations to make it happen. It is not that difficult to do the rockers with a Dremel tool and a small diameter disk or a 1/8" carbide burr. The rocker shafts are best done in the lathe with a tool post grinder or a carbide bit. The shafts are case hardened and normal HSS tool bits won't cut it. When these parts are installed engine oil can pass relatively freely from the pump via the galleries to the swivel rockers spraying onto the head presumably to improve transportation of the heat in the heads back to the oil cooler.

If it is true that with these mods both heads are nearly full of oil then the oil level in the sump will be much lower, so the question is, how much oil does the engine need now? And what about the quantity of oil in the filter and hoses to it?

Those of you who know VW engines are aware the oil filtering is sketchy. The original VW engines ran non-detergent oil so any particulate would settle onto the bottom of the sump, some of it landing on the oil screen cover plate. As a first year apprentice VW mechanic in the early 70's I started with oil changes. All the cars coming in for oil changes had grey goo deposited onto the oil screen cover plate, goo that consisted of wear products created since the last time the oil was changed. It was possible to tell which owners were looking after their cars by the colour and thickness of the goo. The oil screens only keep the chunks in the oil from being recirculated. We VW aero engine builders want something better.

It didn't take long for the French aero clubs to wig to the potential of Porsche's light weight air-cooled engine to power their new sport aeroplane designs.

It is common practice to add a full flow oil filter into the system, however adding lines and a filter to the oil system will cause a pressure drop. If the oil lines are at least 1/2" inside diameter to and from the oil filter the pressure drop will be minimal. The usual method is to take the oil via a special pump cover plate to the filter and back to the engine with a fitting tapped into the main oil gallery above the oil volume control valve. Aero Vee make a special pump and cover designed to have the oil exit and return to the pump cover plate, rendering drilling and tapping the case unnecessary.

Both a remote oil cooler and oil filter can be placed in series with either of these methods. The Limbach 80hp engine mounts the oil cooler in the stock VW location on top of the engine. They also use a spin on filter close to the oil pump.(as per VW T4 engine crankcase)

The next HVX mod is to groove the cam bearing saddles to enlarge the passageway around the outside of the cam bearing shell. Some caution is needed here if later you might need to clearance the cam bearing support tower if it is in the way of connecting rods attached to an 82mm or larger aftermarket crankshaft. It would be better to clearance the crank before cutting this groove.

The four HVX mods combined - drilling the case, modifying the lifters, grinding grooves in the rocker assembly and lastly grooving the cam bearing - all together reduce impediments to pressurized oil getting up under the valve covers, ostensibly to soak up heat and deliver that heat to air passing by the oil cooler.

In doing some research recently I googled "oil spray bars in valve covers". If the idea is to get more oil up under the valve covers to promote cooling, why not plumb a line off the main oil gallery directly to the area instead of making all these changes to internal parts of the engine? Do the HVX mods actually work? Since all the mods are relatively simple why didn't VW Wolfsberg incorporate these "improvements" to VW cooling in the millions of engines produced from 1938 to 2006?

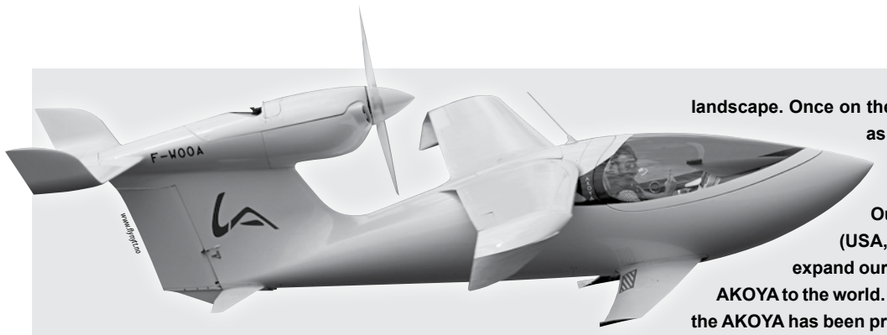
The last HVX mod is adding valve guide seals. Since the oil level under the valve cover is higher than the valve guides themselves, the vacuum created during the intake stroke will suck oil down the valve guide, increasing oil consumption. The cure is to add valve guide seals and HVX mod drawings illustrate the machining required.

Last year was spent chasing down oil related problems with the 2276cc engine I had in my GY201 Minicab. I have had an air-cooled VW since I was 16, did a partial apprenticeship with VW, and finished my training to become a millwright. I thought I knew how to put an engine together and as I said at the beginning of this article I wanted to do it right and I believed the HVX mods were a good idea, and if I were a lemming running towards a cliff I would have jumped off, because everyone else was.

Last May with the installation of a new set of lifters (no grooves), a stock VW cam, a Schadek 30mm oil pump, stock van oil cooler on top, a remote oil filter fed from the pump cover plate to return oil to the main oil gallery on the front of the case, and lastly an extension to the oil pick up tube, solved my oil problems. The lifters regulated the quantity of oil delivered to the heads, as they are designed to do. Now the oil temp on a 21 C summer day reads 212 F, the pressure is a steady 45 psi @ 2900 rpm, 21"M/P and 105 mph cruise.

Perhaps VW Wolfsberg had it right after all. Maybe the oil system was already in balance, doing what it needed to do: lubricate and cool.

For more infromation, check out Bob Hoover's blog at:
http://bobhooversblog.blogspot.ca/2007/05/hvx-mods.html
http://www.1728.org/flowrate.htm
http://www.intlfpa.com/content_cal_gpm-calc.html



Akoya Update

The AKOYA has made several endurance flights (long flights) this year which has enabled the LISA team to validate the performance using different parameters. These tests have confirmed very low fuel consumption data of 5.6L/100km (42MPG) for a range of 2000 km (1,250 miles). During each flight, the AKOYA is equipped with several cameras for recording how the aircraft performs during pilot maneuvers. Beautiful images over the Bourget Lake in the French Alps were captured during long flights in June. These images offer a realistic immersion in the controls of the aircraft during flight gathered in a short video which we have pleasure in sharing with you:"Inside the Akoya". This video highlights the visibility offered from the AKOYA's broad canopy. Panoramic vision and in-flight safety guarantees are both sources of great pleasure.

The high wings placed behind the cockpit give an unobstructed view above and below the pilot's head and vision ahead is unaffected as the engine is at the back of the aircraft. The passengers can now enjoy a stunning view of the surrounding landscape. Once on the ground, ease of use is at an optimum as the canopy is opened and closed electrically.

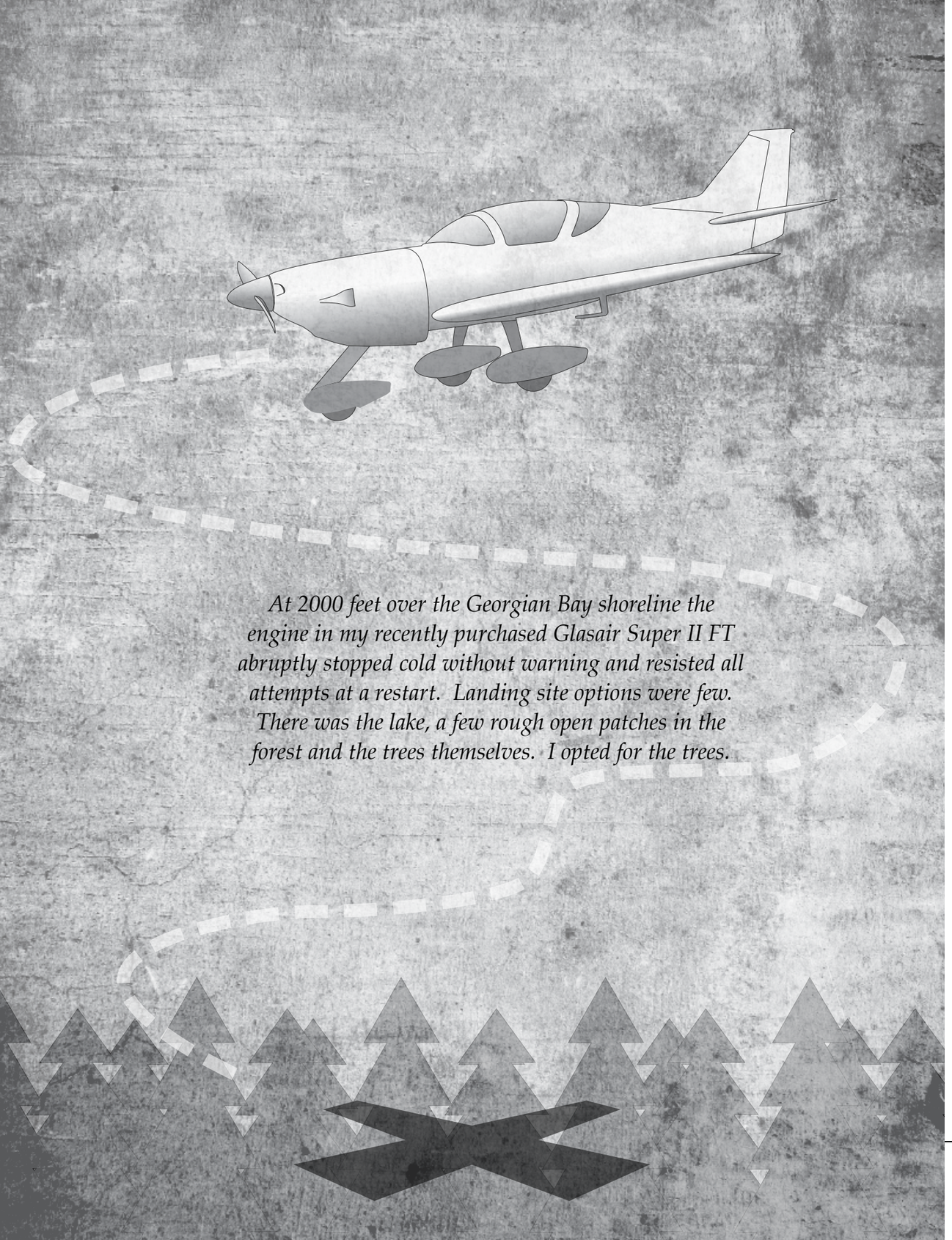
Our participation in three exhibitions (USA, France and China) has allowed us to expand our international stature and to present the AKOYA to the world. 2014 has been of notable importance as the AKOYA has been presented for the first time in China. Each exhibition has been a success thanks to the warm welcome of visitors who have been seduced by both the innovation and design of the AKOYA; confirmed with new reservations!

EAA Airventure OSHKOSH, USA : the screening of an exclusive video offering a realistic immersion aboard the AKOYA during flight, as well as a number of video extracts presenting Seafoil technology have attracted much enthusiasm from visitors and fans of aviation alike.

- The Aix-les-Bains Air Show in France: the visitors were fascinated by the AKOYA and we received lots of encouragement for our will to create a new generation of seaplanes.

- Western China International Fair (WCIF) at Chengdu in China : a great occasion as LISA presented the AKOYA in China for the first time. On this continent too, the AKOYA seduced the visitors, especially by its Multi-Access capacities which allow the pilot to travel more freely and to overcome the lack of infrastructure.

https://www.youtube.com/watch?v=jkh8DNWzN6E&feature=youtu.be



At 2000 feet over the Georgian Bay shoreline the engine in my recently purchased Glasair Super II FT abruptly stopped cold without warning and resisted all attempts at a restart. Landing site options were few. There was the lake, a few rough open patches in the forest and the trees themselves. I opted for the trees.

When Things Get Quiet

The Engine Just Quit. But Why? / *by Dan Mersich, Owen Sound*

FIRST THE GOOD NEWS: there were no injuries of any kind. The Glasair has a reputation for being very crash worthy to which I can happily attest.

Following the advice of Bob Hoover to keep control and fly as deep as possible into the crash I stuck the nose into the canopy between two maple trees. A thousand small branches snapped; the wings were destroyed; the aircraft settled to the ground upright and I stepped out unscathed. The only other damage was a battered lower cowl and a twisted right main landing strut.

It has taken a year of head scratching by some very savvy people to find the cause of the engine stoppage, but the mystery has been solved. Only four things can cause an engine to stop running; critical part failure, no spark, no air or no fuel.

As for critical part failure, the Lycoming IO-360 (250 hrs TTSN) had been fully stopped for at least two minutes before impact. Nevertheless it was completely torn down afterward and found to be in perfect working condition, as were all of the accessories. The prop didn't have a mark on it, and it too passed a teardown inspection with flying colours.

