



Composite Basics part 2 of 3

Winnipeg Area Chapter of RAA Canada

April 2010

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CALENDAR OF EVENTS

April 22, 2010

Tour of Custom Helicopter

Note: this is one week later than our regular meeting

May 8, 2010

Project tour to Brandon

May 20, 2010

Tire Kick – Lyncrest Airport

Model Airplane Building Seminar



Congratulations to Gilbert Bourrier, Larry Brown, all the volunteers and the sixty parents and children who showed up for the first model airplane building seminar. Larry started the presentation by giving the participants a basic lesson in aerodynamics then it was to the construction tables for a day spent working with the kids and their models. At the end of the day, some of the children had built rockets which were shot off and some rose to a height of several hundred feet. Thanks to Jim Gould for preparing lunch for the group. The group came back the next Sunday to finish their projects.

Tour Custom Helicopter – 7:30 22 April

Please join us Thursday April 22 at 7:30 for a tour of Custom Helicopter. Custom Helicopter was founded in 1977, and offers a versatile fleet of twenty helicopters which include Bell 206B JetRangers, Bell 206 LongRangers, Bell 205 A1s and Hughes 300C units. Custom helicopter is involved in pilot training, helicopter maintenance, mining exploration, wildlife research, corporate transportation, forest fire suppression and more. Custom Helicopter is located 401 Helicopter Drive St. Andrews Airport.

Visit to Brandon

Harry Hill has been working with our friends in the RAA Brandon Chapter, to arrange a visit to Saturday 8th of May (rain date 15 May). For those driving, the plan is to meet in the **Canadian Tire parking lot, Unicity Shopping Mall at 8am**, and coordinate car pooling. We will arrive at the Commonwealth Air Training Plan museum at the Brandon airport at about 1015 to 1030. For those planning on flying to Brandon, they could plan for a similar arrival time. We would tour the museum, before going for lunch as a group. At lunch we would organize, in groups for visits to two Brandon area projects and one in Souris. We will be seeing a Sportsman 2+2 (formerly Glasstar), the Cozy mk II in Brandon, and the Pietenpol (located in Souris). If you are interested in joining the group, can you please let Harry Hill know at 888-3518 by 23 April as Brandon RAA has asked for an approximate number who will be coming.

Young Eagles Flight

The Winnipeg Chapter of the EAA is planning a Young Eagles flight for Saturday 12 June 2010. If you know of a young person between the ages of 8 to 17 who would be interested in a free flight then contact either Jack Neima at 261-7876 or Joyce Stoyka at 444-3838 to register them.

Proposed 19 June Air Fair at Stevenson Tech College

In the early planning stages is the return of the Manitoba Air Fair on Saturday, 19 Jun 2010 at Stevenson Aviation on Saskatchewan Avenue just east of Moray Street. (This is on the west side of Winnipeg International Airport and just north of the Nav Canada Area Control Centre). The intent is for the various Manitoba recreational aviation organizations, flying schools, CASARA and others to join together to promote aviation in Manitoba and their activities in to the public. Stevenson Aviation, which is the aviation and aerospace training arm of Red River College, has agreed to host the event at their facility which should help attract a good cross-section of the public. The RAAC Winnipeg Area Chapter will certainly want to support this event and we will be looking for volunteers to man our display there. We would also like to put a variety of amateur-built aircraft on display and perhaps even a project aircraft if someone has something suitable to display. The intent would be to "fly-in" to Stevenson on the Friday afternoon and depart on the Sunday. The Chapter will cover landing fees and assist with other arrival arrangements at

Winnipeg International for those who would want to fly in as part of our display. Watch for future advertising on this promising event."

Beginning Composites Part II

One thing that bugs me when I try to learn something new is that there are usually lots of technical details available but rarely do the authors come out and say, "Look this fact is really important but this other fact isn't". In the real world application of the new technology you still have to learn the trivial from the important by expensive trial and error. So, in this and next month's article I will try and save you from making the same mistakes I did on the big items and help you from fussing over the things that look bad but aren't really important. So let's start with the most important part of the process – You!

Important: How Not to Maim or Disable Your Body

When working with composite resins be aware that the hardener chemicals are usually significantly more toxic than the resins themselves. For resins that use MEKP know that this is a really nasty liquid. The MSDS (Material Safety Data Sheet) identifies it as "Highly Erosive to Corneas". This means that it will blind you if you get it in your eyes unless you get it rinsed out right now. MEKP will also spontaneously combust above 60 degrees Celsius and will produce its own oxygen, so you can't smother the flames. If that isn't bad enough it can cause the chemical in some fire extinguishers to ignite as well. (Did I happen to mention that I much prefer working with epoxy?). Even with epoxy resins, the hardener is more toxic than the resin but not nearly as nasty as MEKP.

Some epoxies are "sensitizers". This means that after repeated contact many people develop allergies to them. This includes skin irritation, red eyes, and headaches.

The solution with any of the chemicals is to avoid direct contact with any of them. Wear goggles when mixing anything with MEKP and wear gloves when handling any chemicals. I always use Nitrile gloves (Buy a box of 100 – they get used up fast!) In Winnipeg, I buy gloves at Diamond Athletic on McGillivray. Princess Auto also sells them but they only carry one size.



