January - February 2011

RECREATIONAL RFLYER

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

RAA
RECREATIONAL AIRCRAFT ASSOCIATION
RÉSEAU AÉRONEFS AMATEUR CANADA

From The President's Desk

Gary Wolf

RAA MEMBERSHIP RENEWALS

To streamline the membership renewal process we are now offering a 10% discount for a three year renewal. This will save considerable time in mailing out renewal notices, data entry, producing cards, and also in the cost of postage. The current batch of renewal notices has this option added, but if you have received one without it you may write it in yourself. The cost including HST for three years is $161.96.

CHAPTER STATUS

The procedure for your chapter events to be insured under the RAA Chapter Liability Policy is simple. Send in a chapter status report and also a complete list of your chapter members with their contact information. If you do this your events will automatically be insured for $5 million premises liability.

The status report is not complicated but each year some chapters ignore this requirement an end up running without insurance coverage. Just state the names and membership numbers of five specific chapter members and send the statement in by email to raa@raa.ca or mail it to RAA Canada, Box 22 4881 Fountain St North, Breslau Ont. N0B 1M0

The names required are those of:

President, Treasurer, Secretary, plus any two other named chapter members. These five must maintain National membership for the status report to be valid. Send in these five names and send in the chapter membership list, and your events will be insured.

ADVANCED ULTRALIGHT – MORE

I wrote in the past issue about the pitfalls of buying a damaged Advanced Ultralight, the problem being to satisfy the requirement for the Fit for Flight Form. In the past month I have had a call from a non-member who fell into this trap when he found that he could not register his recently purchased used Advanced Ultralight because he did not get a Fit for Flight form signed by the seller. Unfortunately his local TC office was also refusing to register the plane as a Basic UL, so the new owner then had a lawn ornament. I explained to the fellow that it would first be necessary that he join RAA as a national member, as this sort of representation is a benefit of membership.

A call to Ottawa and then to the local TC office cleared up the confusion. To reregister the plane it would first have to be deleted from the Transport Canada Registration Database, and it could then be registered as a Basic UL using the standard TC 26-0521 document for the initial registration of an Ultralight.

This sounds like being asked to let go of one trapeze before the next one is in sight, especially if your local office does not understand the procedure. If you end up in this situation, call the RAA office at 1-800-387-1028 and we will explain it to your local TC office. Just make sure that your national membership is up to date before calling.

WOOD AIRPLANE WANTED

RAA member Kevin Elwood is looking for a wood project or plane to suspend from the ceiling of the new high school in his town. Please check his classified "wanted" ad in this issue for contact information.

GEORGE GREGORY HANGS OUT HIS SHINGLE

For nearly a decade RAA member George Gregory has had artistic control of your Rec Flyer magazine. He transformed it from a scissors and paste layout to the professional magazine you are now holding. George is now branching out and is offering his print and website design services to commercial businesses. Does your com-

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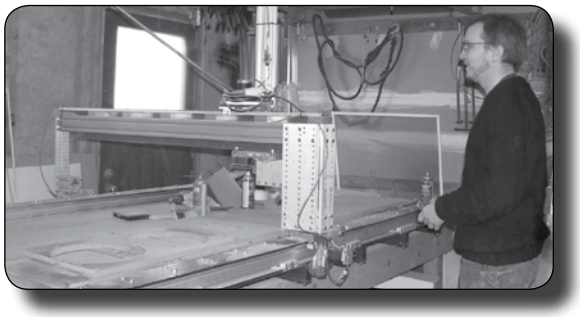


features

columns

On the cover: Ernest Riddle's reverse-engineered side by side Citabria clone; Ernest Riddle photo. Below: Chapter 85's Beat Meyer and his incredible Seafire.

Mark Munzel

Robert Gannon's

World Flying Adventure

February, 2011:

In 1992 I wanted to do an adventure. I had previously sold a small construction company and after taking some time off thought I should get back to work but before I did I wanted to do a good adventure. One of my 6 brothers (there are 14 children in the Iowa farm family I grew up in) had sailed half way around the world and I had joined him several times but always got terribly sea sick.

I was a medic on a medivace helicopter in the Viet Nam war (Da Nang Dustoff) and I had always enjoyed flying (though I didn't enjoy getting shot at) so I thought if I could learn to fly I could create a memorable adventure. In 3 months time I had an instrument license and was the owner of a Cherokee 6 airplane (named her Lucky Lady) and departed San Diego for a Harvard Business Class reunion in Paris, France with 165 hours in my log book. Four months later I crashed in Nairobi, Kenya totaling Lucky Lady but I walked away without a scratch. When I crashed I had 295 hours in my log book and was half way around the world. This time half way would have to do.

For the next 8 years I talked about finishing that trip.

As I approached my 50th birthday in Sept. of 2000, I decided to quite talking about it and get at it. I decided to buy a high wing single engine airplane, a 1968 Cessna 182, and named her Lucky Lady Too out of respect for the first woman I wrecked. Instead of going east I decided to go west. And instead of doing it all at one time I decided to do it over a 10 year period to allow me to see and experience as much of the world as I possibly could. I removed 3 of the 4 seats and put in large fuel tanks. Taking off from Oakland, California in October, 2000 I was 40% over gross weight with fuel. It took me 18 hours of hand flying (I do not have an auto-pilot) to reach Kona, Hawaii. I parked LLT and went home to have back surgery (sciatica) caused by sitting in one position for so long.

I returned three months later to fly on to Christmas Island (part of the nation of Kiribati) and then down to the French Polynesian islands. Then across the south Pacific stopping in as many countries as I could and having a look around. I would fly a leg (usually one to two months in time length) then park Lucky Lady Too and return home commercially for a couple of months to take care of business and plan the next leg then return to LLT and continue with another leg. Since I departed in October of 2000 I have flown around the world west in the southern hemisphere and east in the northern hemisphere. I have flown to 155 countries to date having now set a world aviation record. I have left LLT 40 times somewhere in the world over that time period and returned home on a commercial flight to take care of business and plan the next flying leg. I have flown LLT

Right to left: the author and Lucky Lady II in New Zealand; Heading over the North Pole by way of Eureka, Canada; At the Galapagos Islands. Right, Lucky Lady II loaded up for Hawaii. This was the longest leg, taking 18 hours to fly - covering 2,200 nm with no autopilot.

I have flown to 155 countries to date having now set a world aviation record.

to the Antarctica peninsula and have flown her over the North Pole. I was the oldest bachelor at the Emerald Bachelor and Spinster Ball in the outback of Australia and have flown into Nepal and climbed to the Everest Base Camp. I have scuba dived at many sites around the world and have done a motorcycle trip on the south island of New Zealand as well as up thru the Golden Triangle of SW Asia (first Viet Nam vet to fly into Viet Nam after the war). We have flown to all the Middle Eastern countries including Basra, Iraq on a medical mission to take in medical supplies and toys for the newly constructed Basra Children's Hospital.

I am often asked how I am funded. I have always worked for myself. I have started and owned a construction company, a member of the Chicago Board of Trade (commodity exchange) and I am a Name at Lloyds of London (insurance exchange in London, England) as well as a partner in a small wood manufacturing business in San Diego, California. I have never been married and have no children.

Following is a list of the year and the countries Lucky Lady Too and I have flown into:

2000
California to Hawaii, Kiribati, French Polynesia, Cook Islands, Samoa,

Tonga, Fiji, Norfolk Island, New Zealand
2000
USA states of California and flight to Hawaii
2001
Kiribati, French Polynesia, Cook Islands, Samoa, Tonga, Fiji, Norfolk

Lucky Lady One's luck ran out in Kenya. Eight years later the author was back with Lucky Lady II.

More Resources:

Following are links to several write-ups or videos of the flying adventure:
http://www.earthrounders.com/cgi/gannon_letters.php
http://www.grd.usace.army.mil/news/releases/NR09-03-19-03.pdf
http://blog.aopa.org/blog/?tag=robert-gannon
http://www.youtube.com/watch?v=otMgSuifp-0
http://www.youtube.com/watch?v=ljmHJS0qquc
http://www.timesrepublican.com/page/content.detail/id/526602.html
http://www.signonsandiego.com/news/2011/jan/03/after-a-decade-aloft-ready-for-a-landing/
http://www.fox5sandiego.com/news/kswb-pilot-lands-after-10-year-journey,0,2194114.story
http://www.pacificflyer.com/2011/01/pilot-returns-from-epic-voyage/
http://avstop.com/news_january_2011/gannon_a_vietnam_veteran_describes_his_world_flying_adventure.htm
http://www.aopa.org/aircraft/articles/2011/110121bob_gannon_around_the_world_twice.html?WT.adv=adv1
Various trip videos:
See: http://www.youtube.com/watch?v=nUTaqDMFVCU
See: http://www.youtube.com/watch?v=Wq781-bP78M
See: http://www.youtube.com/watch?v=WOxSOgc32_o
See: http://www.youtube.com/watch?v=-FSiiZ77Mqw
See: http://www.youtube.com/watch?v=h8Uzo8G9L1g
For others videos, 'youtube search' for: "The Adventures of Lucky Lady Too"

Svalbard, Longyearbyn. Presently administered by Norway, it's about as remote as you can get. Until the Versailles Treaty, a number of countries claimed sovereignty; since then, it's been considered part of Norway. It's WAY above the Arctic Circle; polar night runs from late October to mid-February.

Islands and New Zealand
2002
New Zealand, Australia (landed in 125 different places in Australia)
2003
Australia, New Caledonia, Vanuatu, Solomon Islands, Papua New Guinea, Micronesia, Federated States of the USA (Truk, Yap, Chuck, Pohnpei) Palau, Malaysia, Thailand
2004
Thailand, Laos, Viet Nam (I flew back into where I was stationed at), Cambodia, Myanmar, India, Nepal, Sri Lanka, Maldives (LLT flew 14 hours on car gas from the Maldives to the Seychelles), Seychelles, Kenya
2005
Kenya, Uganda, Sudan, Tanzania, Mayotte, Mozambique, South Africa, Zimbabwe, Malawi, Zambia, Botswana
2006
South Africa, Swaziland, Lesotho, Namibia, Botswana, Angola, Gabon Sao Tome, Togo Ghana, Burkina Faso, Mali, Senegal, Cape Verde, Brazil
2007
Brazil, Argentina, Antarctica, Chile, Falkland Islands, Uruguay, Paraguay, Bolivia, Peru Ecuador, French Guiana, Suriname, Guyana, Venezuela, Colombia, Panama

2008
Panama, Costa Rica, Nicaragua, Honduras, El Salvador, Guatemala, Belize, Mexico, Texas, Arizona, Nevada, Utah, Oregon, Washington, western Canada, Alaska, northern Canada and over the North Pole to Svalbard, Norway, Sweden, Finland, Estonia, Latvia, Lithuania, Poland, Germany, Czech Republic, Ukraine, Slovakia, Slovenia, Croatia, Montenegro, Albania, Macedonia, Kosovo, Bulgaria, Romania, Turkey, Lebanon, Jordan, Egypt, Saudi Arabia, Bahrain

2009
United Arab Emirates, Oman, Qatar, Iran, Kuwait, Iraq, Jordan, Syrian Arab Republic, Cyprus, Israel, Greece, Malta, Tunisia, Morocco, Gibraltar, Spain, Italy, Austria, Turkey, Armenia, Kazakhstan, Mongolia, Russia, Alaska, across the middle of Canada, Greenland, Iceland, Faroe Islands, Ireland, Isle of Man, England, Belgium, Germany, Switzerland, Italy, France, Spain, Portugal, Canada and back into the USA with stops in the following US states: Maine, Mass., NH, VT, Conn., NJ, RI, DE, Wash. DC, Maryland, Virginia, NC, SC, Georgia, Florida before continuing to the Bahamas, Turks and Caicos.

2010
Dominica Republic, US Virgin Islands, British Virgin Islands, Anguilla, St. Maarten, St. Martin, Saint Bart's, Saba, St. Kitts and Nevis, Saint Eustatius, Antigua, Martinique, Guadeloupe, Dominica, Saint Lucia, Barbados, Saint Vincent and the Grenadines, Trinidad and Tobago, Curacao, Bonaire, Aruba, Colombia, Cayman Islands, Jamaica, over Cuba and back into the Bahamas and back into the USA with stops in the states of Florida, Georgia, Virginia, West Virginia, Pennsylvania, New York, Ohio, Michigan, Indiana, Kentucky, Tennessee, Alabama, Mississippi, Louisiana, Texas, Oklahoma, Arkansas, Missouri, Illinois, Kansas, Nebraska, Iowa, Minnesota, South and North Dakota, Wyoming, Montana, Idaho, Washington, Oregon, California, Nevada, Arizona, Utah, New Mexico, Mexico.

World Flying Adventure Facts

-Flew twice around the world, west in the Southern Hemisphere and east in the Northern Hemisphere.
-Landed on all the continents of the world.
-Flew over the North Pole and down to the Antarctica peninsula
-Flew 2,200 hours over a period of 10 years and 3 months, approx. 300,000 nm, equivalent to the distance from the earth to the moon and half way back.
-Landed in 1,200 different places in 155 countries including Viet Nam, Iran, Iraq, Syria, Saudi Arabia, and Israel.
-Longest leg flown was 2,200 nm. (California to Hawaii - 18 hours)
-Flew the entire route by hand. No auto-pilot.
-The airplane, Lucky Lady Too, is a 1968 Cessna 182, now 43 years old.
-Parked the airplane in 40 different

Yatkusk, Russia. While in eastern Europe, Robert visited the Gulag sites of Magadan, Russia, and the concentration camps of Poland. Gulag prisoners knew about the Kolyma region (where Magadan was situated) and feared a move to what they called the "gateway to hell". Winter jobs clearing trees for new roads often left only a few survivors and thousands of frozen bodies. The Kolyma Highway linking Magadan with Yakutsk is often called the 'road of bones'.