As for spark, both Bendix B1200 mags were likewise found to be in perfect working condition, as were the harnesses and spark plugs.

As for air, an inspection of the airway from the external intake to the engine intake valves found no obstruction.

As for fuel, both fuel pumps (engine and boost) were operational when tested and the fuel lines, spider and injectors were clean. The fuel servo was sent to the manufacturer for inspection and it too was found to be in perfect working condition. That left only one explanation – fuel exhaustion. The aircraft simply ran out of gas.

But that was impossible because four hours of fuel were taken on at my home field immediately before the flight that ended in the trees forty five minutes later. I personally saw the fuel go into the tank and fill it to the top. The airport manager confirms that he did the fuelling, and my credit card receipt as well as the airport's records show that 127 litres of 100LL were taken on just before departure. Both fuel caps were inspected and secured as part of the preflight and they were visually inspected again in flight as is my habit. In fact I still have them both. Also, no fuel had leaked onto the apron while I was in the terminal making payment. But when I stepped out of the aircraft after the forced landing I smelled no fuel even though the wing was completely opened up and should have ejected over 100 litres of fuel in a single burst. Moreover, the environmental clean up squad that arrived an hour later were surprised to find no evidence of a fuel spill. So where did the fuel go?

Quoting Sherlock Holmes, "When all other possibilities have been eliminated then the one remaining, however unlikely, must hold the answer."

The only other "holes" in the fuel tank were the two vents under the wingtips, and I had been practicing steep turns for about twenty

minutes. But everybody knows that fuel can't leak out of the vents even in a steep turn. Or can it?

As it happens my aircraft was an early serial number in the Super II series, in which the fuel tank design was a single cavity running the full span of the wings, right through the cockpit. It was baffled to prevent slosh but it was all one cavity. It had two fuel caps in the normal positions on top of the wings and a fuel vent out the bottom of each wing tip.

At a loss for an explanation I called the folks at Glasair, but they assured me that fuel could not have vented out because, in a coordinated turn (even a steep turn), centrifugal force pushes all the fuel up against the bottom surface of the tank. Anyone who has seen the video of Bob Hoover doing a roll with a cup of tea sitting on the panel knows that Glasair is right. They further assured me that even if a turn was not well coordinated the ram pressure from the air stream entering the opening of the fuel vents was more than enough to push fuel back into the tank. This too is absolutely right.

And that's when the light went on. There were two vents into the same tank. In a turn, the ram air pressure from the outside wing vent is greater than the ram air pressure than from the inside wing vent because the outside wing is travelling faster. At first glance one might think that the fuel vent openings could not have such a great effect, but they do. The speed difference is great enough that we are taught in flight training to make allowances for indicated air speed readings in a turn depending on which wing holds the pitot. The net result was that the outer vent had pressurized the whole tank and was pumping fuel out the other vent with force.

Nevertheless it was completely torn down afterward and found to be in perfect working condition, as were all of the accessories. The prop didn't have a mark on it, and it too passed a teardown inspection with flying colours.

When I presented that explanation to Glasair I was met with stone cold silence - a sign that they had "lawyered up". I say that because I am retired from the practice of law and have seen this reaction many times. It's the frightened fawn reaction- don't move a muscle and pray the danger goes away.

To be fair, Glasair has issued Service Bulletin 131, Fuel Venting Overboard, which warns of that danger under certain conditions on the ground, but makes no mention that it might also happen in flight. On the contrary Glasair double-assured me that it was impossible. But from discussions with two well respected shops that specialize in experimental aircraft I learned that in flight venting from single cavity tanks is a dirty little secret that is known but not admitted. In fact they wondered aloud why anyone would design such a system. It might be worth noting that later serial numbers in the Super II series now include check float valves in the fuel vents as a standard part of the kit. Perhaps Glasair finally saw the light.

Only after the fact did I discover from Glasair that they would be happy to sell me a couple of these valves for a mere $1,000. Considering that it was their design that made these valves necessary in the first place one might expect Glasair to be more accommodating.

I respectfully suggested to Glasair that they might wish to expand SB131 to include in flight venting or at least take steps to warn their fleet. To my knowledge they have done neither, perhaps on the advice of counsel, as it could be taken as an admission of fault. Maybe this piece will help somewhat in alerting others.

Glasair need have no fear of a lawsuit from me. I prefer flying to suing because suing is such waste of time and resources. After four fingers of good scotch, lawyers will admit that even winners in a legal brawl often feel the cost of the chase wasn't worth the prize.

The Super II is a fairly good machine but I must give it a failing grade solely because of the complete lack of support and attitude of Glasair. My aircraft can easily be restored and returned to flight operation but that is not going to happen. The fuselage and its innards are intact and have been donated to a school that helps needy students pursue careers in aviation. And in my hangar are a virtually new IO-360 and a prop. I hope to put on the front of nice RV7A that needs a new engine. Does anybody out there have one? R

Something's Burning

Fire Safety Considerations for Homebuilders / RAA

IT WAS A LOVELY but cool day for flying so the pilot gave the engine a few extra priming shots, flicked on the mags, and cranked the starter. The engine coughed and suddenly there was a carb fire, and flames started licking out of the cowl. Fortunately a friend was nearby and he grabbed the hangar extinguisher and let loose into the cowl. The fire stopped almost immediately and everyone breathed a sigh of relief. The plane was saved... *or was it?*

This happened awhile ago to a member, but unfortunately even though the fire was stopped all was not rosy. The hangar extinguisher was the common powder ABC variety that is very effective but it can also be very destructive.

When a four cylinder engine is stopped there will be at least one intake open and another with the exhaust open, and there can even be one with both valves open. The powder in an ABC is corrosive to metal, and it is so finely divided that it will get into everything. In this case the engine was torn down two days later for inspection and the owner found etching of the cylinder walls, this despite that the engine was not turning at the time the extinguisher was used. The powder had got into one of the cylinders via the exhaust stacks, and another by getting past the intake filter. This stuff is insidious. Considering that the powder got past the carb, the owner sent it in for inspection and a rebuild. The engine parts were also changed as necessary but the engine still refuses to run properly and the carb is suspect.

There are three major classifications of fire:

Class A - paper, wood, textiles, plastics
Class B – fuel and other flammable liquids
Class C – electrical

There is also Class D which is finely divided metals such as magnesium shavings, but this does not apply to our aircraft.

Theory of the Fire Tetrahedron

Firefighters use the tetrahedron model – to sustain a fire there must be four components – fuel, oxygen, heat, and a chain reaction. Extinguishment of a fire is based on removing or hindering any one or more of these four components. Firefighters generally apply a large quantity of water, which lowers the heat. Unfortunately it is not practical to carry a large quantity of water on an aircraft, plus it is not safe for electrical fires and it may make a flammable liquid fire worse. so we carry an extinguisher on board the aircraft, and we usually have one or more in the hangar.

The most common extinguisher is the powder ABC type. It is effective on the fires that we are likely to encounter because it blankets the area with a powder that sticks to surfaces and prevents oxygen from getting to the heat source. The subsequent lack of a flame results in a cooling of the area, and the chain reaction stops.

A powder ABC extinguisher uses monoammonium phosphate, with nitrogen as a propellant. Unfortunately this chemical is very corrosive, and if water is subsequently added to the area it ionizes and attacks aluminum and other metals. If

1) Waterborne Stewart Systems burnt readily and completely. 2) Polypropylene trunk liner burnt slowly, curled up, and dripped 3) ABS burnt readily and dripped hot plastic. This material is frequently used for vacuum formed parts. 4) Fibre sound deadener burnt well… 5) …and then smouldered 6) Polycarbonate burnt slowly and charred 7) Acrylic burnt readily

used in the cabin there will be clouds of acrid choking dust, so this type is not suitable for use inside the cockpit.

Carbon Dioxide extinguishers are very effective because they smother the flame, ie they displace oxygen, which puts out the flame, and because they chill the area they also slow the chain reaction. The effect is not long lasting because it can be blown away and the fire can reignite, so they are not rated for Class A fires. Their advantage is that there is no residue and no chemical reaction with the materials that we commonly use in aircraft. Unfortunately the bottles must be thick walled and heavy because the CO2 is under high pressure. If used in the cabin the oxygen will be displaced, leaving none for the crew to breath. Also the rapid chill can damage the crew and some instruments. For our applications CO2 is usually not used.

Halon 1211 extinguishers are popular with the auto racing fraternity and are specifically required for many classes. Halon is effective on Class A, B, and C fires and does not conduct electricity back to the operator. Halon works by chemically reacting with the components of the fire to interrupt the chain reaction. Unlike CO2 it does not cold shock the avionics and it is effective in concentrations as low as 8%, leaving air for the crew to breathe. However although not toxic, it is possible inn a small area like a cockpit to displace enough air to asphyxiate the crew, so it is still prudent to open the vents or windows as soon as practical if a Halon extinguisher is used in a cockpit.

Halon is stored as a liquid so the container does not have to be heavy walled. It exits the nozzle as a liquid that can shoot more than the length of the cabin of the average light aircraft, vapourising when it hits the heat source. There is no residue so there is no cleanup with Halon extinguishers.

Many race car systems are plumbed, with one nozzle aimed at the carburetor intake, another at the fuel pump, and a couple at the driver. The production of Halon 1211 ceased in 1994 because it is a CFC, so extinguisher manufacturers have been legally recycling the material ever since. Halon has low toxicity and the FAA recommends its use in the cabins of commercial aircraft.

Plumbed Halon systems are available from many race car suppliers and from Aircraft Spruce. A 5 pound bottle of the Halon 1301 variant with three nozzles and 16 ft of aluminum tubing lists for just over $500, including the bulkhead fitting. Halon 1301 is approved for occupied areas and leaves no residue. A plumbed system plus a second handheld bottle is about as effective a system as is available.

Transport Canada does not regulate which type of extinguisher you use, but at final inspection the MD-RA inspector will be checking to see that it is installed properly. The bottle must be within the reach of the pilot while seatbelted, and it must be held in place by a metal, not by a plastic clamp. The bottle must not be placed in a location where it could become a projectile, so this means not up high and behind the heads of the crew unless secured to withstand high G impacts. Fire trucks use 9 G's as a guideline for securing items in the cab of the vehicle, to ensure crew safety in a crash.

It is important when building your plane to minimize the possibility of starting and propagating a fire. Keeping fuel out of the cabin is a good first step, although plumbing and valves will usually have to intrude. At minimum use metal lines, bulkhead fittings, and fire sleeves. Ensure that the piping is not under a strain when fitted in place, and make allowance for the vibration of the engine. Whether

The fire stopped almost immediately and everyone breathed a sigh of relief. The plane was saved... or was it?

to use a header tank in the cockpit is a hard choice, but in some aircraft there is no alternative.

The chance of an electrical fire can be minimized by using aircraft wire, with switches and fuses or breakers that are conservatively rated for the electrical load. If your plane has two batteries or alternators it might be a good idea to be able to take them out of the circuit if the need arises. Putting the wires into tidy bundles that are supported can lessen the chance of a wire breaking away from its end fitting. Ahead of the firewall ensure that the wires are well supported and allow for engine vibration. Make certain to use proper bulkhead fittings everywhere that wires pass from the cabin to the engine compartment.

Wood and composite materials can burn, while aluminum and metal tubing do not, but fabric covering does burn readily. Keep this in mind when choosing a design.

If possible minimize the flammability of interior fabrics. It has lately become popular to use automotive trunk lining as a lightweight interior fabric, but it will become a flaming goo, something that you will not want overhead. There is also a popular sound deadener that has what looks like fiberglass with a stitched aluminized plastic on one side. The fiberglass side is self extinguishing but when we tested the "aluminum" side it supported combustion readily. Doped fabrics support combustion too, so try to have none of these ahead of you in the cockpit. Thin aluminum sheet makes a good boot cowl on a fabric plane.

Composite planes frequently have rigid foam used as the core of the structure with epoxied fabric material bonded to both sides. The fabric and epoxy are slow to burn but the foam will usually burn readily if there is an exposed surface.

Seat upholstery and rubber foam should be tested with a propane torch before incorporating them into your plane. Nomex fabric looks like cotton canvas and it is what fire suits are made of, so it would be a good choice. Leather is somewhat heavier but it is very resistant to fire. Fabric backed man-made leathers look great and are not expensive, but give them the personal flame test before deciding.