Are You an Earthrounder?

The Earthrounders are a group of pilots with a unique achievement in common: they've flown themselves around the globe in a light aircraft. The only way to join the community, states the website, is to actually do so. While not providing official recognition (that's the FAI's job) the Earthrounders aim is to "include genuine, personal flights undertaken in a true spirit of hands-on flying in the old-fashioned sense of the word". There are a few rules:

- **Flights can originate in any country, but must terminate at the point of departure.**
- **All meridians should be crossed in a forward motion to close the circle (unless in a transpolar circumnavigation) but you do not necessarily need to cross the equator.**
- **Flying round in a circle over the North Pole does not constitute a flight around the world.**
- **At least one of the pilots needs to have been on board for the entire circumnavigation.**

places around the world and returned home commercially to take care of business and plan the next leg.
-Landed in numerous places in all 50 USA states
-Some of the Activities done once I landed:
-Zulu Kings Reed Dance, Zululand, Africa
-Diving with the white sharks off the coast of South Africa
-Ran a rock drill in the bottom of a gold mine (one km deep and one km back into the shaft) in Johannesburg, South Africa
-Scuba dived in numerous sites of the world including 5 of the top 10. Once the dive boat lost us and we floated around in the ocean for 3 hours in a storm hoping it might find us.
-Attended the land diving in Vanuatu (precursor to bungee jumping only using a vine instead of elastic cord)
-Hiked to the Everest Base Camp, Nepal

[I] paraglided in the Annapurna's of Nepal and the Andes of Argentina (learned this 4 years after starting my world flying adventure)

-Attended the Bachelor and Spinster Ball in the outback of Australia
-Motorcycled the south island of New Zealand and hiked the Milford Trek (considered the world's best 5 day walk)
-Motorcycled the Golden Triangle of Laos, Vietnam, Burma, Thailand, to the China border
-Shot wild boar in Australia
-Spent 5 days in the Falkland Islands, rockhopper penguins as well as Magellan and King, albatross, etc.
-Flew the entire length of the Amazon.
-Salmon fished on Bristol Bay, Alaska using nets off the coast, 5 of us one day netted 20,000 lbs. of salmon without using a boat.
-Been to the Gulag sites of Magadan, Russia and the concentration camps of Poland
-Had two village stays, one in Papua New Guinea and one in the Solomon Islands, the first one I was the first white man that year and the second one I was the first white man ever to be in their village.
-Numerous world heritage sites, wild game parks, national parks and monuments all around the globe.
...And stayed out of jail.

On January 10, 2011, Bob Gannon landed at Gillespie Field, completing his 10 years round-the-world adventure. More information on his exploits can be found at www.earthrounders.com. Robert can be reached at Rfgannon@cox.net

Robert Gannon's 10 year adventure - twice around the world, covering 300,000 nautical miles.

Saddle Joint Failures

RAA

A SADDLE JOINT IS THE NAME for a welded joint connecting two tubes when one has been fishmouthed to fit the other. On the face of it this type of welded joint looks good because the weld is distributed all around the fishmouthed tube, and over half the surface of the mating tube. A fuselage normally has some hundreds of these welded joints and the percentage of failures is very low.

The saddle joint is also used on control linkages such as rudder pedals and flap actuators, and these are where failures have been found. The problem with these components is that they can be subjected to forces that were likely not considered by the designer of the aircraft.

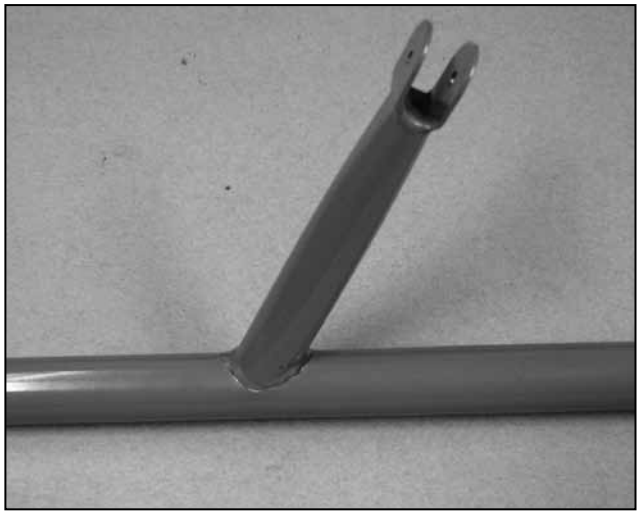
Have a look at the photo of the sample saddle joint – the weld line will proceed around and almost to the equator of the mating tube. When the tubes are thin and the saddle joint is subjected to high loads there can be problems at the weld line. The equator of a tube is the least rigid area, and in a saddle joint there will be a hard line of weld at the equator.

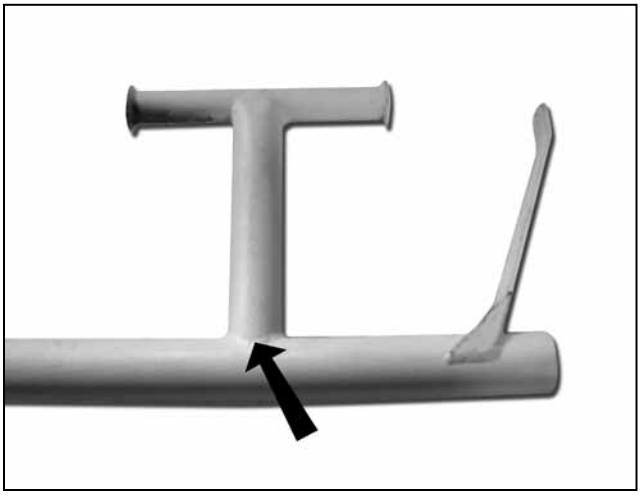
In a set of rudder pedals there can be large forces that can cause problems where the weld line approaches this flexible equator. The problem with rudder pedals is that they are usually designed for only the flight loads, but when the plane has toe brakes a pilot can inadvertently apply braking pressure to the rudder pedals. The pilot will then be levering against the weld line of the pedal's saddle joint and this will be flexing the equator of the cross tube.

The first sign of failure is that the pedals will not line up when the rudder is straight. When that has been noticed it is likely that the forward side of the cross tube has become dented inwards a bit, or if this has been ignored for too long there can be a crack. The crack usually begins at the forward point of the saddle joint weld line.

A welded tube flap linkage is also prone to cracking of its saddle joint, particularly at the base of the lever that accepts the flap actuator. The retracted flaps usually rest against a stop but if the actuator is misadjusted the saddle joint of the lever will be forced into the flap cross tube. Further, if the pilot exceeds the maximum flap speed of his plane the lever will force its saddle joint weld line into the opposite side of the cross tube. The symptom will be a reduced amount of

Left: In the flap linkage the failure began at the equator and spread around the weld, cracking entirely through the thin unsupported large diameter cross tube.





travel of the flaps, and if the crack has become pronounced it might not be possible to actuate them at all.

The situation can be exacerbated by having the actuator arm of the flaps at other than a 90 degree angle to the cross tube. Placing the arm at an angle means that the actuating arm will also impart a torque to the saddle joint. The same can happen with rudder pedals. Some rudder pedals are the shape of an inverted L, which by definition impart a torque to the saddle joint.

What is the cure for this? Better attention to design and thicker tubes can do a lot to prevent these failures. Gussets at the intersection can assist by distributing the forces further along the cross tube. Finger wraps can help too, and these are well described in AC 43.13-1B.

It is winter now and many of us are doing our annuals, to be ready for the flying season. Have a good look at your pedals and the various linkages, and use a good light

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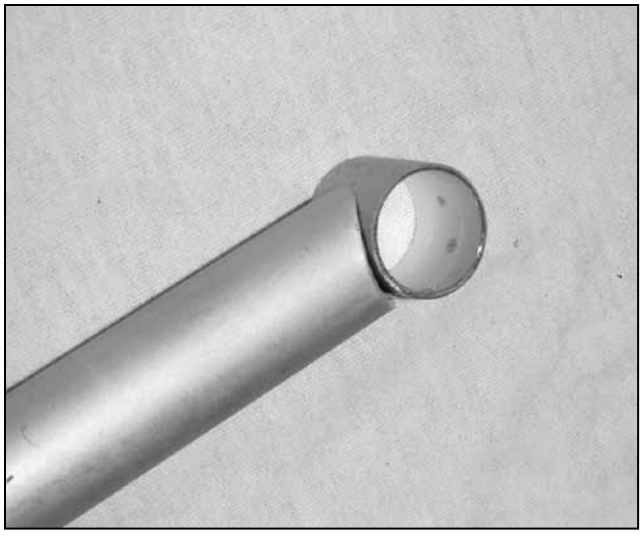
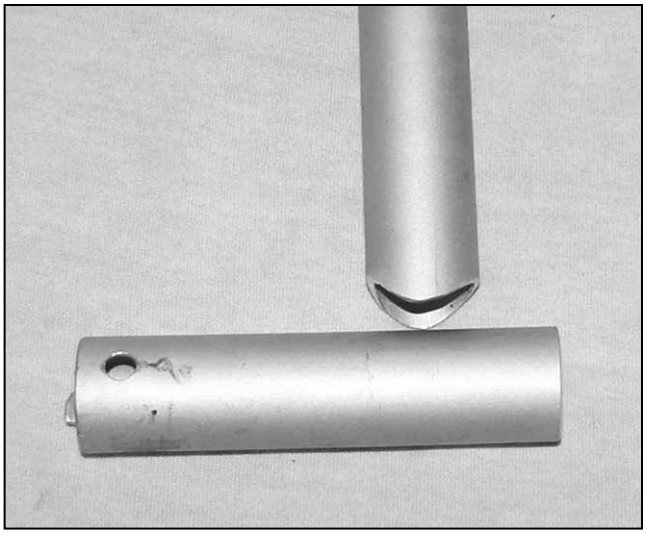
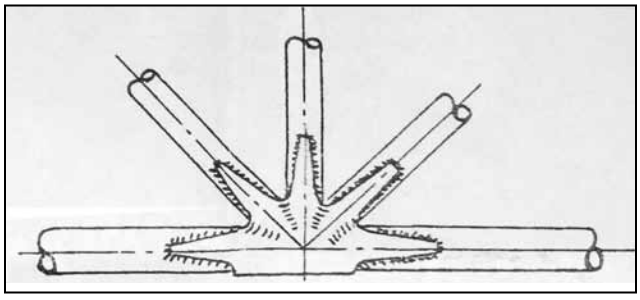
Top: This flap linkage also imparts a torque to the welded area because the actuating lever is at an angle;
Left, this is about as bad as it can get - the cross tube is large and thin, and the rudder cables attach to separate brackets. The arrow points to the spot where the crack will begin.
Below left, The weld joint will run as far as the equator, the most flexible part of the cross tube.
Below right, A typical saddle joint with one tube fishmouthed to fit another.







and a mirror or a borescope to do a close inspection. If you see any paint flaking or the beginnings of a dent, it is time to take remedial action. The repair methods are outlined clearly in AC 43.13-1B. Note that good old AC 43.13 has been superceded and the current version is AC 43.13-1B. The repair methods are given in pages 64-77.

This diagram from AC 43.13 1B shows the approved method for reinforcing a saddle joint. The repair methods are outlined in the following pages.

Understanding Maneuvering Speed

From FAA Aviation Safety

Introduction

This Special Airworthiness Information Bulletin informs you of an airworthiness concern that is relevant to all airplanes certificated under Title 14 of the Code of Federal Regulations (14 CFR) part 23, as well as those certificated under the previous Civil Air Regulations (CAR) part 3.

This information is also relevant to any special light-sport category airplanes (S-LSA), experimental lightsport airplanes (E-LSA), and experimental amateur-built airplanes. At this time, the Federal Aviation Administration (FAA) has determined that this airworthiness concern is not an unsafe condition that would warrant airworthiness directive (AD) action under 14 CFR part 39.

Background

On November 12, 2001, American Airlines Flight 587, crashed shortly after takeoff from New York's John F. Kennedy International Airport. The crash killed all 260 people aboard and 5 people on the ground. The National Transportation Safety Board (NTSB) determined "the probable cause of this accident was the in-flight separation of the vertical stabilizer as a result of the loads beyond ultimate design loads that were created by the first officer's unnecessary and excessive rudder pedal inputs." As a result of this accident and subsequent investigation, it was revealed that many pilots have a misunderstanding of what the design maneuvering velocity (speed), VA, represents. Many pilots believe that as long as the airplane is at or below this maneuvering speed, they can make any control inputs they desire without any risk of harm to the airplane. This is not true.

The design maneuvering speed (VA) is the speed below which you can move a single flight control, one time, to its full deflection, for one axis of airplane rotation only (pitch, roll or yaw), in smooth air, without risk of damage to the airplane.

Even though the accident discussed above is a part 25 airplane, VA is applicable to part 23, CAR 3, and LSA airplanes. Also, even though experimental airplanes may not have a published VA , they will still have some maximum maneuvering speed associated with the maximum structural design loads. Therefore, the pilot should be aware of what speed this is, and adhere to the guidance herein. The regulations governing the design strength requirements for airplane structure require adequate strength for full control deflection (below VA). However, they do not require the manufacturer to make the airplane strong enough to withstand full control input followed by a full control input in the opposite direction, even below VA. Neither do they require the manufacturer to design the airplane for more than one simultaneous full control input such as full ailerons with full elevator and/or rudder.

VA, as published in the airplane flight manual (AFM) or pilot's operating handbook (POH), is valid for operation at the gross weight stated, which is typically at max gross weight. It is especially important to note that VA decreases as the airplane weight decreases. At first, this may seem counter intuitive. All pilots understand that when the air-

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After The Crash

Barry Meek

"POLICE HAVE NOT YET released the name of a 25 year old woman who died on a remote mountain following the crash of her light plane.The rental aircraft disappeared two weeks ago while the student pilot was on her first solo cross country flight. It was found about 60 miles off her intended course, in rugged terrain. Authorities speculate the pilot had survived the crash but succumbed to injuries, dehydration and hypothermia about four days later. The emergency locator transmitter was not activated."

This short news item could appear in any paper, anytime. At this point however, it's just fiction designed to stir awareness of your survival skills. The information in this article comes from personal observation and experience as a long time pilot and ambulance paramedic. So far, it's probably been a lot of good luck that's kept me out of serious trouble. But as they say, "learn from the experience of others. You'll never live long enough to make all the mistakes yourself." I try to live by that advice.

The AIP (now called the AIM, or Aeronautical Information Manual) states in effect, that the pilot must carry equipment sufficient for the survival of each person on board, considering the area, the season and anticipated weather. The very basics are a means to start a fire, provide shelter, obtain or purify water, and for visually signalling distress.

In simple terms, a tarp, matches, water bottle and signalling mirror would meet the regulations. But here's where it would be nice to have McGyver along. Innovation and imagination would go a long way toward ensuring the survival of a downed pilot who is equipped with only the basics. In summer, at low elevations it may be fine. However, in winter or in mountainous terrain, things get a bit more complicated. Most pilots carry more than the regulations require. And it seems to me the more experienced the pilot, the more equipment he has on board. The four basics are a good start, but clearly they're not sufficient for anyone who gets more than a few miles from a major road or settlement.

I'll offer a comment on the first aid kit requirements for private aircraft. The CARS 602.60 state what must be in that kit, but only for commercial operators. Aircraft that are privately owned and operated carry whatever the owner is comfortable with. Quite frankly, the list of recommended items for private operators is extremely insufficient, and a waste of space. You can personalize your kit by first learning something about first aid, then use your imagination to anticipate injuries you're likely to see following a forced landing or a crash. Plan and pack appropriate items. It need not be a huge, well stocked trauma kit. A small knapsack would work quite well. It's a good size, and can quickly and easily be removed from a wrecked aircraft. If it's done right, your fire starter, water purification tablets or

Good flight planning should include planning for what's not supposed to happen.

filter, a couple of space blankets and a signal mirror will fit too. There you go, both kits in one pack. But don't forget the survival and first aid books. Preferably, read them before you leave the ground.

There are no rules set in stone for survival. Nor is there a right or wrong procedure for the administration of first aid. You do whatever works given the time and circumstances. I have yet to find a book that stresses principles over techniques. It's vital that you recognize what you need to accomplish, whether it's starting a fire, building a shelter or stopping someone's bleeding. Then you set about doing it, utilizing your experience, knowledge and common sense. We're all born with at least a bit of common sense. Knowledge can be found in a book, and hopefully the experience is something you won't ever obtain.

The last line of our fictitious news item mentions that the ELT was not activated. The student pilot apparently did a good job on her landing, or the device was faulty. Remember an ELT is installed horizontally in your aircraft, and is activated by a switch that moves along its longitudinal axis. From experience, I know it won't come alive by dropping it on its flat surface. But if you strike one end with the palm of your hand, it doesn't take much force to set it off. It goes without saying that the ELT should be physically accessed following a crash and switched manually to the ON position. The student probably didn't know that yet.

You need not be a survival expert or paramedic to do the right things following a forced landing or a crash. Good flight planning should include planning for what's not supposed to happen. Think ahead to stay ahead. Be safe this winter.

RAA Annual General Meeting

The London/St. Thomas Chapter had the honour and pleasure of hosting the 2010 AGM of RAA Canada at 427 Wing on Saturday December 4th 2010.

Close to forty people were in attendance. The routine business portion of the meeting, conducted by President Gary Wolf, began at 10:00 a.m.

After the business session, the emphasis turned to the future of RAA. Bill Weir presented an outline of the history of RAA Canada and then the attendees were split up Tom Martin, Ed Perl, Gary Wolf, Wayne Hadath, Jim Tyler into smaller discussion groups to consider the following questions.

1. Is there still a need for the RAA?

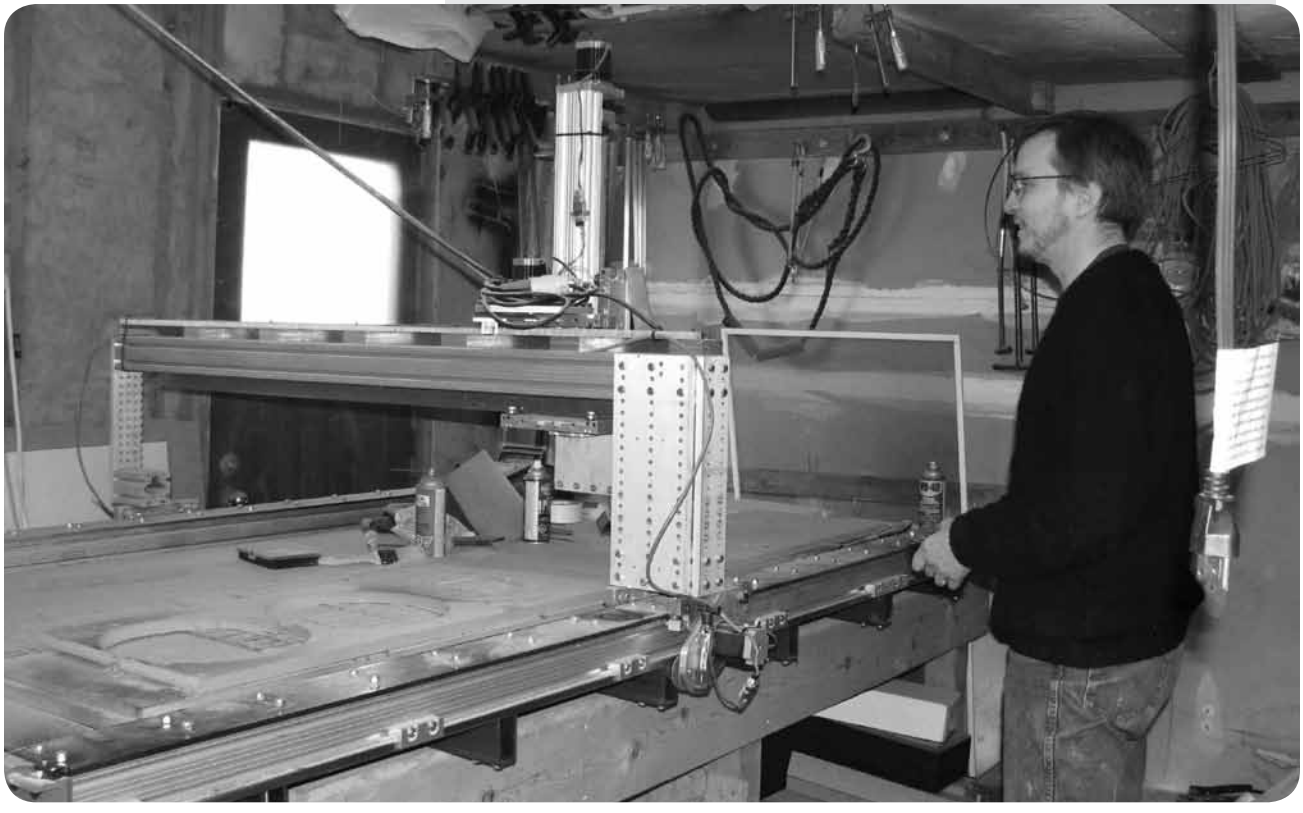
2. How can we make sure the Association is still relevant to members needs?

3. Are there opportunities to work with other Associations?

There was unanimous agreement that there is a real need for RAAC to continue in order to insure that Canadian builders of amateur-built aircraft can continue to build and fly their airplanes with the freedom they now enjoy and with a minimum of red tape. Liaison with Transport Canada and Nav Canada is of prime importance. The May 2010 issue of Slipstream contained an article outlining a number of issues that RAAC had recently dealt with. This article is reprinted on pages 5&6 in order to emphasize again the extraordinary efforts being put forward by the RAAC executive.

There was considerable discussion about how to attract more members. A show of hands indicated that the majority of those in the room were over 55. It can be difficult to attract younger people under present economic conditions, when it is not uncommon to have well over $50,000.00 in an amateur built aircraft. Perhaps the best hope for new members is to convince those who own, or are building an amateur-built plane, and do not now belong to an RAA Chapter, to join.

It is of course necessary to convince these people that there are tangible benefits to belonging; such as liaison with governments, receiving the Recreational Flyer and having access to the extensive expertise of current members. Reaching out to owners of factory-built aircraft is another possibility for recruiting new members.



Amateur CNC

The Future of Plansbuilding? RAA Staff Report

THIS WEEKEND I visited the garage workshop of member Rob Schieck to see the 3-axis CNC router that he has built. Rob had originally been taken aback by the cost of having a custom foam seat cut for his daughter's wheelchair, and decided that he could probably make the machine for less than the cost of one seat cushion at the inflated prices charged by the wheelchair industry.

For those of you who have never looked into home CNC, over the past ten years there has been a dramatic increase in the availability of components and programs. A decade ago the sole supplier of components was an amateur boatbuilder in new England who designed a machine called the Shopbot. It was a rudimentary wood and tube framed machine that was actuated by stepper motors pulling cables than ran over pulleys adapted from Home Depot patio door rollers. Accuracy was a sometimes thing and being able to maintain .050" repeatability was considered good enough for boatbuilding and signmaking, the main uses of the machines.

In the past ten years many suppliers of components and subassemblies have entered the market, and it is now possible to buy aluminum extrusions for the main frame sections, stepper motors with cog belt reduction drives, rack and pinion or acme screw motion systems, and carriages with ball bearings and adjusters for slack. A homebuilder can now collect and assemble all necessary parts for

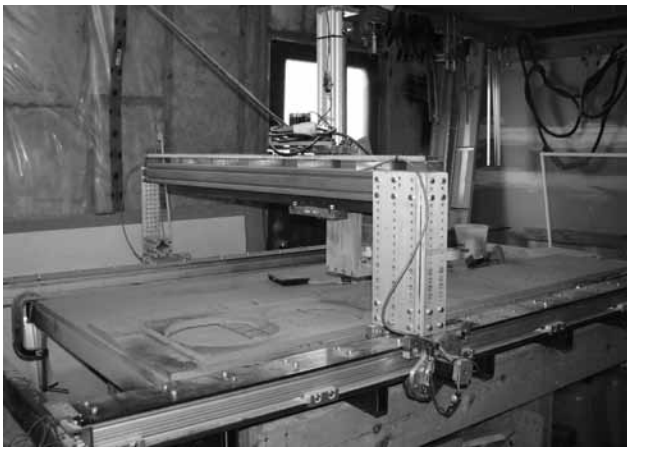
Instead of shipping a set of plans by mail or courier, the designer could send a set of plans on a disc or over the internet, complete with cutting files for the parts and the formblocks.

under $3500 to produce a machine with a working surface of 4' x 8' and a vertical axis travel of nearly one foot. Rob Schieck's homebuilt machine can produce parts in foam, wood, and even aluminum with an accuracy of only a few thou, at a feed rate up to 500 inches per minute. Initially he made the components using his Princess Auto drill press and band saw, then used the machine itself to make replacement parts to end up with the machine he now has.

It is interesting how a CNC uses its tooling. Rob uses a 1/8" router bit with an upwards spiral for much of his work. To make a ¼" hole the bit enters just inside the perimeter of the proposed hole, ramps into the circumference and runs around with a depth of cut of .040". The machine then spirals the cutter down to complete the hole. If the hole is to be oblong, or if it is to have a larger recess for an allen bolt or a tapered area for a countersunk screw, the program can also cut those by spiraling, all without a tool change. The versatility of a CNC router opens up a lot of possibilities for builders of plansbuilt aircraft.

At present an aircraft plansbuilder must lay out and cut all of his parts manually, with a router sometimes used to cut out aluminum or wood parts by tracing a pattern with a laminate trimming cutter. The accuracy of the parts depends on the skill of the person who makes the patterns for cutting and then for forming the blanks into parts. Skins must be made a bit oversize, and all holes must be located and drilled in place, a tedious process that requires jigs and fixtures to maintain alignment during the skinning process.