Commercially produced vacuum formed plastic parts can be flammable, especially ABS which will drip hot balls of plastic as it burns. If you are using a plastic NACA duct to bring cold air into the cockpit, you might want to sacrifice one to see if it will burn and drip.

Canopies are usually polycarbonate or acrylic, and both will burn, but polycarbonate is more resistant to flame and in our simple test it self extinguished. Acrylic caught fire easily and burned very readily.

Ahead of the firewall there are several considerations. Keep the fuel lines well away from the exhaust system, and use an exhaust system that stays well away from the carburetor. On a Lycoming the popular crossover systems usually pay attention to this concern, but make sure to position the exhaust outlets well away from the gascolator.

Rotax 912 and 912S engines have the carbs above the engine, immediately above the exhaust ports.

continued on page 28

Applying an Aluminum Skin to a Wooden Airplane

Submitted by Bill Weir

This article is from Light Aviation, the magazine of Light Aircraft Association, the British equivalent to RAA.

The Flitzer is a biplane of all wood construction including the cowl over the cockpit where plywood is curved over laminated bows. "I described my method of fixing heavier duty aluminum panels to a wooden structure with the use of 'nutserts'. Here I want to describe the preparatory work I do in readiness for affixing a very lightweight aluminum skin to a structure. The non-modelers among you may not know the glass cloth and epoxy form of skinning. With a little care and a fair bit of elbow grease, a very good, totally weatherproof, light and strong surface finish can be achieved. I covered the forward upper decking area of the Flitzer ZIR using this method as, later, aluminum litho plate was to be stuck to this area for aesthetic reasons. To get a really good finish you could see three coats being required with a wet and dry rub between. For my purposes, only the fact that the skinning will toughen and seal the plywood surface is important, so two coats would suffice. lt is also an ideal preparation for a high quality paint finish on ply or wooden surfaces.

The Method

1] LAY THE glass cloth over the area to be covered. I used 0.6 ounce per square yard. Don't worry, if all you can get is 0.9 or 1 oz as it will end up at about the same weight. The lighter cloths are more open weaves so a little more epoxy is required to fill so it brings the finished job to about the same weight.
2] Mix lay-up epoxy resin [not the five minute variety] at the correct mix ratio and pour a little in the centre of the cloth. Using an old credit-card as a squeegee, spread the epoxy in all directions out from the centre pool. All whiteness will disappear from the cloth as it turns transparent, indicating that it has been wetted right through. If you have any "nutserts" take care not to fill them with epoxy. Do not try to mix enough epoxy to do the job in one go; mixed epoxy left in quantity gets fed up with waiting and exotherms, meaning it gets super-hot and quickly sets as it boils!
3] Pay particular attention to the edges of the job, ensuring that the cloth is wetted all the way to the edge - a little beyond doesn't hurt.
4] Check the area all over for dry spots and, more importantly, 'over wet' areas. The wet areas show up as being very glossy and are an unnecessary weight addition. Keep squeegeeing them, scraping the excess epoxy off the edge of the squeegee back into the mixing pot.
5] After allowing it to cure, trim the edges of the cloth with a sharp craft knife. A sanding block will remove excess epoxy at the edges. Sand the area all over, removing the gloss finish. Any runs can be scraped down with a sharp wide chisel held at 90 degrees to the surface, or use a proper scraper if you have one.
6] Wipe down with a tack cloth to remove dust. Make another mix of epoxy and apply another thin coat all over. Much less will be required for this coat as the weave of the cloth is already nearly full and none will be soaking into the plywood surface. A very thin coat should give a gloss finish this time. When cured, flat down and remove dust. Voila! You have a sealed surface that will accept a contact adhesive to fix the litho plate aluminum or a two-pack hi-build primer surface for your paint job. Use a smallish amount at a time, which is poured out on the job quickly so as not to allow the possibility of excess heat build-up, is the way to go. To do my front decking I made four mixes. This could have been cut to three if my quantity estimation had been better. I used this method of applying aluminum litho plate for my Isaacs Fury. Thinking back, however, I realize that it wasn't litho plate on the Fury, but thin commercial grade aluminum. This proved to be the wrong decision as the aluminum had a surface 'grain' that took many hours of 6 sanding and polishing to remove, whereas with litho plate a polished finish is readily achieved with a small polish and far less effort.

hercultespropellers.blogspot.com

shortfinals.wordpress.com

Although not seen a lot in North America, the Staaken Flitzer (above) is an ideal airplane for the litho plate treatment as is the Isaacs Fury (right). In both cases, the cowling and nosebowl are worked aluminum, but for the areas aft, litho plate can work just peachy and heighten the period feel of the aircraft.

What Is Litho Plate?

Litho plate is the thin [0.3mm] aluminum sheet that comes in drawing paper size A3, A2. A1, A0 and so on. Offset litho print shops use it as part of the print process. Normally, when the print run is finished the litho plate is considered scrap and can often be procured at no charge - one more benefit. The second-hand plate comes to you etched on one side with whatever the printer was producing and with a clean aluminum surface on the other. The plate is very light and of a grade that is maleable which is why aeromodellers started using it years ago. I use 3M Scotch-Weld 10 after reading that it was the choice of car homebuilders for sticking aluminum to plywood to make their vintage-style car bodies look more authentic.

APPLYING LITHO PLATE

Some thought needs to be given as to how you are going to accurately reposition the plate after it has been cut (which is easily done with scissors) and the adhesive applied. As most readers will know, contact adhesive means just that: when it touches it sticks. There is no second chance, especially with something as fragile as 0.3mm aluminum. The system I developed involves drilling a couple of 1.5 mm diameter holes in strategic positions through the plate and into the plywood and structure when the plate is where you want and nicely taped down. Then draw your perimeter cut line, after which you can remove he plate. Open out the holes in the plate to say 2mm diameter and drive 1.5mm pins into the Two holes in the structure, leaving them standing up by say 25mm. Pop rivet stems are perfect for this. After nailing together a Groppo Trail recently, I have a few thousand of those! So now you have a register that will allow you to put the plate back into position, theoretically to within a quarter of a millimeter - good enough for most folk methinks. The plate may now be cut but, again, do stop and think about it before diving in with the scissors. The chances are that you will want to 'burnish' the edge of the plate over the edge of the structure which you will have put a small radius on (won't you). lt wouldn't be good to leave a flat edge that would be prone to lifting every time you caught it. I turn an edge about 3mnm wide using a hardwood dowel, the round plastic handle of a screwdriver or maybe even a steel dowel (which could be a screwdriver blade), Now, with the register dowels (rivet stems) in place, the plate cut to finished size - plus edges to be 'burnished' over - and with any hatch areas also cut out of it to the finished size, the plate and the epoxied area it is to be affixed to may be cleaned with lacquer thinner or a proprietary spray cleaner, and then the adhesive applied. Do your best to avoid lumps in the adhesive film, which is applied to both surfaces, as anything under the aluminum will telegraph its presence through to the surface.

CAREFUL POSITIONING

Now you need to take your courage in both hands and carefully locate the aluminum component over the register dowels and drop into position, A Haynes manual at this stage would probably say, 'simply drop into position'. ln fact, you need extreme

care here and to drop the forward upper decking section on to the Flitzer fuselage I enlisted the aid of Jane, my long-suffering wife, and Martin Sims, who now helps me organize the home-builder tent at the Rally (serves him right for volunteering, I say). So, with Jane on one side and Martin on the other, the piece was carefully located on to the two pins I had positioned on the centreline, while ensuring that 7 the panel didn't sag in the middle and prematurely make contact. Then it is a question of lowering the central point to make contact and gently running a hand along the 'ridge' line of the decking before wiping down each side. At this stage a wallpaper roller was used to firmly fix the aluminum. Finally, burnish any edges over. lt is a good idea to practice this first on a piece of scrap litho. lt doesn't need gluing. For a very small weight penalty the above system can give an aircraft a really authentic look, so it is well worth the extra effort.

Icon News


Icon

Since its completion, ESN-1 has been undergoing extensive flight testing and systems performance verification. The objective of this process is to confirm that the production version of the A5 meets or exceeds the performance of the Proof of Concept (POC), which underwent more than 700 test flights for aerodynamic, hydrodynamic, and systems development. The ultimate goal is to prepare the production A5 for ASTM compliance and delivery to the first customer next spring.

As part of that process, the team performed several days of water testing at ICON's primary water ops location, Lake Isabella, California. While the POC's hull design was arguably one of the most modern and sophisticated amphibious hull designs in history, the ICON engineering team pushed ESN-1's design in an effort to further improve the A5's water-handling characteristics. With the goal of making the A5 as safe, easy to use, and fun as possible, water testing focused on verifying that the new hull design's performance exceeds the POC's in the following areas:

1. Landing: **ESN-1 can land easily at a range of airspeeds and deck angles (attitude) without porpoising (a pitch oscillation exhibited by most seaplanes).**

2. Turning: **Aggressive "step-turns" or "carves" on the water can be accomplished, similar to the performance of personal watercraft.**

3. Lateral Stability: **Static and dynamic lateral-stability requirements have been met throughout the design envelope in a range of water conditions, gross weights, and center-of-gravity (CG) locations.**

4. Water Handling: **The A5's design limits have been verified in rougher water and larger waves.**

5. Wind Operations: **ESN-1 can cope with high-wind situations, especially maintaining water-rudder effectiveness when turning to downwind. To test these parameters, ESN-1 was subjected to the full range of weight loadings and CG positions. In the photo below, CEO Kirk Hawkins is evaluating the A5's upper porpoise limit by performing a full-aft-stick water landing at minimum speed. The purpose of this exercise is to intentionally land the aircraft tail-first to determine if it will porpoise, a task that involves a highly unusual landing attitude that appears visually unsettling but enables the ICON team to evaluate the A5's capabilities.**

The ICON team has completed structural assembly of the Engineering Serial Number 2 (ESN-2) fuselage at the Tehachapi, California, production facility. The structure has been fully instrumented with strain gauges and will undergo testing to ensure it complies with ASTM strength requirements.

ICON engineers and technicians are simultaneously assembling Aircraft Serial Number 1 (ASN-1), the third production A5. ASN-1 is the final aircraft which will undergo FAA inspection to ensure the A5 complies with ASTM standards. In addition to the aircraft itself, ICON's manufacturing facility and documentation/quality systems will also be reviewed before serial production proceeds.

ASN-1 also marks a significant milestone as it is the first aircraft that will be delivered to a customer next spring, culminating years of research, development, and design leading to serial production.

The Movies Come to Cetinski Field

Mike Bellinger

MOST PEOPLE KNOW Charlie's field for its relaxed atmosphere while visiting pilots are often surprised to find seclusion so close to the city. The solitude vanished for a day on November 25th when Don Carmody Television filmed scenes from its new six part Netflix original series titled "Between" on and around the airport grounds.

Near the beginning of October a location scout arrived at the field unannounced and asked to look around. He explained that his job was to catalogue potential sites for the filming of a new TV series. After subsequent visits with additional technical people it was decided to film at Flamborough and use my airplane, a Murphy Rebel, in the process.

We arrived at the field at 05:00h as requested on Tuesday to roll the airplane out of the hangar for the morning's filming. Soon after, the film crew's vehicles began to arrive and within the hour the airport had the appearance of a small city. Trucks and trailers that contained everything from wardrobes to a canteen were wedged in to any space available.

By sun up the filming had begun. The original plan was to shoot on the runway but the wind was so strong we were reluctant to let the aircraft out of the lee of the hangar. After some discussion it was agreed that we work near the buildings so the first hurdle was resolved.

My main task was as a consultant to the film crew and actors. Most of the people needed coaching on aircraft etiquette, what a pilot does, and what is possible in a given situation.

At one point we set the tail wheel on some boxes to simulate the flight attitude while huge white screens were placed on the opposite side of the airplane. This way a technician in post-production can fill in the background and some scenes will appear to have been taken in flight. My biggest surprise was how much shooting it takes to get a few seconds of usable footage.

By late afternoon the wind had backed off enough for us to do the flying sequences. I left my hand held radio with John the airport manager so we could communicate with the film crew. My co-pilot Annette and I then did a takeoff for the cameras and then flew a few low and overs. By the time we returned to the hangar the sun was starting to set and we had had enough glamour. My hat is off to the film crews, they routinely work twelve and fourteen hour days when shooting.

"Between" has been filming since the end of October and is set to air in 2015 on City in Canada and on Netflix in the rest of the world. It is the story of a quarantined area that has been left to fend for itself after a mysterious disease breaks out. Filming has taken place in Hamilton, Hespeler, Ancaster, Dundas and surrounding areas as well.