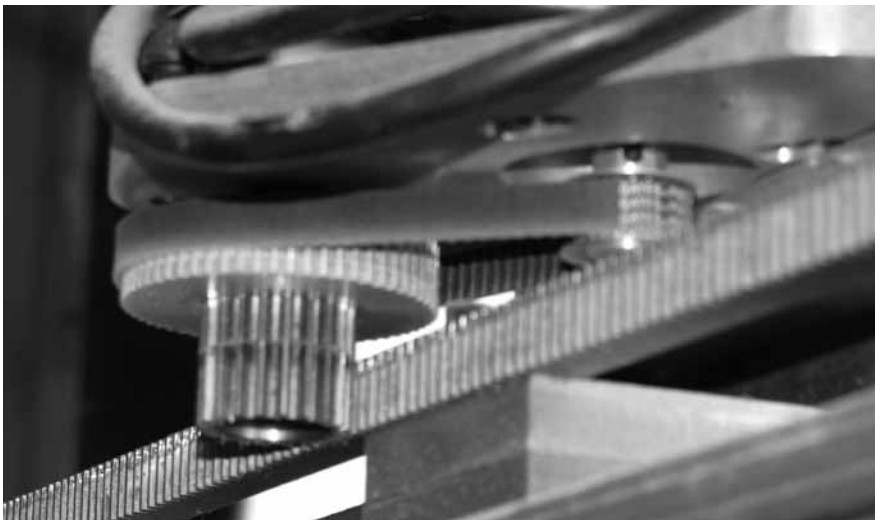
Compare to what is now possible with home CNC. Instead of shipping a set of plans by mail or courier, the designer could send a set of plans on a disc or over the internet, complete with cutting files for the parts and the formblocks. The CNC router could then cut out all parts to an accuracy of a few thousandths of an inch, even to the extent of drilling or routing all rivet and indexing holes. The

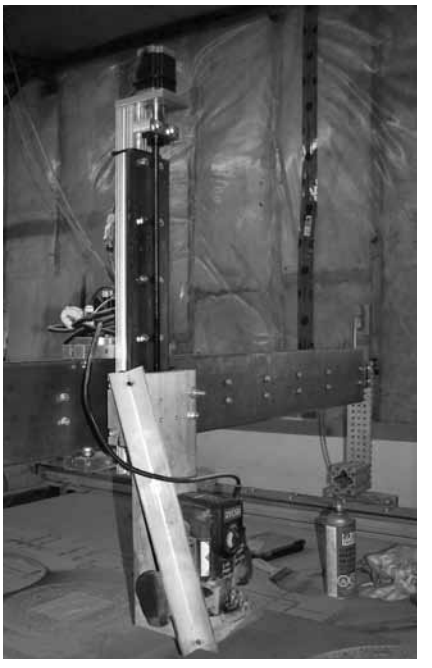


Top Down: The carriage is wide enough to accept a 4 ft wide sheet, and long enough for 8 ft; The main beams are "8020" aluminum extrusions with cold rolled flat steel as the ways for the carriages. Rectangular steel tubes are bolted to the extrusions to form the framework.

Second from bottom: A video game controller is used for initial setup, but it stays within the limits imposed by the programming to prevent crashing the sides or running off the end.

Bottom, Just about any old computer will do for home CNC work





Above: The X and Y axes have stepper motors with belt reduction, then a rack and pinion final drive Right, The Z axis uses an acme screw with a delrin nut for zero backlash. A Ryobi router mounts to the angle plate on the carriage.

designer could limit the use of the program to the production of one set of parts and this would eliminate the problem of bootleg Xeroxed drawings. There would be no need even to use a foot shear to cut the wing and fuselage skins to size because the CNC router could drill all of the rivet holes and then cut the skins out of the sheet stock. The program could also optimize the use of material by nesting parts, even to the extent of cutting smaller bulkheads out of the centres of the larger bulkheads, like a set of Russian nesting dolls.

CNC production is not limited to aluminum. Hot wiring of foam could be replaced by routing, and this would eliminate the problems of drag and concavity in the wing parts, plus it would eliminate the noxious fumes produced when melting urethane and stryofoam.

Wood parts can also benefit from home CNC by having all parts made to machine tolerances, including rabbets and other routed shapes to assist assembly. Expensive aircraft plywood could have almost every square inch used by having the program do the layouts. There would be no need to break and reweld a bandsaw blade to cut the insides of bulkheads, or alternatively using a jigsaw to cut these areas, then finishing the radiused inside corners with a file and sandpaper.

Even a steel tube fuselage could benefit from CNC. The sides of a fuselage are usually laid out on a large sheet of MDF, with small wood blocks screwed down to define the positions of the tubes. Instead the CNC router could first produce the required batch of blocks, then rout out recesses in the MDF sheet to accept these blocks. This would define exactly the locations of the wing carrythroughs to ensure that the plane had the desired angle of incidence. The program could also cut out MDF pieces with grooves to define the width of the fuselage at all stations from the firewall to the tailpost. Landing gear brackets could also be positioned with routed out blocks fitted over the fuselage tubes, to hold the steel brackets while tack welding. The builder would still have to fishmouth tubes the old fashioned way but the improved jigging would reduce the amount of headscratching during alignment and warping when welding.

A chapter could finance the construction of a CNC router and use it for many purposes besides aircraft. Rob Schieck intends to make IKEA-style cabinets for his workshop, and he can produce these at much lower cost than retail, and custom fit them to accommodate the doors and windows in the building.

For More Information:

Most of the parts came from http://www.cncrouterparts.com/index.php
The drive electronics came from http://www.geckodrive.com/
A good place to hang out if you are doing cnc stuff is http://www.cnczone.com/
A place that sells router kits based upon cncrouteparts.com parts is http://www.finelineautomation.com/
The original is www.shopbottools.com

Highs and Lows

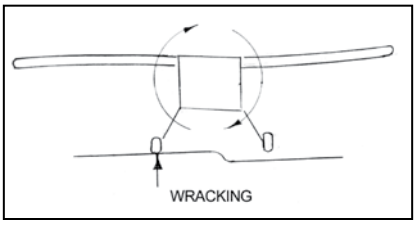
Mike Davy

WHERE SHOULD the designer place the wing? This is a subject about which I wrote awhile back in the "Flyer" but which I believe is worth dusting off once more, particularly since my own project and another one in which I am participating, have chosen opposite views. I will leave you to guess which is which.

The starting point is to acknowledge that the lion's share of the plane's rolling and yawing resistance is provided by the inertia of the wings. Secondly, the landing gear will not always meet the runway in a smooth and level attitude; instead, it will occasionally touch one-wheel first, or the plane will be drifting sideways, causing the downwind leg to dig in.

The wheel loads resulting from this will cause the plane to roll or yaw sharply to regain a straight-running, level attitude. This roll or yaw will be resisted largely by the wings. With a high wing arrangement these loads must pass up from the wheels to the wing by way of the fuselage structure. These could easily be handled by a couple of diagonals or a bulkhead, but unfortunately these would cross the space where the pilot/passenger must be located. The loads must therefore go by a roundabout route to the firewall, or as with the Rebel, via a massive frame at the instrument panel level, and by the baggage bay bulkhead at the rear. The fuselage must not distort or "wrack", the term which describes this action.

By contrast, with a low wing arrangement the landing gear loads are transmitted immediately to the wing, leaving the fuselage free to do its job of carrying people without the problems of wracking. The landing gear can be



mounted on the wings, or inboard on the fuselage, leaving the wings free to do their main task, that of providing lift.

So what is the downside? The low wing arrangement restricts downward view and is marginally unsuitable for a floatplane, where spray and docking problems arise. Also, the thickness of the wing carry-through may be difficult to reconcile with the cabin demands, although this can often be hidden beneath the seats.

Turning up the discussion to much larger aircraft than those met by the home-builder, the typical Boeing or Airbus adopts a low wing. The massive underfloor intrusion of the wing carry-through is of little consequence since the "lower lobe" of the cabin houses baggage and cargo containers which demand more height than the wing thickness.

At smaller sizes such as the regional carriers, there is generally a preference for a high wing which can extend partly above the fuselage line so as not to intrude into headroom. The F27 and Dash 8 are examples, each featuring a "leggy" maingear mounted from the wing at the engine nacelle positions, and avoiding wracking within the cabin. The ATR 42 is also a high wing type, but with a fuselage-mounted gear, requiring massive frames in the fuselage at the wing position and large blisters to house the retracted maingear. In engineering nothing comes free; the added fuselage weight of the ATR 42 is offset by the penalty of the leggier gear and wing reinforcing needed by with the F27 and the Dash 8.

Returning to home-builder proportions, a few years ago I built a Rebel (high wing). My current, and probably my last such home-built has its wing at the bottom.

The late Mike Davy was RAA's main engineering expert. This article is reprinted from the Nov-Dec 2001 Recreational Flyer.

Ryan Gomes, author of several Rec Flyer tech articles, is an apprentice AME who has been competing in the Ontario Technological Skills Compeition and the Canadian Skills Competition, and at both levels he has won the Gold Medal for aircraft maintenance. Ryan will now join with other select students from across Canada to advance to the 2011 World Skills competition in London England.

Ryan also operates G-Craft Contracting and Consulting, a company that specializes in Amateur category firewall forward installations for Lycoming, Continental, Rotax, and Jabiru engines. He can handle hydraulics and pneumatics, electrics and avionics, flight control rigging and balancing, and structural sheet metal repairs.

Contact Ryan at 519-222-3847

Across Canada

RAA Chapters in Action

RAA Saskatchewan

The last few months have been busy in Saskatchewan. In September, RAA 4901 worked with the local COPA club and provided an interesting group activity day for Big Brothers and Big Sisters of Saskatoon. The theme of the day was aviation. There were volunteer pilots to take people for a short flight, for many their first ever in any type of plane. There were volunteers speaking with static displays, providing information on weather, navigation, mechanics…just to provide an understanding of what needs to be considered when flying. This group activity was very well attended by the Big Brothers and Sisters and there were lots of smiles on kids' faces…and the pilots' too!

In October, members of the club began discussions on a new club project. It took a couple of months to sort out options and get the motions passed, but we are the proud new owners of a Christavia Mk-1. The original builder, Bill Halkett sold us the plane in December (Thanks Bill!). The intention is that those interested in the project will build over the next couple of years and that once completed, the plane will be available to members to rent.

As one of our current fundraisers through the summer and into the fall, our club has breakfast at the hangar every Sunday. This year, we were blessed with beautiful weather into November, so there was a long season. Club members volunteer to cook and there is always one designated member in charge of coordinating the breakfasts and ensuring the supplies are always ready. This year's coordinator was Ed Zelko. In December, Ed presented the club with the money from the breakfast and the club acknowledged his efforts in making the fundraiser a success.

RAA Saskatchewan's Exec at the Christmas Bash

The RAA Forum is up and running!

RAA's new forum is online! We hope to add many features over the next while to enhance the value of your membership. The URL is the same at raa.ca - simply click on the "forum" tab to get there.

Members are encouraged to send in news and chapter happenings for postings on the site. Get the word out, and check frequently for news on upcoming events. You can post them directly on the forum, and we'll make sure they make it onto the main site as well.

Any suggestions and ideas for improvements are welcome and can be sent to George Gregory at gregdesign@telus.net. Stay tuned for further developments!

RAA Office Move

The office has been relocated, so please bear with us. New contact information is: Phone 518-648-3030 or 1-800-387-1028. email raa@raa.ca
The new mailing address is: 22 - 4881 Fountain St North, Breslau On. N0B 1M0

Left: Brian Caithcart checking out RAA 4901's (Saskatchewan) new Christavia Mk-1.
Centre, Ed Zelko (right) presenting breakfast fundraising monies to Brian Caithcart, RAA 4901 president.
Below, some of the 99's that attended the Scarborough/Markham meeting in October. Left to right: Dee Birchmore, Akky Mansikka, Capt. Gillian Parker, Anna Pangrazzi, Marilyn Dickson.

Upon presentation of the cheque, Ed admitted that his loyal dog and sidekick Benji eroded the profits with an occasional stolen piece of bacon. The club didn't mind.

Last year, Mother Nature cancelled our annual After-Christmas Christmas Party and just about succeeded again this year. However, members and guests braved the blowing snow and enjoyed a relaxing evening of food and socialization.

Scarborough/Markham

At our October meeting, Captain Gillian Parker of the Canadian Air Force gave us an excellent Power-Point presentation about some of her experiences while serving in Afghanistan as a pilot of the CC-130 Hercules. She discussed some of the properties and specifications of this extraordinary aircraft, and its capabilities in very different operational environments in various parts of the world. She told us about the many varied missions required of the crews of these aircraft in Afghanistan involving the off-loading and pick-up of troops, equipment and supplies. She spoke about some of the difficulties flying around Kandahar and Kabul - the high heat and humidity, the dust storms, and the danger of collision at crowded airbases. She ended her talk on an upbeat note to the effect that, despite all the difficulties, many good things are happening in Afghanistan. Capt. Parker was also adept at fielding questions coming from the audience.

For example, she made us aware in an unbiased fashion of some of the background and considerations involved in the controversial purchase of F-35 aircraft for our Air Force. In addition to her obvious professionalism, Gillian was a very engaging speaker. We are grateful to Capt. Parker for giving us a most insightful evening. It was anadditional plus that her talk drew a number of spouses to our meeting,and some members of the 99s.

At our November meeting, we were addressed by Duncan Campbell (CampbDu@navcanada.ca), an Operations Specialist for NavCanada who works in the Buttonville control tower. Duncan spoke about the airspace around Toronto, how it ties in with airline instrument approach procedures to the various airports, and how VFR pilots can avoid getting mixed up in these approaches. He also discussed what is likely to happen in the future, particularly as traffic increases at City Centre. We convey our thanks to Duncan Campbell for taking the time to give us this talk.

As an addition to his F-1 Rocket, Wayne Hadath (RAA's national treasurer) has recently completed a superb 4-seater RV-10. He will tell us about it at our February meeting. In March, our guest speaker will be Kurtis Arnold (kurtis.arnold@gmail.com) who works for NavCanada. He will talk to us about his involvement with the TV program The Aviators. He gave a similar talk to the Toronto Region (Brampton) chapter, and it was very well received.

RAA-KW

KW RAA continues to hold informative monthly meetings at the Air Cadet building at CYKF, and in return the KW RAA makes an annual donation of $500 to the Air Cadets. In January member Mike Adam, who holds an aircraft evaluation accreditation, made a presentation that explained how a current market value may be established for any given aircraft.

Every Wednesday morning the members of KW RAA have a coffee and aero BS session and then either a BBQ or

pot luck crock pot lunch, depending on the season. Chapter president Clare Snyder donates all profits to the Mennonite Central Committee to assist with their relief work in third world countries.

Member Mike Adam gives a presentation on establishing prices for aircraft to members of the RAA-KW crowd.

London St. Thomas

Another year, 2010, has passed in the blink of an eye! With goodflying weather and many aviation activities to attend, it looks asthough 2011 will bring even more flying opportunities. The Great Lakes International Air Show promises to be one of thebiggest and best air shows in the country, right here in St.Thomas.

We were sorry to have to cancel our December planning meeting, but concern over poor drivingconditions during the record snowfall made it a prudent choice. Thanks to Don Hatch for gettingthe word out so quickly via e-mail and phone. We'll have another chance to revisit the chillifeed / planning meeting for January.

2010 was good year for the London / St. Thomas Chapter of the RAA. Most meetings were held at 427 Wing, but there were four away from the Wing. There was one first flight during the year. Cor Wester first flew his RV 7 on May 3rd. Cor won an award for Outstanding Workmanship at Oshkosh with this aircraft. And there is another accomplishment of note that deserves mention. Our member Tom Martin continues to win air races all over North America with his EVO1 Rocket.

Coming Events

March 5, Kars Rideau Valley Airpark (CPL3): Kars RAA Chapter 4928 9th **Annual Ski Fly-In.** Comm 123.4 RWY 26 /08. One week after Moe's world famous ski Fly-In. Homestyle food served from 11 AM till 2 PM in our new Clubhouse. PUBLIC WELCOME. Dilworth Road just East of 416. For more information please email Dave Stroud dstroud@xplornet.com

March 29-April 3, Lakeland, FL: The 2011 **Sun 'n Fun International Fly-In & Expo** will be celebrating the Centennial of Naval Aviation and will showcase the popular Blue Angels Precision Jet Demonstration Team. For more information visit http://www.sun-n-fun.org/.

RAA Flamborough Chapter - Planned Events

Saturday May 21, 2011. 8 am to Noon. Breakfast Fly-In. .

Friday June 10, 2011 5 pm to dusk. Family and friends barbeque. All welcome. Donations expected and accepted.

If flying in, field elevation is 840 ft. 43 22.25 N 79 55.95 W. Circuit height 1,000 ft. and ALL circuits must be to the EAST of the field. If driving, take Hwy 6 North from Hamilton to Conc 6 East. Turn right at the corner and proceed to Flamborough Centre and Centre Rd. Cross and continue on East for 1/4 mile to railroad tracks. Cross tracks and after 50 yards take the first laneway to the left (Flamborough Springs). Follow lane N through woods to the hangars. There are no signs.

Saskatchewan Aircraft Adventure

Last year more than 200 adventurers flying 100 airplanes made an outstanding trip to the Yukon in what was the largest group flight in Canadian history. The Century Flight Club will conduct the third annual 100 aircraft flight on July 16 - 23, 2011. This time into Canada's northern wilderness.

Registration is $695.00 ($595.00 for registrations booked before Dec.1.2010) Call or go online now to register! Limited to 100 aircraft. 1-778-297-7377

WWW.CROSSCANADAFLIGHT.COM

July 17, Kars Rideau Valley Airpark (CPL3): RAA Chapter 4928 **11th Annual Kars 'n' Planes Summer Fly-In BBQ**. Comm 123.4 RWY 26/08 Glider activity in area. Homebuilt, Classic and Antique Aircraft, Rideau Valley Soaring Club, Model Aircraft displays, Vintage Cars, Swords and Plowshares Military Museum. BBQ served from 11 AM till 2 PM. Large Brats on a Bun, World Famous steamed Hotdogs and assorted beverages. Overnight camping on Saturday....campfire, "beverages" and food available to campers. Limited bunkhouse space available in new Clubhouse. Reserve ahead. PUBLIC WELCOME. Dilworth Road just East of Highway 416. For more information please email Dave Stroud dstroud@xplornet.com.

RAA Flamborough

During the summer, and often during the winter too, there is activity on the field on any Tuesday or Saturday. Visitors are welcome, but you may want to give a heads-up to our President Karl

continued on page 37

A Man-Sized Hauler

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A reverse-engineered, side by side Citabria clone gets the job

COVERED that I was a ormal aircraft builder in of age: I started flying s in 1997 and got my te licence in February of t the age of 53. As I later d this is about the average r a "typical" builder.

est Riddle

done with style

I also discovered that flying was expensive and renting was *very* expensive. I concluded that I could save money by building my own plane and thus started the think about the right thing to do. Given that I am 6ft, 3 in. tall I could not consider many of the smaller kit type planes and began to consider scratch building a plane that provided lots of room both in height and width. My frame does not fit comfortably in a Cessna 150.

I acquired a set of reverse engineered CAD plans of a Citabria. These were not complete plans (I did not know that when I bought them) but they gave accurate details of the welded frame and the wing ribs and profile. There were no building instructions included.

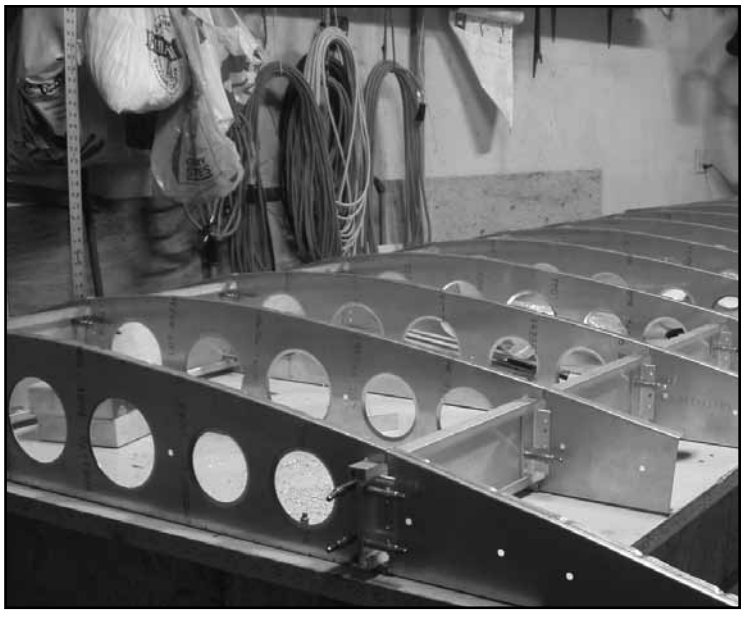
In early 2000 I purchased a large bundle of 4130 tubing and several sheets of aircraft aluminum for the wings. I also purchased all four books from Tony Bingelis. These were very helpful on many occasions.

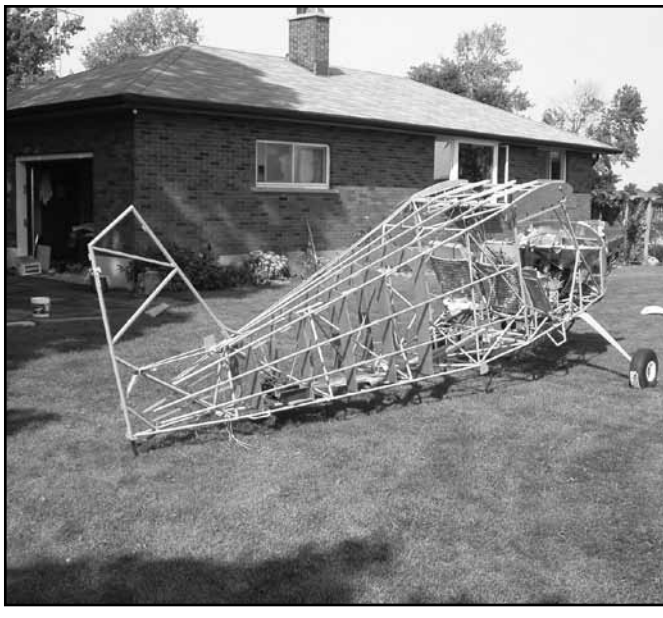
The wing profile is Clark Y. I purchased high density polyethylene (HDPE) to use as form blocks for making the wing ribs. I made left and right hand forms and clamped the aluminum sheet between them and then clamped that to the edge of the table and used a hammer and an oak block to form the ribs. This is tedious, but resulted in very good consistent ribs. I added lightening holes and upset the edges with a die-set that my brother Bob made. I had originally planned to cover the wings with fabric as shown in the plans, but the ribs were so uniform that I decided to cover them with aluminum instead. Manufacturing the wing ribs alone took about two months.

The next task was building the air frame. I had done a little welding but was not a welder, however I had worked in a number of places where welding was done and I knew what had to happen. I practiced by making T joints and breaking them until I could consistently break the parent material outside the weld rather than the weld itself. I became very good at contouring a joint with an angle grinder to get a close accurate fit.

A welding table was required so I purchased two 4 by 8 ft sheets of 1 inch thick melamine and built two tables that were positioned together and then carefully levelled to provide a 4 by 16 ft surface. I laid out full scale drawings and began making the top, sides, and bottom frames and tacking them together. All welding was done with oxyacetylene. I did not own a tig welder and did not have enough power to run one anyway. Oxyacetylene is slow but the welds are annealed when the welding is done. I also learned very late in the process that using a magnetic fixture to hold parts in position is very helpful while doing the welding, but very bad when you decide it is time to install the compass. I created little magnets all over the frame that had to be de-gaussed later.

To assemble the frame a folding ladder was used as a fixture to support the pre-welded frame parts in order to marry them





Above: the plans originally called for fabric covering, but the ribs were so consistent that it was decided to cover the wings with aluminum instead. Centre, getting ready for covering. Right, the control panel is basic VFR steam gauges. Below, the covered fuselage on its jig and just itching to get a coat of pain on.

together. After much measuring and adjusting the parts were tacked together. Finish welding took a long time and used many "small" tanks of gas. I have purchased the small tanks which you can own rather than rent the larger tanks which you cannot own.

The air frame was set aside and assembly of the wings began. The ribs were attached to the spars by small angle brackets (1/8 by 1 by 1). Making and installing 120 brackets and drilling 8 holes in each took a while as did positioning and riveting them in place. The leading edge was formed by bending the sheet back on itself and sealing the edges. A 2.5 inch plastic tube was placed inside to prevent over bending and then the air was drawn out using a vacuum. The next step was to add the skins with the top skin going on first. Pre-cover inspection was done by Bob Buchanan of MDRA and then the bottom skin was added.

When the wings were complete, they were stored next to the ceiling and the frame again took centre stage. After changing my mind several times I decided to make metal ribs and a metal floor pan. All aluminum sheet was 6061 0.025 except for the wing ribs which were made of 6061 0.032. The floor pan under the cockpit was made with a removable panel to allow inspection of the cables for the control stick and rudder pedals without the need to raise the floor. When the fuselage was complete, everything ahead of the doors was aluminum as well as entire floor.

Next came the fabric. The fabric

used was the medium weight Dacron which was bonded around the edges and then shrunk with a heat gun. There are recommendations that this should be done with an iron but it appeared to work out okay. Later after paint was applied some areas were found that appear to be less than adequately tight so it probably would have been a good idea to use the iron. A small friend of mine crawled inside the empennage and heated the fabric from the inside after paint and it tightened okay with no apparent damage.

Painting was done in the garage as well. I borrowed my brother's explosion proof exhaust fan from a farm application and mounted it under the garage door. The door is the roll up kind consisting of several panels so that there is a gap at the top when the door is part way up. The bottom space was filled in with two pieces of plywood. When the fan was running there was a good flow of air in at the top of the door, down past the parts being painted and out the fan at the bottom. The paint scheme is yellow and blue and when mixed you get green. I have a nice green strip down the centre of the driveway.

Like everything else, painting took a lot longer than expected. The fabric was primed with the Hypec Sun Barrier which is a single-part air dry polyurethane that depends on the moisture in the air to cure. This seems to be the best adhesive known to mankind since anything that is allowed to dry with paint on it is not coming apart again. At one point it was necessary to punch a hole in the top of the paint can to get the remaining paint out.

The top coat is Endura FC two part polyurethane. The FC stands for fabric cover and represents an additive to allow for flexing. Both fabric and aluminum were covered with this to avoid the need for two types of paint. Both this paint and the Hypec require a separate air supply for the operator. All painting was done while wearing a hood with a fresh supply of air from the same compressor used for the paint gun. The compressor was placed outside and upwind which resulted in no paint smell at all when spraying. After spraying was done a small fan (a big version of what is in the back of a computer) was placed in the window and all other openings to the garage were closed. No smell was noticed in the house.

With painting complete it was time for final assembly. The first attempts to fit the wings to the body were done outside with a 2 by 4 between an A-frame and the basketball standard and two pulley blocks. Of course a few extra hands were required as well. I received a lot of assistance from a number of friends, neighbours and family over the course of the building project. Given that my garage is only a 1 ½ car garage it is not possible to assemble a plane that ended up being 24 feet long and 33 feet 4 inches wide. Again a very helpful neighbour allowed me to use the top half of his barn for a winter or two to rig, jig and assemble the aircraft.

While setting the airplane up it became apparent that there was minimal clearance between the prop and the ground if the fuselage was in the flying position. In addition, there was a tendency for toe out on the main gear which would result in difficulty with take off and landing. To solve this two blocks were designed and manufactured to mount between the bottom of the gear legs and the axles

We had more than one curious visitor stop by during the summer to ask where we landed the airplane to get it in the back yard

to raise the airplane 4 inches and correct the alignment. This turned out to be very successful.

The instrument panel is all steam gauges. I bought some used and some are new. The holes were machined in the panel by using a ¼ inch carbide cutter in a router with WD40 for lubricant. It worked very well.

In the spring of 2009 the airplane finally emerged into daylight and was assembled in the back yard behind my house. This allowed me to make fairings and various pieces for closing gaps as well as to make several fibreglass parts to blend the form between the wings and the fuselage. We had more than one curious visitor stop by during the summer to ask where we landed the airplane to get it in the back yard.