MARCH SKI FLY-IN
RAA Chapter 4928 (Ottawa Rideau) Winter Ski Fly-in will take place on the 7th of March, 2015, FROM 10 AM TO 2 pm. The airfield is CPL3 Rideau Valley Airpark (KARS) at N45°6.00' / W75°38.00' . Frequency is 123.4. The contact is Larry Rowan 613-489-2332

Come and join the members of RAA 4928 for a hot meal and enjoy the company of other aviation enthusiasts. Call before leaving for runway conditions. Skis only.

Learning to Fly, The Easy Way

Barry Meek

IT CAN BE AS EASY as falling asleep! When I think back to the time I was learning to fly, memories of instructors who just didn't share my enthusiasm come to mind. A young person aspiring to be a pilot is anxious to learn the skills, practice the procedures and get on with the process. But it always seemed to me that the instructors dragged their feet, prolonging the learning and most of all, cutting short the lessons just as I was beginning to master the particular item of the day. Flying circuits is a good example. We would fly for about an hour, round and round the pattern. Every time around, I would mess up on some maneuver. Determined to get it all right, we would do it again. But almost every touch-and-go ended with something less than perfect. I would roll out on final and be lined up wide of the runway, or the speed would be too fast, or the descent rate too high. That was usually the point where the instructor would end the session. So, with great disappointment, I'd finish up the paperwork and go home.

On days when I just couldn't get it right, quitting seemed the wrong thing to do. Any time we fly, much can go wrong, but if we conclude with a good landing, we feel much better about the entire flight. Maybe I'm a slow learner, but it was several years before the process of taking small steps, then letting the brain do the rest, finally sunk in. Learning professionals have absolute conclusions that point out how the capacity of the brain is governed by volume and time. You can force a lot of skill and knowledge into your head at once, but what happens with it after that depends on the time you give the brain to sort it all out.

A good example of this can be observed by going back to those one-hour sessions in the circuit. The determined student pilot thinks that the longer he practices, the better his techniques will become. Of course that is true, but when you stop the physical practicing and let the brain then work it out, the learning actually comes much faster. Twenty four hours later, after a rest, the landings are much better. That's because the brain needs the rest, the time to sort out all the learning it's been force-fed.

Call it digestion if you like, because in basic terms, it is a similar process to what happens to all the food you eat. The processing of knowledge and skill can be compared with the processing of food. Eating doesn't extract the calories from the food. That procedure is what comes later as the digestive system takes over and it takes time to do it's work. The brain has a volume capacity, as does the stomach. It's a bad example of a similarity, perhaps. But you get my point.

Another example of good learning is experience, which has often been touted as the best teacher you can have. It all starts during the time before the flight tests. Creative instructors devise situations that give the student a few moments of terror, a time when the he must make quick decisions and take the responsibility for them. Some instructors will shut off the fuel supply, pull a circuit breaker that disables the radios, stick a piece of tape over a couple of instruments or put you under the hood in mid flight. You just flew into IMC! There's no question that situations like this will cause you to learn very fast, and learn the way out much better than sitting in on a lecture about engine failures, radio procedure, partial panels and getting out of the clouds. Learning is nothing more than a matter of forming memories. And memories come from the brain filing the skills and information in the proper framework. For that to work, the brain needs rest, time to sort the material. Without enough rest, the information doesn't get properly encoded in the memory, and we haven't learned anything.

Learning is nothing more than a matter of forming memories. And memories come from the brain filing the skills and information in the proper framework

I know a fellow, who happens to be learning to fly at the age when most pilots are retiring or leaving the cockpit. His enthusiasm is remarkable, and he often stays in the cockpit with his instructor for hours at a time. Still, the learning curve is proving to be very steep. If all this information is true, he might be much better off spending less time in the airplane and more time sleeping!

Learning the written information in ground school is similar. Students will frequently attempt to learn the content by reading the text several times. That may help in passing the test where the multiple-choice answers are word for word of what's in texts books. But all the research points to the technique of reading and comprehending the information to a point where you could actually teach it to someone else in the near future. Good instructors have plenty of real-world experience to draw from, ways to illustrate the points the student must learn. Reading alone can result in the student focusing on extracting facts but failing to link what he learns to retention.

Much of this is my own experience-based observations. It's what works for me after many years of giving the brain time to work it all out. And if you've not figured it out by now, that means a lot of time spent napping, sleeping or just plain and simple relaxing. During the years I spent in broadcasting, I came in contact with the theory that "we LEARN only a small amount of what we read or hear, more of what we see, and a greater amount, maybe half, of what we see and hear together. If we then go on to consider what we experience, the retention is higher yet. And hopefully, we understand and comprehend about 95 percent of what we teach to someone". I doubt the scientific accuracy in specific cases, but experience shows there's a lot of truth to it. Now if I'm learning a new skill, in flying or in anything else, I remember those first instructors who made me practice for an hour, then leave it alone for the rest of the day. When I come back to it, somehow magically it all falls together as it should. It's also helpful if there's an opportunity to teach the new knowledge to someone else. That way, I need to have it right.

A Canadian Staggerwing

Then and Now / by Mike Davenport

THE CLASSIC BEECHCRAFT D17S Staggerwing first appeared in 1937 and was a follow-on design for Walter Beech of the original fixed gear Model 17 of the early 1930s. It was considered to be one of the finest and fastest aircraft of the time. It was expensive with prices quoted between $14,000 and $17,000 US dollars depending upon the engine selected. A complex aircraft with retracting gear and a comfortable cabin large enough for five adults and some baggage, it had a top speed near 200 mph and that appealed to the wealthy business man in need of fast, efficient transportation.

This Staggerwing, registered CF-BDJ was manufactured by Beech in the spring of 1938 for Imperial Oil in Quebec. Imperial ordered the seaplane version as indicated by the model # SD17S. Two major differences are the fuel system and the addition of a right side cabin door. There were three tanks in the seaplane version instead of the four normally found in the landplane configuration. There was a tank in the lower wing right and two belly tanks making it easy to fuel from a dock without the need to climb ladders to fill upper wing tanks.

The airplane was delivered to Canada from the factory in Wichita, Kansas to Fairchild Aircraft in Longueil, PQ where it had a set of Canadian made EDO WA-4665 floats installed. Six weeks later, the wheels were reinstalled but brake problems caused an unfortunate incident. On August 12, 1938 the airplane overshot the runway and collected the airport boundary fence in the process. The damage included a bent propeller and also required the replacement of the front spars and a number of nose ribs in both lower wings. The airplane was back in service by Oct 7, some 7 weeks later.

Imperial operated the plane as an executive transport for the next ten years. For nine of those years the primary pilot was a well-known bush pilot, T.M. (Pat) Reid DFM.

Born in Ireland in August of 1895 and educated there, Reid served in WW1 with the Royal Naval Air Service. He learned to fly with the RAF and in 1918 was awarded the Distinguished Flying Medal[1]. Moving to Canada after a brief career with Handley-Page in England and Zurich, Switzerland he had a long and distinguished career in Canadian aviation. He began with the Ontario Provincial Air Service in 1924 and four years later in 1928 went on to join Northern Aerial Mineral Exploration Co. (NAME). There, he flew extensively in the north, opening up new routes as well as participating in a number of searches for lost aircraft both in Alaska and northern Canada. With his extensive knowledge of flying and the north, he joined Imperial in 1931 as aviation manager for their western division and was soon promoted to aviation sales manager, a position that he held until his death in 1954. In 1944 he was awarded the TransCanada Trophy (McKee Trophy) for the combined years of 43/44 for “outstanding pioneer flights which

greatly helped to promote aviation in Canada".

According to the logs, it appears that BJD was Pat's personal airplane as he flew it 417 times for an estimated 600 hours between August of 1938 and September of 1947. The logs show flights from Halifax on the east coast to Vancouver on the west and north to Fort Smith and Norman Wells on the Mackenzie River in the Northwest Territories.

In 1954, Pat and his wife Marjorie were travelling to Victoria when they were killed in a tragic mid-air collision over Moose Jaw. They were passengers in a Trans-Canada Air Line's Northstar when their aircraft was struck by a locally based RCAF Harvard. Thirty seven lives were lost that day including one on the ground.

Imperial Oil declared BDJ surplus in 1948 and sold it to Northern Wings in Sept Iles in eastern Quebec in 1948, after purchasing two DC-3's for their expanding aviation department.

Northern Wings operated the Staggerwing until late in 1955. During that time, the aircraft appears to have led a difficult life, as letters between the owners and the Department of Transport attest.

They took BJD out of service in 1955 and stored the disassembled airframe in hanger at Sept Iles for the next 14 years. If you are following the chronology, this airplane saw approximately 16 years of service and had accumulated a total of just 2761 hours in that time.

In 1969, the remains of BDJ were sold and flown as cargo in a Curtis Commando (C46) to Montreal where it was picked up by the new owner, Ron Uloth. More about Ron later.The floats arrived in Montreal later in 1970 by barge. The fuselage was stored in a technical college and the remaining parts were stored in various garages in the Montreal area and all were eventually moved to Kemptville near Ottawa 21 years later in 1990.

RESTORATION 2003 - 2014

In the fall of 2002, Jim Britton of West Vancouver, BC was looking for a retirement project and purchased the airframe from Ron Uloth. Jim had recently retired after a long career in the petroleum industry and was looking for a project to prevent physical and mental atrophy in his "golden years".

Jim was born in Woodstock, NB in 1934 and was educated in Ontario obtaining a degree in geological engineering from the University of Toronto. For the next 45 years, Jim, worked for a variety of oil companies in Calgary and Vancouver drilling wells in Alberta and the NWT. In 1957 he married Silvija and her name is highlighted on the right side of the cabin celebrating over 57 years of marriage to date. Along the way, Jim also found time to get a glider licence and spent hours soaring in Alberta.

I asked Jim, why he had bought a Staggerwing to restore as it is hard to comprehend why anyone would undertake such a complex task as a first time project. He replied simply that he wanted something to keep him active in retirement. He certainly has achieved that goal.

Jim has been exposed to aviation since he was 4 years old when his father, Russell (Jim) Britton, an aircraft engineer would take him to work with him and "Jimmy" would play in the hanger surrounded by Fleet Finches, Dragon Rapides (or should that be Dragons Rapide?) and other biplanes of the era. His first ride came later in a J-3 Piper Cub.

In school, he met and became best friends with Ron Uloth. Together, they built and flew model airplanes. Ron was Jim's best man at Jim and Silvija's wedding in 1957. Ron went on to a career with Air Canada as an aeronautical engineer and in retirement bought a Staggerwing (CF-EKA) to restore. Along the way, he also acquired CF-BJD and ultimately sold it to Jim.

*I asked Jim why he had bought a Staggerwing to restore ... as a first time project. He replied simply that he wanted something to keep him active in retirement. He certainly has achieved **that** goal*

With Ron's help and in a 5 day driving marathon, they moved BJD from Kemptville to West Vancouver in a rental truck.

The restoration work has taken 12 years to complete and included replacing all of the woodwork with the original parts serving only as patterns. There were times when the wood was in such bad shape that Jim had to obtain copies of the original factory drawings to ensure that the parts were made correctly. Over a period of 4 years, from 2003 to 2007 he built all new wing panels, flaps and ailerons, vertical fin, rudder, horizontal stabilizer and the elevators and used Sitka spruce for the spars and ribs and Finnish Birch plywood for gussets and skins where appropriate. G2 adhesives and sealers were used throughout.

The steel tube fuselage, motor mount and all of the metal fittings were taken to Lindair Services Ltd, a maintenance facility in Richmond at the Vancouver airport. There they were x-rayed and magnafluxed and coated with epoxy. Lindair was charged with assembling the airplane and rigging all of the controls and providing the necessary signatures. Then Jim fitted the fuselage with the all new formers and stringers; the fairings that give the Staggerwing its distinctive art-deco shape. Like so many first time projects, the quality of the wood work is so high that it seems a shame to cover it with fabric. I asked Jim if he had a background in carpentry or cabinet making and his reply was "no but my grandpa did". I guess that it must be in the genes.

Next came the restoration of the instrument panel back to its original layout complete with freshly overhauled old style instruments. The radios are Garmin, including dual GNC250XL GPS/coms, a GTX transponder and a 340 audio panel. The electrical system was updated to 24 from 12 volt, completing work begun by Northern Wings in 1960. A run-out 450 hp P&W R985 was obtained and sent to Aero-Engines Inc.[2] in Los Angeles for overhaul. Jim also obtained and overhauled a Hamilton Standard two blade propeller complete with a huge and impressive chromed spinner.