In September 2009 we loaded the plane on a trailer and

Top: who wouldn't like to have an airplane in their back yard? More than one curious spectator wondered how it got there. Right, the project on its way to the airport for final assembly. Opposite, the fuel flow test went well.

Given that the plane had been converted from tandem seating to side by side seating it was not certain what would happen with the weight and balance.

transported it to the Brantford Airport for final assembly. We had to manufacture an A-frame to support the wings while there were aligned with the fuselage, but it went well. Many parts had be fastened together with hardware from the local hardware store. Luck was with me since Aircraft Spruce moved their Canadian distribution to the Brantford Airport in the fall of 2008 and all I had to do was walk 100 yards to their door to buy the hardware I needed. I was impressed by how often they had everything I needed in stock. I got to know everybody on a first name basis.

We borrowed a set of electronic scales from RAA (Gary Wolf at Kitchener) and did the weight and balance. This went well and was quite easy to do. Given that the plane had been converted from tandem seating to side by side seating it was not certain what would happen with the weight and balance. The engine was positioned as far back as possible without hitting the firewall in the expectation that the C of G would be to far forward. It turned out that the C of G is a little back from the ideal position. When the fuel is at minimum and no pilot the C of G is still within the envelope. The ideal would be to have the minimum pilot weight bring the C of G just inside the front of the balance envelope.

The fuel flow test went well with 36 gph with the main gear up on a set of car ramps. It would be great if the plane could climb continuously at that angle.

Winter happened and C-FTER sat outside in the weather all winter. With

This plane flies differently from a Cessna 172.

Specifications:

Empty Wt.: 1310
Gross Wt.: 2095
W & B: Gross weight requires full fuel; 190 lb pilot (me), 88 lb baggage and a 272 lb passenger.
Climb rate:..... Solo about 800 fpm
..... gross about 400 fpm.
Cruise: ..... 115 mph at 2200 rpm
Max speed: ..... 133 mph at 2500 rpm
Fuel ..... 37 gallons U.S
..... (71 litres per side).
Endurance:..... 4.2 hours w/reserve

the arrival of spring, Bob Buchanan came down again and did the final inspection. He found a few things that needed attention and I thank him for his careful scrutiny. Another set of eyes, especially trained eyes is always a good thing.

First flight occurred on May 24, 2010 with Daryl Gilbert doing the flying. He found that flight a little more interesting than he expected given that 1) the door latches did not hold, 2) the air speed indicator read too low and 3) there was a tendency to turn right. Given the low reading airspeed he was running at full throttle which increased the right turning forces.

New door latches were made, a new air speed indicator was purchased and installed and a small trim tab was added to the aileron. The airplane then flew well except the engine rpm was lower than desired due to being overloaded by a 74 by 58 wood prop made by Ed Sterba. Not knowing what to ask for when I was building, I asked for a prop suitable for an airplane that flies at 110 mph with an160 hp Lycoming 320 engine. After flying most of the 25 hours I asked for permission from Transport to change to a C172 7557 metal prop which worked better. It now comes up to 2500 rpm at full throttle in level flight and flies at 133 mph which is considerably faster than I was told to expect.

This plane flies differently from a Cessna 172. This is a rudder airplane in that it responds very well to rudder but it lacks differential ailerons and exhibits adverse yaw when aileron only is used for turns. When you lead with rudder it

Right: a router proved a handy tool for cutting the holes in the instrument panel. No EFIS here! Opposite, Ernest's design resplendent in the Ontario winter.

responds very well. Now that I have some hours in it I very much like the way it handles.

A few facts about the airplane: The engine is a newly overhauled Lycoming 320H2AD (non-certified) spinning a wood 74/58 Sterba Prop. The windshield was liberated from a Cessna 180 and required minor fitting. The brakes feature dual master cylinders, and steering is accomplished by tailwheel springs; differential braking handles sharper turns. I purchased the gear legs, wheels and tires.

The fuel system can handle alcohol but so far I've only had 100LL in the tanks. The oil filter is a remote filter assembly (non-aviation), 10 micron, and the oil cooler is inline and fed by SCAT tube from the back of the baffling.This works well even at temperatures in the 80° F range.

The radio is an Icom A200. There's no transponder at this point, but "probably, some day" best describes where things are at right now. Southern Ontario provides lots of need for it.

Heat is supplied with 2 inch SCAT tubing to and from an air box on the exhaust manifold; cooling is by NACA scoop that moves a huge amount of air.

The seats were custom made from 4130 tubing and alumiinum banding. The form is a copy of a car I owned and is much more comfortable than the rental Cessna seats I have been on.

A large plywood box painted grey will hold up to 88 pounds or more of baggage depending on the weight and balance.

The wings are all aluminum with the spar capable of withstanding 6 G's at 2000 pounds.

The 25 hours are behind me and the paperwork from Transport has been received to remove the restrictions. These documents arrived just in time for the first snow. The airplane is now in a clean dry hanger at Springvale Ontario awaiting the warmth of spring and the first of many flights with passengers.

Thanks go to my patient and supportive wife Jackie as well as to Domi Bruyn who helped with many tasks and my brother Bob who made a number of custom parts for me on the lathe.

Ernest Riddle is a recently retired engineer wo resides in Branchton, Ontario.

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 Fourth Monday 7:30 PM Lake Simcoe Regional Airport Contact Secretary Dave Evans 705 728 8742

E-mail david.evans2@sympatico.caCOBDEN: Third Thursday 8:30 pm at Club House, Cobden Airport. Contact Pres. Clare Strutt, 819-647-5651.

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. Keith Weston at 705-444-1422 or e-mail at ckweston2@sympatico.ca

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 7:30 pm at various locations. Contact President , Jim Easter 519-676-4019 jim.easter@teksavvy.com.

KITCHENER-WATERLOO: Meets the third Monday of each month in the upstairs meeting room of the cadet building at CYKF, except during the summer months when we have fly-ins instead. Please contact Clare Snyder clare@snyder.on.ca

LONDON/ST. THOMAS: First Tuesday 7:30 p.m. At the Air Force Association building at the London Airport. Contact President Angus McKenzie at 519-652-2734 or angus.mckenzie@sympatico.ca

MIDLAND-HURONIA: First Tuesday 7:30 pm Huronia Airport. Contact Tom Massey 705-526-5304, fax 526-5310

NIAGARA REGION: Second Monday 7:30 pm at Niagara District Airport, CARES Building. Contact Pres. Elizabeth Murphy at murphage@cogeco.ca, www.raa-niagara.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

OWEN SOUND Contact President Roger Foster 519-923-5183 rpfoster@bmts.com

OTTAWA/RIDEAU: Kars, Ont. 1st Tuesday. Contact: Secretary, Bill Reed 613-831-8762 bill@ncf.ca

SAUGEEN: 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 8:00 pm at Hangar 41 on north end of Brampton Airport. Contact: President Brian Heinmiller 905-877-7947 b.j.heinmiller@sympatico.ca

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 Gerry Theroux 403-271-2410 grtheroux@shaw.ca

EDMONTON HOMEBUILT AIRCRAFT ASSOC: First Tuesday 7:30 pm EAHS boardroom. Contact President Bill Boyes 780-485-7088

GRANDE PRAIRIE: Third Tuesday, Chandelle Aviation Hangar, contact Jordie Carlson at 780-538-3800 work. or 780-538-3979 evenings. Email: jcarlson@telusplanet.net

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 Kelowna Yacht Club. Dinner at 6:00pm, meeting at 7:30pm Contact President, Cameron Bottrill 250-558-5551 moneypit@junction.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: Tim Nicholas vibraanalysis@shaw.biz.ca. Website http://raa85.b4.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 - Dick Suttie Phone 250-374-6136 e-mail - richard_suttie@telus.net

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 Richard at 782-2421 or Heath at 785-4758.

Chapter executives, please advise of changes as they occur. For further information regarding chapter activities contact RAA Canada, 13691 McLaughlin Rd, R R 1, Caledon, ON L7C 2B2 Telephone: 905-838-1357 Fax: 905-838-1359 or call toll free: 1-800-387-1028 email: raa@zing-net.ca www.raa.ca

President's Message / from page 2

pany have need of artistically laid out advertising but you do not have your own art department? Contact George at *george@sidekickgraphics.com* and he can handle this for you in a prompt and professional manner.

INDUSTRY UPDATES

The economy has forced some changes in the business of light aircraft manufacturing. ASAP, the manufacturers of the Chinook awhile ago announced that they were looking for someone to buy their company, and that after Christmas they would use only email for contact with customers. In the past month they have announced that they are now manufacturing their last run of parts, and most of these will be incorporated into kits. If they do not find a buyer for the company they have announced that they plan to close the doors by summer. Owners of Aula Chinooks will then find themselves in a bureaucratic limbo as a requirement of Aula is that there must be a manufacturer to handle continuing airworthiness issues and to supply parts.

Murphy Aircraft is now batch producing aircraft kits and parts subject to accumulation. Rather than inventorying parts they wait until the orders will justify a production run and then they produce the parts that have been ordered. Parts are still available but there might be a wait until they are being run. Patterson Aero Sales are the dealer for Murphy and they may be reached at www.pattersonaerosales.com .

BushCaddy went through a rough patch last January when the TSB issued their inaccurate report in the Aviation Safety Letter, and Bushcaddy's order book became filled with cancellations. Despite the RAA article and the retraction by TSB and the ASL the damage was done. BushCaddy has now been bought by Tony Watkin, an Australian investor who has moved the company to Lachute Quebec. The website is www.bushcaddy.com and email may be sent to tony@bushcaddy.com . Tony has also taken over the operation of LAMAC who assist potential manufacturers in qualifying their paperwork to enter the Aula category. The new LAMAC site is www.lamac.info .

Challenger has announced a new model that has a larger vertical tail. After years of maintaining that pilots must learn to use their feet they have now produced two new models with a larger tail to give better yaw stability, similar to the tail that has always been required in the UK. The new models also have differential ailerons that are claimed to eliminate the adverse yaw of the earlier models. www.challenger.ca.

Sonex has just test flown their new single seat version, called the Onex (One-X). It is all metal, aerobatic, and has a folding wing, so that the plane will fit handily on a trailer and can be parked in a single car garage. The standard engine is their 2200cc Aerovee, same as is used in the 2 seat version, so performance is reported to be impressive. Details are available on their website www.sonexaircraft.com .

Can-Zac Aviation has become the Canadian importer for ULPower CNC-machined flat four and six cylinder direct drive engines with FADEC. The engines range in power from 97 to 130 hp, and except for the aerobatic version they have a TBO of 1500 hours. www.can-zacaviation.com

Maneuvering Speed / continued from page 12

plane is subjected to an external force, such as the aerodynamic force from a control surface, the airplane responds by accelerating (rotational acceleration) about one of the airplane's axes. This was stated many years ago in Newton's Second Law of Motion. The law states that when an object of mass 'm' is acted upon by a force 'F', it will undergo acceleration 'a' in the same direction as the force. More simply stated in the widely known equation "F = ma", which can be rewritten as "a = F/m". Rewritten this way, it is clear for a given control force 'F', as the airplane weight 'm' decreases then the acceleration 'a' will increase. This higher acceleration gives rise to higher loads on the airplane structure. Therefore, as the airplane weight decreases, the allowable maneuvering speed must also decrease, to ensure that the airframe is not damaged. Pilots may remember from their written exam that VA-NEW = VA √ (WNEW/WMAX-GROSS) as the way to calculate the corrected (new) maneuvering speed due to operating at a weight less than the maximum gross weight. NOTE: This formula is for calculating the VA change about the pitch axis; however, it can be used for all axes.

Recommendations

The FAA wants to clarify that operators should know what the maneuvering speed is and to caution pilots on what to avoid by adhering to the information described above and contained in the regulations. We recommend the following for maneuvering at, or even below, VA:

DO NOT apply a full deflection of a control, followed immediately by a full deflection in the opposite direction.

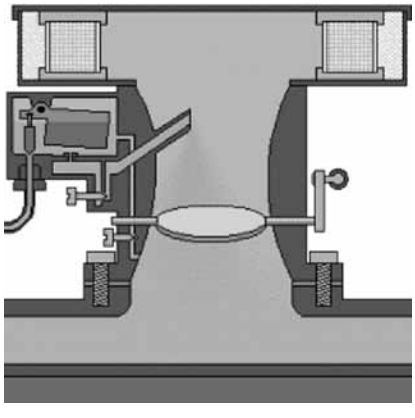
DO NOT apply full multiple control inputs simultaneously; i.e., pitch, roll and yaw simultaneously, or in any combination thereof, even if you are below VA.

Reduce VA when operating below gross weight, using the following formula: VA-NEW = VA √ (WNEW/WMAX-GROSS)

For Further Information Contact Mark James, Aerospace Engineer, 901 Locust, Room 301, Kansas City, MO 64106; phone: (816) 329-4137; fax: (816) 329-4090; email: mark.james@faa.gov.

Carburetor Icing

Keeping the airways clear / Harry Hill



THANKS TO GOOGLE it can be seen that carb ice occurances keep happening despite all that is said and taught on the subject. So maybe there is some sense in trying again to understand carb ice and its handling. In this, my part of the discussion, I will try to concentrate on icing in the carburetors of the smaller types of engines that most of us will fly. And I will not give much time to other than carb heat as a means of combating carb ice. Other ideas or thoughts will find a way in of course.

Why is there air? Although I couldn't find it on the records (LPs) that I have, I feel quite sure that the question was the title of a stand-up bit by Bill Cosby. And I feel equally that the answer was something like "to blow up basketballs". And that makes sense to a kid growing up in a big city in the USA. We, in recreational aviation, might have a similar tongue-in-cheek answer, " so that we can fly ".

So let us have a quick look at air because it is, of course, essential to our enjoyment of flying and at times gives us problems in flying. I expect that we all were supposed to learn something about air when we were learning to fly. If you know it all, please forgive me this review.

The major components of air are nitrogen and oxygen, about 78 % of the former and about 21% of the latter, according to one weather text that I have. There are small amounts of other gases and water vapour. Near the surface of the earth, natural processes keep the two main gases in balance near the values given. However, the amount of water vapour in a sample of air can vary from a high of about four percent in tropical areas to a small part of one percent in the Arctic.

The " other gasses " don't mean much to our use of air but the water vapour does. There is a maximum amount of water vapour that a sample of air, at some temperature and pressure, can hold. For our use, we express lesser amounts of water vapour as a percentage of the maximum and we call such percentages "relative humidity". Air containing the maximum amount of water vapour is said to be saturated.

If a sample of air, that contains water vapour but is not saturated, is cooled down sufficiently, a temperature will be reached at which the same amount of water vapour becomes the maximum amount that the sample, at the lower temperature, can hold. We call that lower temperature the "dew point". And in normal circumstance, the vapour condenses and becomes visible in the forms of cloud, fog or ice crystals, or maybe something else that I haven't thought of at this time.

Aviation weather reports usually include the temperature and dew point and we call the difference between the two, the "spread". When the spread is small, a small amount of cooling can cause the air to become saturated. And a small spread also means a high relative humidity of course. A large spread indicates a low relative humidity and what we call dry air. It is worth noting that very cold air, say –30 C, can have a high relative humidity but contain only a very small amount of water vapour. When that air enters our homes and is heated to say, 20 C, it then has a very low relative humidity. Thus endeth the lesson on air.

Discussions of carb icing frequently start with at least mention of induction system icing and three types of icing that can happen: impact icing, throttling icing, and fuel evaporation icing. The first can happen when supercooled water or wet snow contacts surfaces, such as air filters and intakes ducting that are below freezing temperature.

Of course, when that happens, ice will also accumulate on the airframe and stress levels will rise in the pilots and knowledgeable passengers. In our kinds of airplanes, we don't have means of getting rid of airframe ice so we better have means and knowledge that will allow us to keep the engine running so that we can get out of the conditions causing the puckers. The effects of impact icing are sometimes taken care of by "suck-in" doors in the induction system ahead of the carb. In the second type of icing listed above, throttling refers to the reduction in flow area in the throat of a carburetor caused by the venturi or by the throttle plate. Both of these cause a reduction in pressure and consequent cooling in the throat of the carb. We have all probably felt fuel evaporation cooling because we have all probably spilled gasoline on our hands. The cooling effect is immediate and quite noticeable and results from our body heat being used to evaporate the fuel.

In the research that I did for this article, I was unable to find estimates of the amount of cooling, in a carb that was attributable to each of those cooling elements. I did find that it is estimated that the total cooling can reach about 40 Celsius degrees. Consider a nice summer day, with a temperature of 20 C and relative humidity of 50 %. If I read the small psychometric chart in a handbook that I have, correctly, it would take only about 11 degrees (Celsius) of cooling to raise that air to 100 % RH. So carb ice happens.

Well then, under what circumstances can it happen?

Firstly, consider the conditions of the air in question. You can find lots of words about the weather conditions in which carb ice can happen. I think that the information is much better presented in a forecast temperature and dew point. The graph will enable you to estimate the severity of icing that might happen in flight under those conditions.

Carb icing can be more severe with closed throttle or reduced throttle settings. I would surmise that is a result of the tighter restriction in the throat of the carb and resulting greater cooling effect. At the same time, less power and less heat under the cowl are generated with lower throttle settings. And smaller throttle openings result in smaller gaps for ice to bridge if it starts to develop. Things could get ugly in a hurry. This may help explain the "serious icing with descent power" area shown in the carb ice graphs. So carb

ice happens in lots of flight conditions.

Also, the use of mogas can lead to carb icing at higher ambient temperatures. Again, my 1993 info says " In severe cases, ice may form at OATs up to 20 C higher than with AVGAS. " I presume that that happens because mogas evaporates more readily than avgas and so causes greater cooling due to evaporation.

And how do we know if carb ice is happening? To simplify this discussion, let us look at cruise flight at the same altitude and throttle setting. When carb ice develops beyond a trace of ice, you can expect a power loss. With a fixed pitch propeller, there will be a loss of RPM. With a constant-speed propeller, there will be a drop in manifold pressure. In either case, the engine could start to run roughly. And we can use carb heat to see if icing is happening, as we will see later.

Can anything be done to prevent carb icing? In 1970, the Fuels and Lubricants section of the National Research Council issued a report titled "Aircraft Carburretor Icing Studies". (Yes, they did spell it with two tees.) The main purpose of the study leading to the report was to see if additives in the fuel or if surface treatments in the throat of the carburetor could reduce markedly or eliminate carb icing. In my judgment, the test was well set up and some good results, relating to icing in general, were obtained. For example, the test set up allowed quick disassembly of the intake after a test and so permitted good photographs of ice that had developed, before melting could eliminate the evidence. It was found that a couple of glycols with fancy names could eliminate icing and that a Teflon coating of the throttle plate and carb throat would prevent ice from adhering to those surfaces. Neither of these practices were adopted, of course, and so we are left with carb heat as our defensive weapon.

Carb heat should not be used on takeoff as power will be reduced by its use.

In our kind of airplanes, the carb heat system usually starts with a muff around some part of the exhaust system to gather heat. Heated air from the muff is ducted to a means of introducing heated air into the intake system before the carb. A manual control in the cockpit controls the diverter valve in the system. The carb heat system bypasses the intake air filter and so it is recommended that heat not be used on the ground except for check purposes.

For flyers of factory-builts or of amateur-builts with good operating instructions, use of carb heat starts with an understanding of any directions with respect to the topic. After that I think that use of carb heat starts with a check of the weather reports and forecasts, before flight. A check of the spread will permit, with the carb icing graph, an estimation of the possibility and severity of carb icing. Some aircraft check lists or handling notes call for a check for carb icing on run-up. Whether it is called for or not, I think it is a good practice, especially if the spread is not great. It is a simple check, usually done at an intermediate RPM used for other checks on the run-up. The throttle is prevented from moving and the RPM noted; full carb heat is applied and left long enough to ensure that any ice is removed; then the carb heat control is moved to full cold and the RPM noted. If there is an increase from that seen before the check, there was ice in the carb and it can be expected to occur again as the flight progresses. Carb heat should not be used on take-off as power will be reduced by its use. If take-off is delayed much after the run-up, heat could be applied until just before take-off, to ensure that no ice will develop during the wait.graphical form, such as can be found in your AIM. The graph is the same as in my AIP on a page dated 1993.

If ice has been found on the run-up check, or if the forecast spread is small, it could be prudent to check for ice after levelling off for cruise. The routine of the check is the same. If icing is found, then the pilot can expect more ice build-ups as the flight progresses. The routine of the check will remove any ice again. Some handling instructions suggest trying to find a setting of the carb heat control just high enough to prevent ice build-up. If that can be done, the mixture should be adjusted to suit the higher intake temperature that results. If throttle is not wide open before setting the carb heat, it can be adjusted up to regain power before adjustment of the mixture.

If one is just punching holes in the sky when carb icing may be present, it would be prudent to occasionally level off, set the throttle and go through the icing check process to eliminate any ice and to prevent worsening of an icing situation. I seem to remember (from some 50 years ago) that, in Harvard training, we did a full "vital actions check" that included a check for carb icing before doing stalls, spins or aerobatics. If icing was present, we were not supposed to do spins as they were done with the engine shut off.

On descent with reduced power, under-cowl heat will fall, exhaust heat will fall, and so, if carb heat had been used continuously in cruise, a higher setting should be selected to ensure elimination of ice during descent. Some handbooks call for full heat on descents and in the circuit. A note, in a section on landing, in a Cessna 172 manual that I have, reads "Carburetor heat should be applied prior to any significant reduction or closing of the throttle." Sources seem to agree, that if carb heat is on, prior to landing, and the landing is aborted, or if a touch-and-go is made, the throttle should be opened fully before the carb heat is removed.

I am a fan of carb temperature gauges.

I think it started with the Expeditor when I was flying in the RCAF (Aux) or reserve or whatever it was called. I was with 402 Squadron in Winnipeg and the Air Navigation School was also flying the Bug-Smashers from Winnipeg. There were some losses and someone decided that the problem was carb icing. The solution to the problem was to require all RCAF operators of the aircraft to fly, after take-off, with + 5 to 10 degrees Celsius on the carb air temp gauge. The probe/sensor for the system was downstream of the carb and all the cooling so that maintaining carb temp in that range ensured that ice would not form. It was simple, it worked for me and many others, and did not cost anything in performance in my fairly long experience in those airplanes. About the only thing a pilot

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had to remember to do was to add a little heat after reducing power for descent.

Adding a carb air temp gauge to a certified aircraft is not impossible, just expensive. I found the web site of one supplier of a system. It would be easier and less expensive for an amateur builder to add a carb temp gauge for his powerplant. A local "engine person" suggested that a Radio Shack temperature gauge could have its sensor epoxied into the intake system, downstream of the carb and provide the vital information. I imagine there is someone out there with more elegant but still doable and not too costly, solutions.

One thing more about the use of carb heat; I was in the right seat of a DC-3 and we were about to take off into a temperature of –40 or colder. I remember thinking that if I were captain, I would have added some carb heat before take-off. Not because carb ice might happen but because I was sure the engine would not like having such cold air pushed into its vitals. As confirmation, I believe, I am sure that one engine at least made one quick burp as we rolled on the take-off run. No harm done but I felt for those poor engines. Not many of us are likely to go flying at –40 in our little aircraft, but if the occasion arises, may I suggest the addition of some heat for take-off. There will still be lots of power and the wings will develop bags of lift in such cold air.

Chapters / continued from page 21

Wettlaufer at 905 876-2551 lazykfarm@sympatico.ca or Director Bill Brubacher at 905 628-2304 w.brubacher@sympatico.ca. Recent arrivals at our field include an SE5-A Replica flown up from Florida last fall and a beautiful Glastar with a glass panel built and owned by Jim Anderson.

RAA Ottawa - Rideau

The Secretary's report was omitted due to the late start time. We were not able to get into the club house. The locks were frozen..

Dan gave a great presentation on the workings of the jet engines. Dan brought along failed components of jet engines and explained the difference between the Rolls Royce and Pratt & Whitney engines.

RAA Toronto

The new executive, chosen by the elected directors was announced. Jim D's Treasurer's report indicated 68 paid-up members plus 16 today.

The Christmas dinner was a success with 52 guests, and excellent speaker, and a productive silent auction.

Alain O., our safety officer mentioned a recent concern in the Quebec flying community was the inadvertent entry into IMC. This is an increased risk in winter due to possible white-out conditions caused by snow. Bernie Wurster gave a 'Minute for Maintenance' talk concerning engine oil systems. Explanations for the pressure system, bypass valves and their performance, and interpretation of oil pressure and temperature were all covered.

We have Jack Smits to thank for a donation of a lovely computer in the clubhouse with which we can access the internet. Many thanks Jack since this unit has been seeing constant use by the members.

Ken showed some literature on the Battery Minder, a handy device to optimize the charging and maintenance of your battery.

Jerry mentioned a flight plan program from an American company which has versatile software and therefore is adaptable to homebuilts. It is excellent! See www.flightplan.com or the article later in this newsletter.

Fred Grootarz distributed worksheets, and presented a slide display on the Self-Paced Study Program printed in the Aviation Safety Letter 4/2010. This fulfills the 24 month recurrent training requirements of CAR 401.05 (2) (a). Fred also kindly distributed pre-printed sticky tags for use in our logbooks. Thank you for an extremely well done presentation Fred!

Thanks to Fred Groodarz for leading us at the January meeting through the Aviation Safety quiz and providing logbook stickers for our 2-year currency requirement. This was a much better learning experience than doing it on our own. Thanks also to Bernie Wurster for informing us about engine oil systems in his Minute for Maintenance segment. Continuing education like this is not only fun, but contributes significantly to our ability to operate and maintain our airplanes safely. Thanks also to Jack Smits for the donation of an excellent computer for the club house. With this machine and Paul Yardy's magic on the Internet link we have an excellent flight planning and filing tool right in our own facility.