New streamlined flying and landing wires were ordered from Bruntons in Scotland and were installed.

All leather upholstery fabricated by Wolf Kaiser's Custom Furnishings Ltd of Richmond completed the interior, at a somewhat higher price than that quoted by Beech in 1939. Beech's price list then showed a price of $60.00 for a leather interior.

Modern Cleveland wheels and

The clean, art-deco look of the Staggerwing is a tribute to prewar engineering prowess. It looks great from any angle.

brakes were installed in place of the original factory installed Goodyear's.

Jim has also added a fourth fuel tank in the lower left wing, increasing the total capacity to 124 US gallons and the range to four hours with good reserves.

PRESENT DAY

As I turned the corner at the hangar, his truck was parked in front of the doors, a sure sign that Werner Griesbeck was there. I slid the door open enough to slide through and said, "Good morning, you in here, Werner?" A grunt from the cabin of the yellow biplane indicated that he

"It takes a village to raise a child". The same could be said (sort of) about a project the size of the Staggerwing. Jim chose to acknowledge many of the people who were involved in the restoration by having their names listed alphabetically on both landing gear doors.

indeed was inside and doing some mysterious thing. "What are you up to today?"

"Trying to hook up this damned turn and bank"he replied. It seems that the turn and bank was the latest breakdown of note on this project. Previously, he had replaced the manifold pressure gauge, the prop control, the primer, the prop governor, and the clock, all things installed as working by a prior engineer. Each of these of these tasks was made more difficult due to the lack of room to work in and on a D17.

He crawled out from under the panel swearing and with bleeding hands from numerous cuts from sharp corners in the close quarters where he was working.

The pressure was on as this was the week when the first test flight was scheduled. The owner had arranged to have an experienced Staggerwing pilot and his engineer come to Langley from Salmon Arm and Edmonton to examine and then not only test fly the aircraft but check out at least one local pilot in the complex and very fast antique. That was not to be as snowy weather in the mountains prevented the pilot and engineer from driving through to the Fraser Valley.

Murphy – as in Murphy's Law – was also on site as minor problems, one after the other continued to need to be addressed. Detail items such as the javelins for the flying wires and the placards for the instrument panel, all were needed to complete the restoration and were late in arriving adding to Werner's frustrations.

At this point, Werner has 2 years into the project, which started out be just fabric and paint work but morphed over time into final assembly and all the other assorted things that needed doing - some of them several times.

Werner is uniquely qualified to do this covering work, having restored a number of aircraft and covered many others. His Fairchild 24 and Porterfield are examples of his dedication to detail as they both are consistent trophy winners at airshows and flyins each year.

"Just fabric" on a large fast biplane like the Staggerwing is a major project in itself that can only be done much like eating the proverbial elephant, one bite at a time. Many hours are required to prep the parts for the fabric, more to glue and shrink it in place and many, many more to rib stitch four wing panels, all the control surfaces, and the fuselage, all using the special 'staggerwing knot'. Once that is done, then it is time to apply all of the tapes and then to plan the paint process. Numerous coats of silver were applied and sanded, taking care not to cut through the cloth or to hide the tapes as they were planned to be still visible even after all of the colour coats are applied.

The aircraft had arrived from Richmond to a hanger in Langley,

sans fabric in January of 2013. All of the smaller parts, four wing panels two flap panels, elevators, ailerons and rudder went out to Werner's shop in Aldergrove where he, Dan Holliday and I covered and rib-stitched the lot. Werner applied all of the tapes and sprayed the silver, two intermediate coats of white[3] and five colour coats of yellow.

By this time the weather had turned cold so a deal was made to use a heated hanger for the winter. Werner then applied the fabric on the fuselage and Dan and I finished the required stitching around the cabin.

During the winter, the fuselage and most of the multitude of small parts were painted. Each requiring the same coats of primer, white and yellow as per the wings and control surfaces.

Now, in late spring and back in the unheated hanger on the west side, he began the assembly of all these pieces, a complex job on any light aircraft whether a J3 Cub or a Cherokee but particularly difficult on a Staggerwing. Think about the complexity of the gear retraction system with its multitude of doors, springs, motors, brackets, cables, chains, gears, cranks and back-up systems and you begin to get the idea. Several days were consumed in designing and fabricating the jacks required just to lift the airplane in order to "swing" the gear.

The first engine run was also problematic. It wouldn't start. No fuel was getting to the engine. It seems that the fuel selector (indicator) was in error, pointing to a tank that was believed to contain fuel, but was in fact a different, empty one. One more snag for the list.

After a number of delays due to weather and pilot schedules, the first flight of the restored aircraft was rescheduled for December 7, 2014, fifty eight years after the last flight in 1956. The weather was forecast to be flyable, the first in weeks. An experienced Staggerwing pilot and owner, Mark Hyderman came over from Edmonton, Alberta along with Ron Helgeson his engineer from Salmon Arm, to do the initial test flight and to check out Brad Jorgenson of Delta, BC.

A number of snags prevented flight but did allow some engine runs and a brief taxi test. Some adjustment to oil pressure and significant work to the ailerons would need to be done. Because these concerns needed to be addressed and planned vacations were scheduled for January, the plans to fly were delayed until early February.

This time will not be wasted though, there is still the headliner to install as well as the carpet for the floor and then the scuff plates to protect the carpet, touch up any paint chips and and and and... R

Notes:

[1] From 1918 until 1933, the DFM award was made to non-commissioned officers and men for an act or acts of valour, courage or devotion to duty performed whilst flying in active operations against the enemy. Officers received the DFC. After 1933, the DFM was discontinued and all ranks received the DFC

[2] Aero-Engines Inc. closed in August 2014 after 59 years overhauling Pratt and Whitney R985's

[3] The finish colour on this aircraft is yellow and as yellows tend to be very transparent, they often require many coats to provide coverage and hiding. Several colours of primer are used in the finishing process; silver on the fabric as well as grey, green and beige on the metal. (Green for the zinc chromate, grey for the primer surfacers and yellow for the fillers.) To reduce the number of colour coats and to provide an even base, all of the parts have to first be painted white.

Fire / continued from page 15

Fortunately the carbs have overflow hoses, and some models have little drip trays under the carbs, with drain hoses that should be routed well away from the exhaust. You cannot do anything about the positioning of the exhaust ports and the carbs, but you could choose an exhaust system that positions the muffler where fuel cannot drip onto it.

Now back to the powder ABC extinguisher that we all have at our hangars. If you end up using one of these you must not try to wash the powder off with water. That will just allow the monoammonium phosphate to get into every crevice, and then propagate by capillary action. The ionized chemical will etch any metal parts and you will no longer have the plane you started with. Mechanical removal is the first step, initially with a brush and a small dustpan, and then with a shop vac. If the powder found its way into your gauges, starter or alternator, you might as well go shopping. An initial investment in Halon could save you a lot of money in the long run.

It is winter now and most of us are not flying our planes. This would be a good time to have a look at your own plane to see if you can maximize its fire safety. R

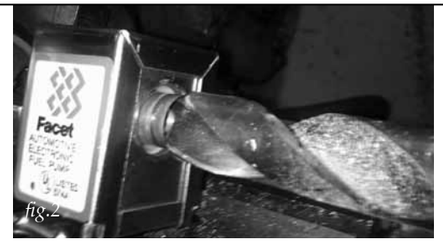


fig.2


fig3


fig4

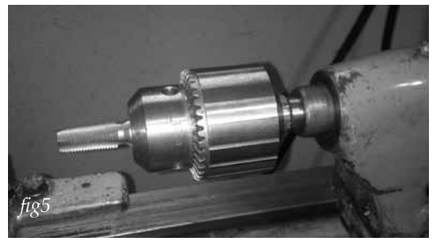


fig5


fig6

fig.1

Go with the Flow

Modifying a Facet fuel pump for larger fittings

by Clare Snyder

FUEL SYSTEMS IN Amateur built planes, particularly those with alternate engines installed, cause more problems, and more unscheduled landings than any other component of the aircraft. Low wing aircraft, and aircraft with top mounted carburetors, depend on the fuel pump to make sure sufficient fuel gets to the engine under all flight modes. Unlike certified aircraft engines and the venerabler Rotax 900 series engines, my Corvair conversion does not have an engine driven (mechanical) fuel pump. One of the most common electric fuel pumps in use today on experimental aircraft is the "Cube" electronic pump, the most common of the genre being the Facet (fig 1)

Most of these Facet pumps come with 1/8" NPT fittings on both the inlet and outlet of the pump, yet many of us run 3/8" (AN-6) tubing for the fuel lines. I did NOT like the idea of reducing the line size that drastically at the pump and set about looking for a solution.

I dissassembled one to see what could be done about it. This required stretching the crimp at the end of the "cylinder" to allow the piston to come out.

I accomplished this (fig 2) by mounting the pump body in the 3-jaw chuck of my Myford Super 7 lathe and, using a 3/4" drill bit, turned the pump backwards to reform the end "crimp" on the brass tube. This allowed the piston to come out. Watch the little nylon washer at the bottom of the cylinder (fig 3)!

I then chucked the inlet "nut" into the lathe and drilled the hole out to 7/16" and threaded it with a 1/4NPT tap. (fig 4 and 5)

I then chucked (fig 6) the outlet end of the pump in the lathe and drilled it out, from the inside out. (The next one I did, I was able to remove the outlet end and cyl, which made the job easier).

continued on page 42

Definitely NOT a Rotax installation.

Mass Moment of Inertia

Matching your prop to your engine really matters. Here's how to do it
by Dan Oldridge

MASS *WHAT*? That was my reaction when I first heard about mass moment of inertia, but I'm glad I took the time to find out more. Here is why it should matter to you too regardless of what you fly, but especially if you are considering a new propeller or flying behind a Rotax engine in your plane. Let me start by telling you why it matters so much.

First, your warranty depends upon not exceeding the MMOI limits. In Part 4.1 of the Rotax Installation Manual, under Safety Information – Engine Run, one of the conditions stated among the usual items like not leaving the engine running unattended and making sure the fluids are full, is a simple statement with obvious consequences. This particular bulleted line states, "Propeller and its attachment with a moment of inertia in excess of the specified value must not be used and releases the engine manufacturer from any liability".

Second, even if your engine is out of warranty, using a propeller with a MMOI that is higher than allowed, can put undue stress on the gearbox thereby creating a situation that can lead to premature gear wear and even catastrophic failure of the gearbox and possibly the engine. Part 1.2 of the Rotax Installation Manual, under Operating Limits, clearly defines the maximum permissible moment of inertia on the propeller, which we will explore later.

Third, when your engine is idling, the power stroke tries to accelerate the prop and the compression stroke tries to decelerate it. Singles have the most cyclic variation and a six cylinder inline is pretty smooth. Singles need a big heavy flywheel to become smooth, while a six can get away with practically nothing. High inertial loads increase compression and hinder the stroke causing many engines to idle poorly. Some people fiddle with timing and fuel mixture trying to solve this problem, but never suspect that high MMOI may be the culprit. Rotax engines specify an idle speed above 1800 rpm for this very reason. If you have flown behind a Rotax engine, you have likely experienced the chatter that results from allowing the engine speed to get too slow. Idling below this speed can cause inertial forces to damage the gears as the internal dampeners can no longer handle the forces created by the MMOI of the spinning propeller. As the engine speeds up, the effects become less noticeable.

Fourth, vibrations from a propeller with a MMOI that is too high are transmitted through the gearbox, engine, and airframe thousands of times per minute during flight in a typical light aircraft and unless the loads are reduced or dissipated, the associated vibration can cause instrument failure, engine damage, prop failure and airframe damage. Rotax has tried to solve this by installing a gearbox dampener to absorb the pulses of power and compression. The dampener absorbs some of the energy and then gives it back. That takes some of the load off the gearbox so that the gear teeth do not hammer against each other. Rotaxowner.com contains the following explanation of how the dampening system works, "The torsional dampening system consists of a pair of metal "dogs" which ramp against each other. When a piston pulse is transferred through the gearbox, these dogs ramp against each other and the force is absorbed by a set of disk springs (spring pack) holding these dogs against each other. These metal dogs and disk springs do wear over time and will loosen the spring pack tension within the gearbox. When the gearbox spring tension loosens, the torsional dampening system is less able to absorb the piston pulses. This will result in more vibration and a rougher running engine at low RPM's. Over time, a "loose" gearbox will cause excessive wear to gearbox components as well as transferring unwanted vibration to other engine and airframe components. A "loose" gearbox can also cause hard starting issues. Engine roughness or vibration caused by low gearbox spring pack tension can slowly increase over time, as the gearbox wear increases and the spring tension decreases."