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

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For Sale

SIDEWINDER. All metal two seats. Equipped with Lycoming O-290-D engine with logs. 3-blade ground adjustable Wrap Drive Prop. Bendix / King KY97A radio, Icom portable standby radio; transponder / c. Full cockpit & panel lighting; strobes, nav lights & L/L lights. Ready for MD/RA final preflight inspection. All drawings and building manuals included. $20,000 CDN. Call Norm @ 519-745-7971 or e-mail Idservice@rogers.com. June/10

FOR SALE: (1) a 1967 C-172, 3170 TT, Cont. 0-300, 1020 SMOH, new windshield, new battery in Sept./10, new paint in 2005, a working DME, two 720 com. radios, a 121.5 ELT, current annual till Sept./11. $35,000.
(2) a 40' x 30' calhoun super structure. It has 5' steel walls, 10' high doors, fabrene roof and will hold a C-172. It was put up in Nov./04 & taken down in Nov./09. $6,000. Phone 705 544 8743 or whiteheadbj@msn.com Oct10

NEW PRICE! Zenair Zodiac 601HDS Tricycle gear, registered 1993, Rotax 912 UL, ARPLAST flight adjustable prop. 756 hrs TT. ICOM A-4, 2 headsets, GARMIN 95 GPS, Vacuum AH. Stainless exhaust, new upper paint 3 years ago. Canopy cover. Cruise 120 mph. Asking $24,000 CDN. At Oshawa. Dave, 416-282-5252 Oct10

Early model Zodiac HDS Speed Wing spars,

ribs & plans. $400 or best offer. F.O.B. Don Benton 1-519-442-2962 dorothybenton@hotmail.com Apr10

MINI-MAX ttsn 217 seoh 29.8. Rotax 447 new GSC prop. skis. radio. always hangared. excellent condition $11,900.00 obo

Lazair project. ttsn 123 hrs. total new Ceconite 2.7 covering. ROTAX 248 24 hp engines and 4017 props. skis. $4900.00 obo New Colin Walker prop SAE1 6856 epoxy LE $500.00 GSC 48" prop with adjustable hub Rotax 75mm bolt pattern.$200.00 Scott tailwheel, C65 to C90 Starter, Cessna 180 generator, NAS3 carburetor Stromberg. All for $200.00 Contact 780-460-6841 (Home) J J Williams 780-945-0411 (cell) June/10

For Sale: C 90 engine core $2500. Four overhauled cylinders with new pistons and rings $1000. As a package, $3200. Bob 519-884-9094 June/10

Acro Sport II project. Tacked fuselage, wings ready to cover, tail feathers, wheels, tires, brakes, instruments, fuel tank, windscreens, hardware, much more. $7,500.00. lussierm@telusplanet.net June/10

For sale KR-2 fuselage in boat stage and metal kit for retractable landing gear castings $300.00 call Ian 604-856-1159 or email tri-pyramid@telus.net

For Sale: Lycoming 0-235-C engine, disassembled, rebuild started,crank good, needs carb and ring gear hub. $1800.00. Tom at 1-519-822-6693, 1-519-638-5075, millfly@sympatico.ca June/10

For Sale: CH-701, Basic Ultralight, Rotax-912, jeep gear, gull wing doors, $24,500. Tom 1-519-822-6693, 1-519-638-5075, millfly@sympatico.ca June/10

C-IGVE Cara-two (Karatoo) 2 seat basic UL with overhauled Continental 75 hp engine and Zenith wood prop. Steel tube and fabric taildragger fuselage with all metal wing. Day vfr panel, no electrics, 600-6 wheels with disc brakes. $12000 OBO Bill Rice 519-461-1849 June/10

C-ICPZ Silverbird single seat Basic UL with aluminum fuselage, all metal wings, HAPI VW 1600 direct drive engine with dual ignition and Ellison carb/injector, day VFR panel. First $5000 takes it all Bill Rice 519-461-1849 June/10

C-IFWE Cloud Chaser single seat Basic UL that began life as a Schweitzer 126B sailplane. 40 ft span all metal wing, steel tube and fabric fuselage and tailfeathers, tricycle gear with telescoping nose strut and fibreglass main gear. Powered by electric start Kawasaki 440 with belt redrive and IVO prop. Day VFR panel. plexiglass canopy. $7000 OBO Bill Rice 519-461-1849 June/10

2002 Emeraude with 47 TT. O-290G Lycoming with 393 SMOH. Sensenich metal prop, Icom A5 and intercom. Full conventional panel, custom interior, all logs. Always kept in a heated hangar in Stratford. Asking $29K. Jim Demerling 519-348-9655 for details. Sep10

RV-3A project with original construction drawings, not updated to B model. Includes a set of original spec wing spar channels made by Leggatt Aviation and a set of Van's factory made wing ribs. Also includes several fuselage bulkheads and vertical tail spar, plus some tail ribs. This project has been donated to RAA Canada, so please make your offer by email to raa@raa.ca, and put RV-3 in the subject line.

Ed Johancsik's 1991 W-8 Tailwind C-FHCE As seen in Sept-Oct 2005 Recreational Flyer, 450 TAFH, 115 HP O-235-LC2, 35 hrs since TEOH in 2008, cruises at 150mph on 4.5gph, Climb out at 800-1000 fpm. Located in Brantford, Ont. Asking $25000 OBO, Contact Colin at Johancsik@shaw.ca or 403 225-0639. Oct10

Beryl project - tail feathers, all 26 wing ribs, plans - unused. Some Sitka & a/c grade plywood. The Beryl is a Claude Piel design - like a more robust Emeraude but with tandem seating. Good x-country and strong enough for mild aerobatics. Some instruments too. $1,000 takes it all. Call Nigel (705) 429-3449 or landnlaw@sympatico.ca Oct10

Citabria instruments for sale. Airspeed, vacuum turn and bank, whiskey compass, oil pressure, oil temperature, 2 ammeters, battery powered red cabin light. John Foubert 289 752 1650 Brampton. Oct10

Sonex Ser# 0551 Airframe complete, Ready for engine of your choice, some instruments. Asking $ 16500.00 (780) 968 6739 George Minchau. Email gminchau@telus.net Oct10

Cougar project for sale. Fuselage and tail feathers complete, controls installed, on wheels and ready for inspection. Lycoming 0235 mounted. Some instruments installed. Spars are ready, wing materials available. Price $8,000 obo. Call (519) 945-8731 or nseiler@netcore.ca. Oct10

Continental A 75 that was installed on Davis DA-5A homebuild aircraft. Total time since major overhaul 63.5 hours, Balanced, no electrics, two advance magnetos, engine has excellent compressions and 75 - 80 Hp at 2300 RPM $ 7,800 Negotiable Rob (905) 484-0804 Oct10

Homebuilt Davis DA-5A less engine, All metal tricycle aircraft with 136.05 hours total time. Built to fly with C65 Continental (....it did fly with A 75 Continental) No electric system, includes Sterba wood propeller and basic instruments. Always hangared $5500 OBO (905) 484-0804

For Sale; CH-601 Canopy cover, professionally made, like new, Value $400.00+ Will sell at $300.00 Phone Mike @ 905-476-3438 Dec10

For Sale; New 66"dia. 3 blade Warp Drive propeller with 4" dia. bolt pattern and bolts for Rotax 912S. Never used as it was purchased as a backup. $1500.00 Call Mike @ 905-476-3438 Dec10

STRETCHED PACER PROJECT - ESTATE SALE 0320 160 HP Lycoming engine in crate

- extended fuselage 18" - ready for covering - new windshield - side-by-side sticks and toe brakes - large luggage compartment - 2 doors - welded float fittings - seats included - main gear with new Cleveland wheels and double puck brakes - tail wheel and spring - wheel pants - super cub wings with cuff leading edge ready for covering - extended flaps and ailerons- fiberglass wingtips - 15 Imp. Gal. Tanks/wing - most instruments included $29,500.00 complete (905) 985-3195 Rose Dec10

Brand new dynafocal ring for Rotax 912/914, never used. Regularly $800 plus tax, I have one for $375 CDN plus shipping. gpeees@hotmail.com Dec10

RV-3 Parts: RAA has received a donation of RV-3 components. The package includes a set of the original drawings, factory made wing ribs, a pair of wing spar channels to the original spec, some fuselage bulkheads, and many small aluminum and steel parts. The package will be sold to the highest bidder. Dec10

For sale: Engine Mount for LOM 337B Engine installation into a Zenith CH 801. Asking $1,200.00. Nose Gear for the same, $1,000.00. Walter Lom Engine: New factory overhauled M337B (6 cylinder, inverted, inline, supercharged, certified 235 HP aircraft engine): 1400 hours TBO with possible 200 hour extension, including spare parts, tool kit, log book, and manual. In its original shipping crate. The distributor, governor, and oil lines for a LOM V541 propeller are factory installed on the engine.
Walter Lom Propeller: V541 (2 blade) constant speed propeller with tool kit, log book, and manual. The propeller is brand new and is in the original shipping crate.
One set of aluminum anodized engine mount pad blocks, vibration isolators, and bolting kit. For further information and images contact: Dan Marshall 519-794-3270 dgmec@bellnet.ca Feb11

68 Cherokee PA-28 with 160 hp cylinders. Low time airframe with engine on condition. Plane is based at Brampton. Exterior 6/10, interior 7-8/10. VG's, speed mods, glideslope, Mode C, annual to July 2011. Best Offer. 905-785-9032.

Need to pick up or deliver a plane on a trailer and don't have one? At YKF is one available for members for a reasonable rental fee. Ttrailer has a flat platform and is 16' x 8', dual axle one of them with brand new electric brakes wired to work. A class III hitch is required with a 2 5/16" ball. A hitch can be provided complete with load distribution bars. The trailer is NOT suited to haul a backhoe or a pickup truck. For more info email Rudy at rudyhane@gmail.com

Wheel Pants Galore! I have several sets in various conditions. Some need work and/or painting. They came off Cessnas and Pipers and likely could be adapted to your homebuilt aircraft. Prices negotiable from $75 per pair to $200 per pair. Contact Rudy at rudyhane@gmail.com

A whole airplane for parts. Sale subject to court decision in US. 1972 Grumman AA5, 2955 TT, 940 SMHO with Millenium cylinders, overhauled 200 hrs ago when high compression pistons were installed. Sensenich prop with 60 hrs TT. Newer radios and instruments. Landing gear with new brakes installed. Parts will not be available till April. And if you need information on how NOT to import an aircraft, I can help you! Contact Rudy at " rudyhane@gmail.com

Propellers, wood, new, never mounted, tractor cwise (view from cockpit), priced OBO plus shipping: One 42x23, weight 2 lb., Lepper, conventional outline, 4 bolts on 70 mm b.c., $195. One 43x34, 4 lb., squared tips, 6 bolts on 75 mm b.c., $295 Call Frank, 905 634 9538

FREE ENGINE Titan T51 Mustang,partially built,includes 160 hp belt drive suzuki engine. Buyer responsible for pick and delivery costs. For more info on kit go to titan aircraft.com Price $54,900 can.email piper22@telusplanet.net or ph.1 780 623 3151
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350 ‘ 1x19 316 Stainless Steel Aircraft Cable $175.00, 3 Sheets of Aircraft Grade Plywood. Sheet 4130 Steel 10”x10”x.060”,12”x18”x.090”, Smaller sheets of very soft aluminum in different thicknesses and sizes. Just ask, maybe I can help.
1 Set of Zenith 601 HD Wings complete with Attachment plates. They have 450 Hrs. of flying time on them with no Damage. They have built-in wing lockers. They come with custom supports on casters for safe storage. Asking $1500.00 obo. 1 complete set of new Zenith 601 Drawings with VHF tape. $200.00 obo. For a detailed list of sizes and prices Please contact Erwin @ 905 457 3716 or erwinhornemann@bell.net

Wanted

WANTED Abandoned aircraft or project. Have your aircraft fly everyday over the heads of enthusiastic onlookers forever. Looking for an aircraft to suspend from the ceiling of new Angus Ontario high school technical shop. Ceiling is 30ft. Prefer a wooden fabric covered airframe striped of engine and interior. Call or email for info Kevin Elwood 705 428 0063 kelwood@clearviewnursery.com

Wanted – ground adjustable prop with Rotax 2 stroke pattern, 6 bolts on 75 mm circle. I need a 2 blade that is LH, as used on a Rotax 2 stroke tractor installation. No IVO’s please. 519-623-1418

Wanted: Zenith CH701 wings and landing gear. Partially completed kit would be considered. Call Fred at 519 924-2594 or karatclub@bmts.com

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: classified@raa.ca and place “RAA ad” in the subject line.

New In Canadian Skies

Jim Tyler's RV-6

Jim Tyler's RV-6 first flew in May of 2009. The first flight was from the Tyler farm strip near Stratford, Ontario. The aircraft is powered by an Aerosport Power 0-360 with a Hartzell constant speed propeller. Performance and flying qualities match Van's Aircraft claims.

In 2010 paint was applied by Purple Hill Air Limited, an amateur-built aircraft friendly maintenance facility located near Thorndale, Ontario.
C-FNMT joins Jim's Kitfox Model 2 in the farm's hanger. The Kitfox's first flight was from the same strip in 1993.

Send us Photos of your completed projects

Share your accomplishment with others - you've earned it!
Please include a brief description of your aircraft and any other details you want to include, and send us a colour print with it.
Mail to: Recreational Aircraft Association of Canada, Waterloo Airport, Breslau ON N0B 1M0
...or email us the information and a high resolution digital picture (jpeg format, 300dpi please) to: raa@raa.ca

Colin Walker's beautiful Super Emeraude.
George Gregory Photo.

Cleaning Steel and Aluminum

Cleaning steel and aluminum before treatment with a surface coatings is normally done chemically with phosphoric acid, sold commercially as Metalprep or Alumaprep at $40-80 per 4 litre container. One container will treat 400 sq. ft. and the average 30 ft span aluminum plane has an outside surface area of 500 square feet, plus the same number of square feet inside, if it too is to be cleaned and finished.

Metalprep and Alumaprep have historically been available at the shops that supply the autobody trade but recently it has become difficult for the man on the street to buy these products. However RAA member Clare Snyder has done some research and has found that the the same product is available at water softener stores. It is sold as Res Care, and at less than half the price of Metalprep and Alumaprep.

Resin Care sells for $18 per 4 litre container. For those who are building wood and composite aircraft the savings are even greater. These aircraft have only a handful of aluminum parts plus the usual steel parts used for the control sysem. One litre of Metalprep sells for $25, while the same amount of Resin Care costs $8.00.

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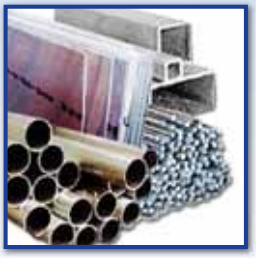
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