Understanding this, it is important that you shim, replace disk washers (also known as Belleville washers) and dogs as they wear, you will limit the likelihood of additional gearbox and engine damage. Only if you are negligent will further damage occur.

Fifth, a propeller with low MMOI will spin up faster and slow down quicker, theoretically making a quicker recovery from a hazardous situation, although our own reaction time may have more of an influence in this case. However, if you remember that the spinning propeller also causes gyroscopic precession, you will also understand that the larger the mass of the gyroscope, the more precession you will experience; therefore the lower the MMOI the better to reduce adverse turning tendencies and torsional stress created by the spinning mass of the propeller.

So what is MMOI and what can I do about it anyway? Rotational MMOI can be thought of as the resistance to changes in rotational speed. Mass moment of inertia is best understood by considering two things, first that inertia is a force that resists change in motion, and second that moment, as we remember from our weight and balance calculations, is the distance from a set point. In this case the set point is the centre of the propeller hub, so the MMOI is the inertial or resistive force trying to accelerate (or decelerate) a mass (the propeller) at a distance from the center of the hub. Given this information, you can see that not only the amount of mass (overall weight including extensions, bolts and spinner) makes a difference, but also the distance the mass is from the hub (prop diameter) and the distribution of that mass (shape and thickness of the blades throughout their length).

...using a propeller with a MMOI that is higher than allowed can put undue stress on the gearbox thereby creating a situation that can lead to premature gear wear and even catastrophic failure of the gearbox and possibly the engine

You are probably thinking, "There are likely as many different prop designs, lengths and pitches as there are pilots and planes", and you would probably be right. Currently, there is still a substantial amount of confusion in the amateur, LSA and ultralight aircraft industry regarding propeller inertia. There are some companies that routinely test and publish MMOI figures for their various models, but many more are blissfully unaware of MMOI, or hope that we are, so they can continue to produce and sell propellers that may not meet the specifications spelled out by engine manufacturers like Rotax.

Engine manufacturers are concerned with the rotational mass moment of inertia of the propeller, which is defined as the sum of the product of mass times radius squared, where the radius is the distance of the mass from the axis of rotation, or Rotational Mass Moment of Inertia = mass * radius^2.

For a propeller, the mass in this definition includes the mass of the propeller hub and the propeller blades. However, the bolts and spinner add to the actual mass so it may be good to give yourself a little wiggle room when considering the MMOI of the prop on your plane. If you look at the Rotax specification, you may notice that the units on the Rotax limits match the definition [kg (mass) * cm^2 (radius, or distance, squared)].

Rotax specifies the following propeller mass moment of inertia limits for their various gearboxes in order to "not overstrain the propeller shaft and gearbox and to avoid problems with the shock absorber installed in the gearbox":

Model "A" or "B" gearbox–less

than or equal to 3000 kg cm^2

Model "C" gearbox–less than or equal to 6000 kg cm^2

With so many propeller choices out there, how do you know which one is best suited for your plane, while avoiding a propeller that exceeds the recommended MMOI for your engine? If you are buying a new propeller, I believe it would be in your best interest to demand MMOI specifications or measurements from the manufacturer. Many of the larger propeller companies like Sensenich provide the MMOI as a regular part of their practice, but smaller companies and custom prop manufacturers may be more reluctant to provide numbers. Ask if you can make it a condition of sale that it falls within the recommended range for your engine. Don't hesitate to test it when it arrives using the method described below, which is from the Rotax Service Instructions. Lonnie Prince advised me that because many of the props he has been making at Prince Aircraft are custom props, the MMOI will be dependent upon a number of factors including the density of the wood grain, which influences weight, the length and pitch of the prop, which determine the profile and therefore weight distribution and the required size and thickness of the hub, which also influences weight. If a custom prop manufacturer knows up front that you are concerned about mass moment of inertia, they may be able to select a lighter blank or recommend changes that will help reduce MMOI.

If you already have a propeller mounted and don't know what the MMOI of the prop is, consider removing it during your next service cycle and measuring it. If you've been experiencing vibrations or rough idling that you can't seem to resolve, test it ASAP. It only takes a few minutes to do the test and could save your gearbox, engine or life. I suggest you pick up a couple of bolts about 2" longer than your current prop bolts and a couple of nuts ahead of time so you are not scrambling for them when you do the test. Most propellers will measure between 3000 and 6000 kg cm^2, but at least one propeller that was commonly used on LSAs and ultralights is reported to have a MMOI of over 10,000 kg cm^2. Remember 6000 kg cm^2 is the limit even for the "C" gearbox used on 912 and 914 engines and only 3000 kg cm^2 on the direct drive Jabiru 2200 engines!

How to Measure Mass Moment of Inertia

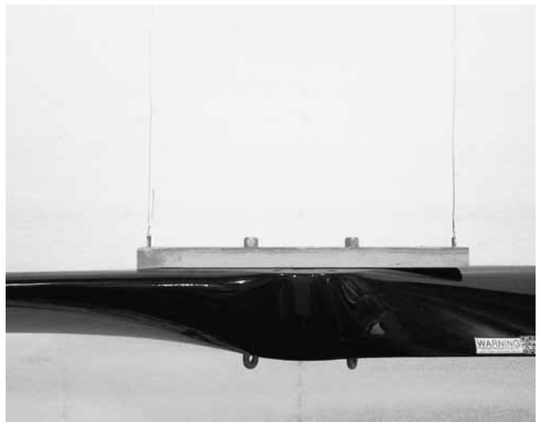
Rotax published a document in 1992 that still stands as their benchmark method for determination of Propeller MMOI. It can be found at *http://www.flyrotax.com/portaldata/5/dokus/d02941.pdf.*

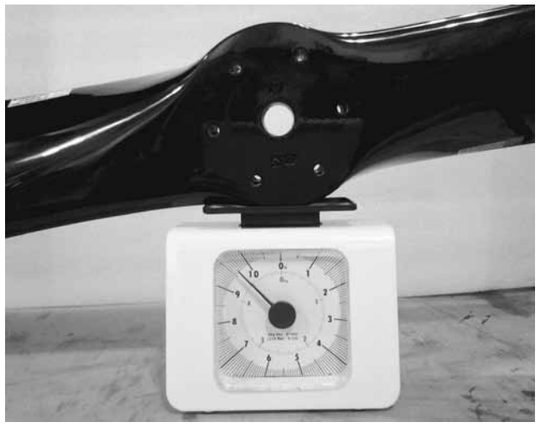
Basically, it measures the timing of oscillations of a propeller suspended on two wires (safety wire works well), to determine the MMOI. The set up and test method are very simple although they may look a bit intimidating at first glance. Here is how to do it…

Cut two pieces of safety wire about 80" long. Fasten one end of the two wires 12" apart to the ceiling of your garage or workshop using fencing staples, cup hooks, or whatever works to allow free movement of the wires. Fasten two more staples or hooks into a small piece of wood 12" apart. Drill two holes to accept two bolts that will reach through the propeller and the wood and allow a nut to fasten them together. Then suspend the wood piece and fasten the wires so they are 72" long. Now mount the prop to the wood block. Using a stopwatch, time the propeller through 30 full oscillations (back and forth) starting at about 10 degrees each way and record the time in seconds. Weigh the propeller and record it in pounds or kilograms to one decimal accuracy. (A food scale works well for this.)

Using the Rotax-supplied chart in the document mentioned above, simply find the intersection of the weight and time lines to find the MMOI of the propeller. Note that propeller weight is shown in kilograms on the left side and pounds on the right side of the graph. An example of a propeller that weighs 4.2 kg and takes 175 seconds to complete 30 oscillations is shown on the chart. The mass moment of inertia works out to be 4500 kg cm^2 for the example propeller. Another example is that my 74-51 Prince carbon fibre propeller with its maple core weighs 9.7 pounds (4.35 kg) and took 195 seconds to go through 30 oscillations, yielding an MMOI of 5800 kg cm2. Although this is on the high end, it is within Rotax specifications and does not void the warranty or create excessive stress on the engine and gearbox. Should I be concerned about getting a prop with a lower mass moment of inertia? Since the MMOI of my prop is within the specified range for my 912uls, probably not, and here's why…

Having a lower mass moment of inertia does have some advantages,





After hanging the prop (above left) swing the prop about 10 degrees and time the oscillations. The propeller is then weighed (right) on a common kitchen scale and the timing and weight are compared to the Rotax supplied table. The intersecction of the weight and time lines will yield the MMOI of your particular propeller.

but there are trade-offs too. Using a prop with low MMOI means that the prop now takes the brunt of the cyclic variation. It is more likely to have cyclic variations in speed, and the amplitude is largest at the tips. The gears and damper have an easier time of it but the prop now has to deal with the variations. Some propellers are flexible enough to whip, and some just break near the hub where the loads are the highest. Blades that are light and whippy have a cross-sectional change right at the root where it becomes round and tend to place a lot of stress right in the clamped area. This is where a few of the early ground adjustable wood props always seemed to fail. Most aircraft propeller manufacturers are aware of this now and put an incredible amount of engineering into strengthening this section of the propeller blades and designing fastening systems that hold the blades firmly in place. With modern engineering, it is possible to get low MMOI propellers that are as strong and resilient as those that traditionally would have had a much higher mass moment of inertia. Do your research and choose wisely.

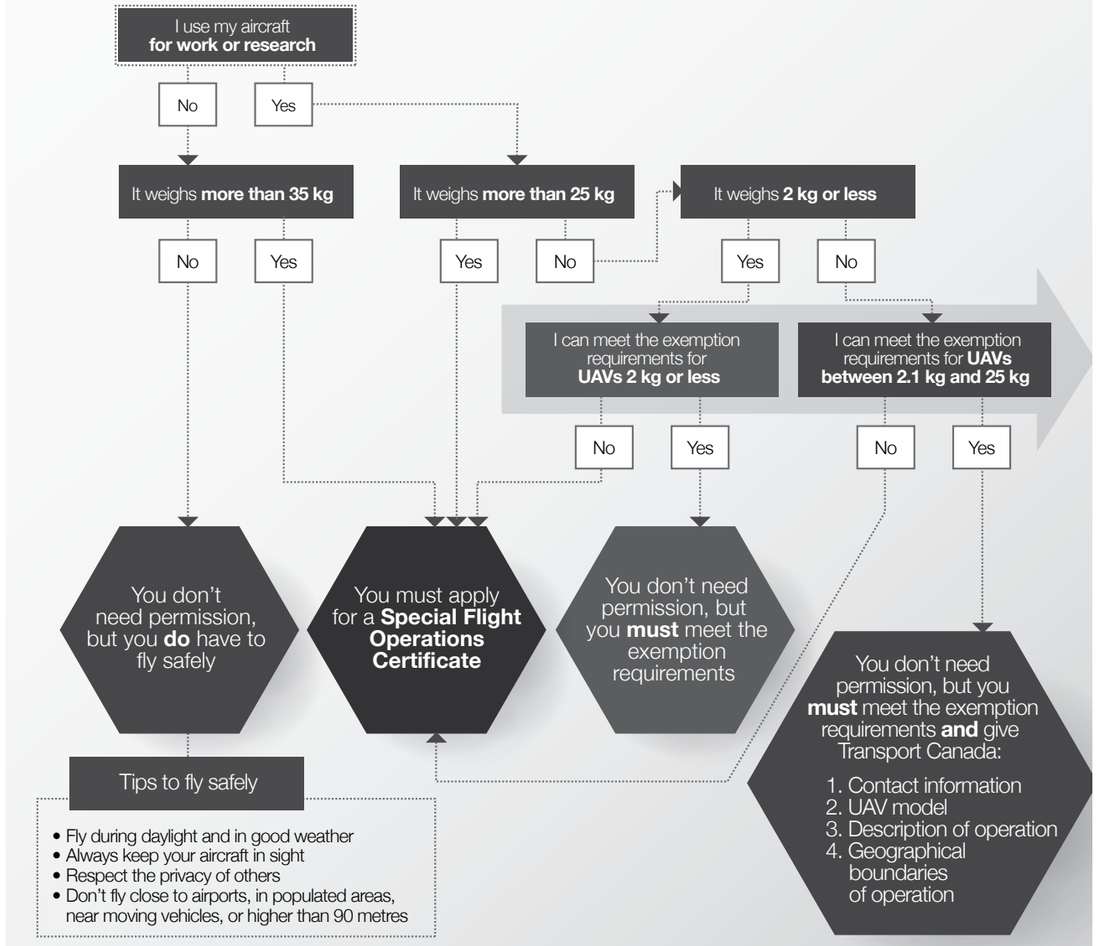
Not everyone is aware of MMOI, and some make a personal choice to ignore it. I have some acquaintances that fly their machines at the limits of their operational abilities and are willing to take a chance on having to rebuild a gearbox, just for the ability to take off 10 or 20 feet shorter than everyone else by running propellers of excessive diameter (the moment of inertia increases exponentially with diameter) that may be over-stressing their engines. Like dirt bike racers, they are willing to spend the winter and more money than some of us rebuilding their engines so they can over-stress their engines in the summer and be just a little faster than everyone else. It's their choice, and many of them are so attuned to the sound of their engines that they recognize when something is not right and do whatever maintenance is required. I respect and admire pilots that can push their machines to their limits and seem to do this safely, but it's not the way most of us fly or operate our aircraft. To us, awareness of the MMOI should make a difference as we try to minimize risk and unnecessary repairs. As a first time builder and low time pilot, I am not an expert, so my hope is just to make you aware of MMOI so you can make the right propeller choice based on your power plant's requirements in addition to the usual reasons of how and why you operate your aircraft. I encourage you to find out more about mass moment of inertia on-line or through more experienced RAA members.

Propeller choice is personal and should reflect the mission profile, the owner's tastes and style preference, but most of all it should be a well-researched choice that considers safety and the operational limits of the aircraft's engine design, which includes awareness of the propeller's mass moment of inertia.

Transport Canada Transports Canada

Flying an unmanned aircraft?

You may need permission from Transport Canada



tc.gc.ca/safetyfirst

Canada

Exemption requirements for operating UAVs without permission

THIS INFOGRAPHIC IS FOR EASE OF REFERENCE ONLY. YOU MUST CONSULT THE OFFICIAL EXEMPTIONS.

UAVs 2 kg or less

- Be safe, well trained and know the rules of the sky
- Be 18 years old, or at least 16 years old to conduct research under academic supervision
- Have at least $100,000 liability insurance
- Be alert—not tired or under the influence of alcohol or drugs
- Inspect your UAV and site before flight to ensure they are safe
- Get permission before you go onto private property
- Inform Air Traffic Services if your UAV enters controlled airspace
- Give right-of-way to manned aircraft
- Fly during daylight and in good weather
- Keep your aircraft in direct line of sight and always be able to see it with your own eyes
- Verify that radio frequencies/transmissions won't affect control of your UAV
- Have an emergency plan ahead of time
- Carry a copy of your UAV exemption, proof of liability insurance, contact information, and aircraft system limitations
- Follow the manufacturer's operating and emergency procedures, including those if the remote control loses contact with the aircraft
- Respect laws from all levels of government
- Operate only one UAV at a time, with a single remote control
- Immediately stop all operations if you can no longer meet the exemption requirements or if the safety of a person, property or other aircraft is at risk
- Stay at least 30 metres away from people, animals, buildings, structures, and vehicles not involved in the operation

UAVs between 2.1 kg and 25 kg

- Be safe, well trained and know the rules of the sky
- Be 18 years old
- Have at least $100,000 liability insurance
- Be alert—not tired or under the influence of alcohol or drugs
- Inspect your UAV and site before flight to ensure they are safe
- Get permission before you go onto private property
- Carry a copy of your UAV exemption, proof of liability insurance, contact information, and UAV system limitations
- Respect laws from all levels of government
- Keep your UAV in direct line of sight and always be able to see it with your own eyes
- Operate only one UAV at a time, with a single remote control
- Give right-of-way to manned aircraft
- Fly during daylight and in good weather (no clouds, snow or icy conditions)
- Create and follow procedures for landing and recovering your UAV and for contacting emergency responders and air traffic control.
- Have an emergency plan ahead of time
- Follow the manufacturer's operating and emergency procedures, including those if the remote control loses contact with the aircraft
- Verify that radio frequencies/transmission and eletronic devices won't affect control of your UAV
- Assess the risk of losing connection with the UAV and decide when to use the flight termination setting
- Have a fire extinguisher on site
- Inform Air Traffic Services if your UAV enters controlled airspace
- Follow the manufacturer's maintenance/assembly instructions
- Ensure the UAV does not have an emergency locator transmitter
- Report accidents to Transport Canada and stop operations until you have addressed the risks
- Immediately stop all operations if you can no longer respect the exemption requirements or if the safety of a person, property or other aircraft is at risk
- Stay at least 150 metres away from people, animals, buildings, structures, and vehicles not involved in the operation

DO NOT:

- Fly closer than 9 km from forest fires, airports, heliports, aerodromes, or built-up areas
- Fly over military bases, prisons or in controlled or restricted airspace
- Fly over crowds or higher than 90 metres
- Participate in special aviation events, air shows or system demonstrations
- Carry dangerous goods or lasers

tc.gc.ca/safetyfirst

Canada

Catalogue No. T86-5/2014E-PDF ISBN 978-1-100-25401-2

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. George Elliott gaelliott@sympatico.ca 705-445-7054

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. KW-RAA meets the second Tuesday of each month at 7:30 pm at the Air Cadet Building at CYKF. In summer months we have fly-ins instead of meetings. Please contact President Dan Oldridge at oldridge@golden.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 Meeting: First Tuesday, 7:30 pm at Midland/Huronia airport (CYEE) terminal building. Contacts: President Ian Reed – 705-549-0572, Secretary Ray McNally – 705-533-4998, 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: Meetings, Second Monday, 19:30 at the Aviation Museum. Contact: President Roger Smeland (780) 466-9196 or Jim Gallinger (780) 242-5424 . Website - http://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: jjwvanhalderen@shaw.ca

SUNCOAST RAA CHAPTER 580: Second Sunday 13:30 pm Sechelt Airport Clubhouse, sometimes members homes. Contact Pres. Gene Hogan, 604-886-7645

CHAPTER 85 RAA (DELTA): First Tuesday 7:30pm, Delta Heritage Airpark RAA Clubhouse. 4103-104th Street, Delta. Contact President President: John Macready jmacready@shaw.ca. Website www.raa85.ca.

VANCOUVER ISLAND AVIATION SOCIETY (VICTORIA): Third Monday 7:30 pm Victoria Flying Club Lounge. Contact Pres. Roger Damico, 250-744-7472.

THOMPSON VALLEY SPORT AIRCRAFT CLUB: Second Thursday of the month 7:30 pm Knutsford Club, contact President Wally Walcer 250-578-7343

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.**

Classified Ads

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, Waterloo Airport, Breslau ON 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.

For Sale

WANTED: CONTINENTAL A65 PARTS: Pistons, cylinders, carb, magnetos, rocker covers, spyder, cams, etc. Also interested in complete engines up to C90. Email Chris at cphorsten@yahoo.ca or call 416-918-6569.

Hangar For Sale at Sundridge Ontario, beside CPE6 airpark. Hangar is a wood framed building with steel siding, roof, and doors, with a gravel floor. 40x40x10 on 7.5 acres. Taxes last year were $352. Asking $50,000. Phone 705-386-9080. Email whiteheadbj@msn.com

RV6 for sale $72,000, 410 hrs TT, Lycoming A1A 180 hp, Sensenich Fixed Pitch Propeller, JPI Fuel Flow Gauge, Dynon D10A and autopilot servos, Dynon Heated Pitot, Kannad 406 ELT, GPS Garmin Aera 560, Transponder KT76A, Odessey Battery, Bell Tailwheel Yoke, Stereo Intercom PM3000, Garmin SL30, ADF KR87, Certified for IFR, Call George at 647 588 8544

FOR SALE MINI MAX. TTSN220 TSEO40. In wing tank. New ICOM radio. Always hangared. Aluminum skis. 447 Rotax.
Very good condition. $8900.00 OBO. Contact by phone only at 780-460-6841 (Alberta)
Sump for O-360, complete and in good shape, includes heater and rear mounted carb. This was removed from a Sundowner. Asking $500 OBO. Located at my hangar in Hanover Ontario, will ship, postage or UPS extra. Please call 519-881-6019 between 9 am and 8 pm EST or email to fleetair@wightman.com

4 Pietenpol lift struts for sale.They are brand new and are made from 4130 streamline tubing bought from Aircraft Spruce Part # 03-00192. Wall thickness 0.065. major axis 2.697", minor axis 1.143"
These have been epoxy primed and painted black -price: $1500. pjb@ornithopter-pilot.com Ontario

1946 Luscombe 8E, 2755TT 90 Cont. 1108 S.M.O.H., Alternator, Val Radio, Skis, Paint and interior good, $24000. firm.
Also a Benson Gyro with McCutcheon Blades. Also a partially Pietenpol project. Best offer.
306-645-4320. Rocanville, Sask.

0-290-D Lycoming Engine with newly overhauled carb, 6 Bolt prop extension
Newly reconditioned 80 amp light weight alternator. Starter. 80 amp gel-cell battery. Cooling plenum. Log book and maintenance manual Asking $8,000 OBO ontact Norm at graham110@rogers.com

Czech aluminum 1150 floats with mounts for Savannah / 701.$6500. al.hayduk@shaw.ca

Engine sump for Lycoming 150/160 hp with intake tubes and oil pickup tube. Removed from Grumman Traveller. $250 OBO. 519-925-3712 flybobbriggs@bell.net

1947 Stinson 108-2 Voyager w/float fittings, no floats, restoration started by retired AME. Sandblasted and zinc chromate, all new bearings, pulleys, cables etc. All logs and tags included. $7,500 / OBO. 705-653-4525. davidcarlaw@prototyperesearch.com

Dakota Hawk (Fisher Flying Products) Amateur Built, with Cont C-85 (711.3TTSN) with Warpdrive ground adjustable prop.¬† Full VFR panel including Icom IC-A200 comm, Garmin GTX327 xpdr, AVMap EKP-V GPS.¬† Based in Brampton.¬† Was factory demo plane for Fisher Flying Products.¬†$32,000 OBO For more info paulried@rogers.com or call 416-358-6941 and ask for Paul

BOWERS FLY-BABY FOR SALE. Cont. 65 H.P. T.T.E. 1,577.6 Hrs. S.M.O.H. 2.9 Hrs. Air Frame T.T.S.N. 29.8 McCauley Metal Prop. 302.7 Hrs. T.T. As is and where is.
Shipping and Tax extra. $10,000 for Aircraft, $5,000 for just the Air Frame. mustangbc@outlook.com

Private Aviation Art Prints, by well known Artists, for sale. Contact mustangbc@outlook.com

Stinson 108-1 with Franklin engine. This certified aircraft is in nice condition and has been in storage with the wings removed. $15K OBO. Walkerton ON 519-881-1685

Completed RV9 tail section (empennage). Interior parts all painted with rust inhibiting primer. Comes complete with fibreglass wingtips. Can be seen in London, Ontario. Price $1200 CDN. New price from Vans is $1795 US. rebel56@rogers.com 226-777-4155

Zenith 100 Mono Z, the first example of the series and built by Gerry Boudreau. This historic aircraft is in good condition but the VW engine has an oil leak and should be dismantled before flight. $8000 204-261-1007 jill.oakes@umanitoba.ca

Continental A65 Firewall forward setup. 90 SMOH Removed and stored indoors on Engine stand. No Engine Logs, Non certified. Dual Slick Magneto (only 90 hours since new) Carburetor overhauled by AME. Includes exhaust system. $4500 OBO Or Will consider partnership in Aircraft. Darren Pond, Cambridge Ontario 519-241-4242 pilotpond@rogers.com

Aerovee stainless 4 into 2 exhaust for VW, brand new in the box. New price $445 US, Selling for $375 CDN. garywolf@rogers.com

Project aircraft, complete. Very good value! Began as a 1955 TriPacer, in process of converting to 'Colt' configuration. Lycoming 0-235 (X)0SMOH, Sensenich prop, SMOH (Hope Aero). Fuse blasted, epoxy primed, new sealed struts (Univair), new Cleveland wheels/brakes, new spinner, windshield. All materials to finish. MDRA inspected for 51% (2004). Please contact for more detail, photos. No cylinders for engine (were stolen!). New radio, intercom, instruments. New firewall, panel, boot cowls. Must sell and move on. Asking 22K, will break up. Make me an offer that will get this aircraft back in the air. Close to ready for cover. dnorris@rosedaleunited.org 416-927-9713

Wanted – A-65 cylinders in good condition. 204-261-1007 jill.oakes@umanitoba.ca

Wanted: plans for a Zenair STOL 750 and accumulated parts. Contact me at bill_donig@hotmail.com

Looking for 2 MTV blades 195-30A or a complete MTV14B/195-30A or MTV14D/195-30A propeller.
May look at other MTV props for a Lycoming flange including MTV-16 4 blade or MTV-9 3 blade.
Must be capable of handling 350HP. No metal propeller blades. macmaz@xplornet.ca

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.

Classifieds On The Internet:
http://www.ocis.net/tvsac/buyandsell.html - more ads from our Kamloops chapter
http://www.lyncrest.org/sfcclassifieds.html - more ads from our Winnipeg chapter

Across Canada *RAA Chapters in Action*

RAA London St Thomas

Bob Buchanan reported that now he has sold his Spezio Two Holer and that it will be displayed as a motif at a motel in St. Ignace. Dave Hertner told that he is working on the plug for the radiator enclosed of his RV 10. Roland Kriening reported 25.1 hrs on his Rebel and that the next step is climb test.

Dave Hertner had on display a page of Fisher Flying Products plans and showed a CGS propeller of which Dave is dealer and a length of aluminum streamlined tubing. Dave noted that the tubing has flat surfaced on its inner wall so that a solid insert will fit tightly when held with through bolts.

Howard Faulkner showed a variety of objects that he felt Chapter members find interesting. Cor Wester of Armo Tool showed examples of the very clever and precise tooling used to fabricate tubing in production factories. Like Daryl's

Bill Strawbridge showed "Merlinfingers. The RR Merlin and the Kestrel that preceded it and the Griffon that followed had overhead camshafts with four valves per cylinder. The camshaft acted upon the top of the rocker arms with a rubbing action causing their galling and rapid wear. The "Merlinfinger" process is to insert a carbide wear surface in the top of the rocker arms. This has created a world market for this Stratford product.

RAA Vancouver

Retiring President John Macready writes:

Well, this is my last report as President of RAA Chapter 85. Looking back on the last three years, I could describe it as challenging. The chapter executive accomplished a number of things, and we made some mistakes along the way. But, they say if you don't do anything, you won't make any mistakes. We chose to do things and make decisions and for the most part we are further ahead than we were last year.

Here is a summary of the past year's accomplishments.

1. A letter of intent to renew the License Agreement for the airpark was sent to Metro Vancouver. The negotiations will start in the New Year. We don't anticipate any surprises or major changes in the present agreement. The document will be signed in 2015.

2. The Chapter sold our aircraft (Turbi) to a Manitoba pilot who intends to repair the damage caused during collapse of the landing gear in 2013. The executive decided that The Turbi had reached the end of its useful life for our chapter and we would be better off looking for another airplane.

3. Chapter 85 will purchase a replacement aircraft. We did consider an Ercoupe and a Piper Tri Pacer. No firm decision has been made as yet. The incoming president has recommended we pursue the idea of building a kit aircraft such as a Zenair 750 Cruzer or something similar.

4. The Building/Hangar Chairman has been promoting the use of our facilities to attract new members. He has organized the workshop and improved the management of the hangars. Thanks to John de Visser we are much better organized in this regard. John has completed many other projects and his services have been invaluable to our chapter.

5. We held our Annual Awards Banquet at the Delta Town and Country Inn in March of 2014. A local airpark pilot gave a talk about flying his aircraft to Central America. Yours truly won the Most Valuable Member award and I am grateful.

6. The Annual July 1 Fly-in was held on the long weekend. The weather was very unpredictable and windy as a cold front had just gone through. It limited the number of visiting airplanes but it didn't stop the antique and classic cars from coming. Everyone who attended had a good time.

7. Chapter 85 established exhibits at the Langley Fly-In, the Abbotsford Air Show (August) and the 100th Anniversary of historical Cammidge House (September). The chapter plans to host these exhibits at other aviation events in the future to increase public awareness of our activities.

8. Dave Marsden made significant progress with his Dova Skylark. The aircraft structure has been completed and painted thanks to the help of John de Visser. A new Rotax 912 engine has been mounted and is ready for plumbing and control connections. See the attached pictures. Congratulations to David for his success in the construction of this aircraft.

9. Our chapter contributed 500 dollars to the Mary Swain Memorial Fund. The money will be awarded to an aspiring female aviation student on an annual basis. We also renewed our commitment to fund the Don Souter Memorial Bursary to a BCIT aviation technology student.

10. Cyril Henderson has agreed to be our new Aircraft Chairman and Sebastien Seykora has offered to be the Program Chairman.

11. A new Executive was elected in November. Peter Whittaker will be President for 2015. Gerard van Dijk is Vice President, Bruce Prior volunteered his secretarial skills and Eric Munzer and Shawn Connelly have offered to be Directors for 2015. Other executive members include Tom Boulanger, Treasurer, Hugo Regier, Custodian, Tim Novak, Peter Lenger, John de Visser and Cyril Henderson will continue on as directors. Dave Marsden is the membership chairman. I will serve as Past President.

12. We held the Annual Barbeque in September. Several aircraft owners were invited to bring their aircraft for demonstration purposes. Trevor Skillen's Boeing Stearman was the highlight of the show.

13. Our Christmas Party was held on Dec 2, 2014. The attendance seemed to be down from last year but a pleasant evening was had by all.

14. During the year Chapter 85 hosted four pancake Breakfasts during the months of January, April, July and October.

15. Remembrance Day was held on November 11, 2014. Air Cadets from Richmond Squadron were again in attendance. Their contribution was much appreciated.

I would like to express my gratitude to the executive of the chapter for their hard work and enthusiasm for the past 3 years. It has been a rewarding experience being President of Chapter 85 but I couldn't have done it without the support of the rest of the executive.

Happy New Year!

John Macready, "Signing off"

Chapter 85's Terry Elgood writes:"[Here's] a photo of our yellow beast all bright and shiny with its new wing tucked happily in its new hangar in our back yard, hopefully the minister of transport will not stop me from flying off our property.

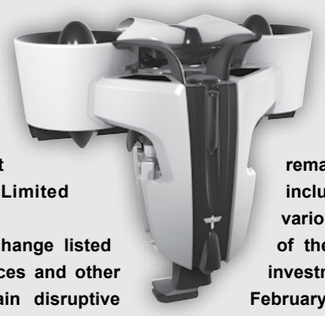
Scarborough - Markham

Fred Briggs reports that the Chapter's Christmas Party on Friday, December 5 at the Mandarin Restaurant at Eglinton and Birchmount was a big success. Fully 19 people attended, with appearances by both old and new Chapter members. A good dinner was had by all. Once again, we thank Fred for making the arrangements.

We are happy to report that Bill Phipson appears to have made a truly amazing recovery. Not only is he up and about, he has made some minor repairs to his Aeronca, primarily the propeller. The aircraft is reported to be in flying condition, and Bill hopes to have retrieved it from the Peterborough Airport by the time you read this newsletter. It is our belief that Bill has used up at least 11 of his 9 lives!

We are also happy to report that Peter James is up and around, and able to cope in a satisfactory manner after the trouble he has suffered with his legs. These updates on Bill and Peter are the very best news we could have for a Happy New Year to start 2015!

Martin Aircraft signs agreement with KuangChi Science Limited



New Zealand-based Martin Aircraft Company Limited (MACL) is delighted to announce that it has signed an investment agreement with KuangChi Science Limited (KuangChi Science).

KuangChi Science is a Hong Kong exchange listed company engaged in the novel space services and other innovative technology business with certain disruptive innovations and technologies. The agreement is for a long term strategic partnership which over time will see KuangChi Science have a major shareholding following up to a A$50M (approx NZ$53M) investment in MACL over the next 30 months.

The transaction with KuangChi Science remains subject to a number of approvals, including MACL shareholder approval and various regulatory approvals. Subject to receipt of these approvals it is anticipated the initial investment by KuangChi will be completed in February 2015.

Based on current projections, it will also allow Martin Aircraft to fund full commercialization of the Martin Jetpack.

President's Message / cont'd from p 2

risk, and the flight is Day VFR within safe gliding distance of a safe landing spot.

RAA STATUS REPORTS

As soon as you have had your elections please send in your new status report so that your events will be covered under the RAA Chapter Liability Policy.

The basic requirement is that President. Treasurer, Secretary, and two other specifically named members must be current National members of RAA Canada. The other requirement is to send in a full chapter list with contact information for all.

When these requirements have been filled your chapter status will be valid. Please email as an attachment to garywolf@rogers.com .

MARCH SKI FLY-IN

RAA Chapter 4928 (Ottawa Rideau) Winter Ski Fly-in will take place on the 7th of March, 2015, FROM 10 AM TO 2 pm. The airfield is CPL3 Rideau Valley Airpark (KARS) at N45°6.00′ / W75°38.00′ . Frequency is 123.4. The contact is Larry Rowan 613-489-2332

Come and join the members of RAA 4928 for a hot meal and enjoy the company of other aviation enthusiasts. Call before leaving for runway conditions. Skis only.

WEBSITES OF INTEREST

http://www.vimeo.com/100670266
This is a video of the Cameron Airshow 2014 (or just put Cameron Airshow 2014 into Google). Cameron is a small town 40 miles north of Kansas City, MO. It has a small airport and a wonderful ability to attract superb airshows.

http://www.aeromobil.com
This is a video of the Aeromobil, another flying car. You may have looked at the Terrafugia in the past. Some of these designs show amazing ingenuity of design.


fig.7

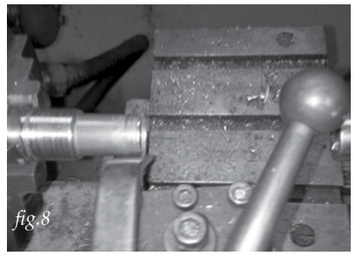


fig.8

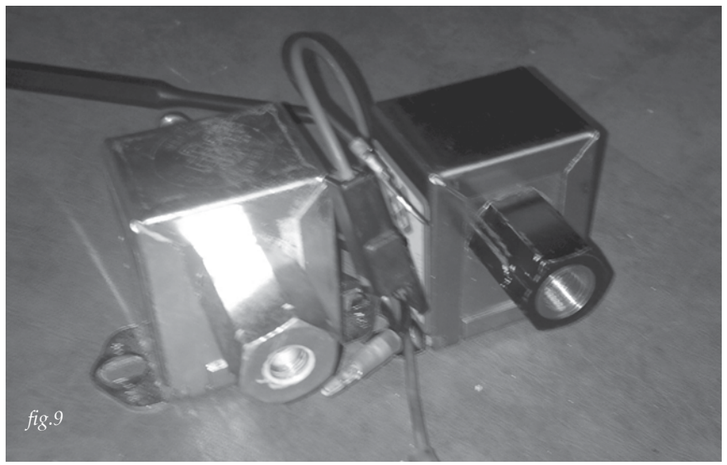


fig.9

Flow / continued from page 29

I tapped the first one by hand in the vice (fig 7) then used the lathe to tap the second one.

Instead of chucking the tap directly in the tailstock chuck after the first time, I used an 8 point socket on a cut-off 3/8" extention chucked in the lathe to hold the tap, which allowed the tap to "self feed" as I turned the part in the main chuck. Then came the job of reassembling the pump, which required re-forming the end of the brass cylinder, using a brake adjusting spoon against the compound rest to "spin" the end to retain the piston and allow the "O" ring in the inlet nut to slide over the end (fig 8) without damage (with the help of a little "Super Lube")

Figure 9 shows the difference between the original 1/8" and the new 1/4" threaded pumps.

This should provide about the same size inlet and outlet as the hole in an AN-6 fitting.

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

CELEBRATING 50 YEARS IN AVIATION
50th
1965 - 2015

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

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

AIRCRAFT SPRUCE TRANSPORT CANADA APPROVED
ASK FOR YOUR STAMP!

www.aircraftspruce.ca

Proud Sponsor of
EAA AOPA
Strategic Partner

Aircraft Spruce & Specialty Co.
SINCE 1965

FREE CATALOG!