Almost more important than gloves is barrier cream. This is a cream you apply to your skin which makes it impervious to any oil based chemical. The best I have found is a product called PR88. This is great stuff. Just put it on before you start and rinse it off when done. This will protect your hands when the gloves rip – which will happen.

With barrier cream, gloves and goggles your skin and eyes are protected. What about your lungs? Once the resin has hardened, you will probably be sanding down the high spots and, where appearance is

important; there will be a lot of sanding and filling. Wear a dust mask at a minimum when sanding. As further protection I like to hook my shop vac to the sander to keep as much dust out of the air as possible. Remember, those are glass (or carbon fiber) shards floating around in the air and your lungs won't thank you for breathing them in. Kevlar is much more benign than glass or carbon fiber but why take the chance? – keep the dust out of your lungs.

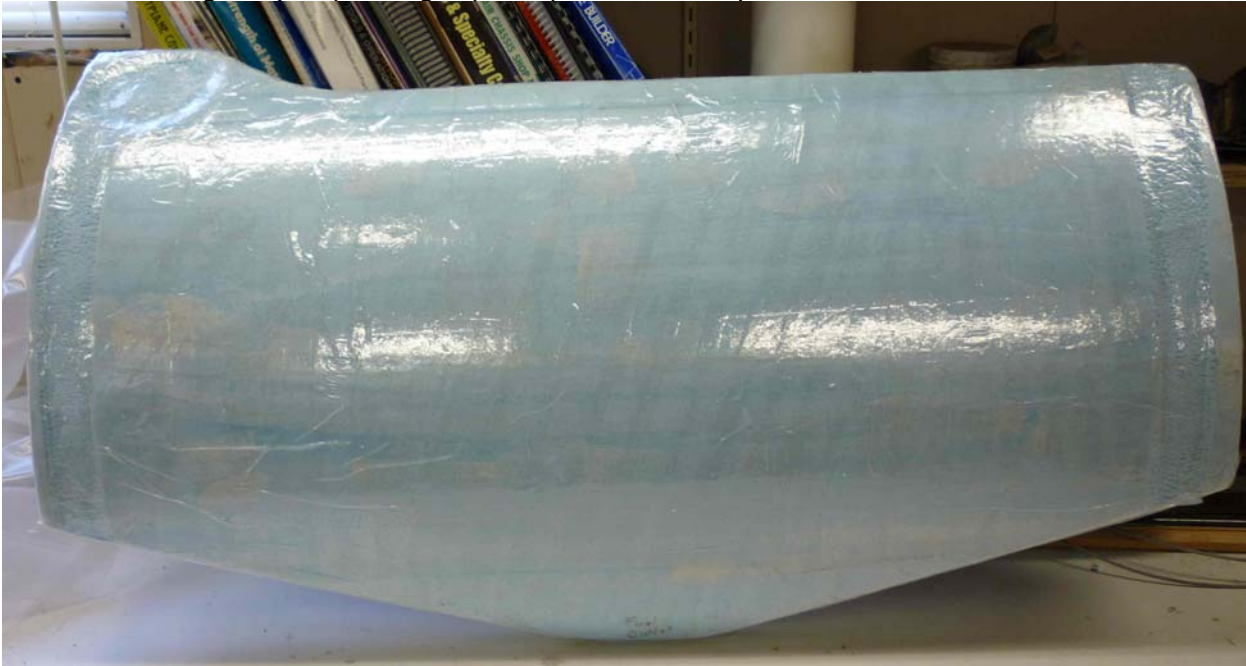
When the ester type resins are hardening they produce strong odours so keep the ventilation going. Epoxy resins, aren't as nasty but you still want some ventilation.

Lastly, when you are mixing thickeners, be aware that many of these contain silica. Not good for your lungs. Mix them downwind and away from your face. Better yet, wear a dust mask.

Molds – What is Important

I am assuming that you are using the positive mold process. This is where the cloth is laid up on top of wood, Styrofoam or other core material. The picture below shows an example of a fuel tank mold made from Styrofoam. OK, so what is important here? First, you may notice that this is far too shiny to be just Styrofoam. Right, because this mold is for a fuel tank which might some day contain gasoline with ethanol. For chemical compatibility with ethanol I am using Vinyl Ester Resin instead of epoxy (Ethanol is one of the few chemicals which weakens epoxy). Unfortunately, vinyl ester eats Styrofoam (and quickly I might add). To prevent my mold from disappearing

when the resin has been added the whole mold has been coated with two orthogonal layers (that means at 90 degrees) of packing tape to protect the Styrofoam.



They say good judgement comes from experience and experience comes from bad judgement. Here is how I learned about Styrofoam and ester resins: Some years ago I attempted to make a console to go between the seats of my van. After several days making a complex form out of Styrofoam including pockets, little doors, and other useful and complicated doodads, I blissfully applied glass cloth and polystyrene resin only to watch the whole thing fold into a little amorphous puddle on my workbench. I resolved not to make that mistake again.

Lesson 1 – Make sure that the mold material is compatible with the resin. Test on some scrap first.

The second thing you may see on this form is that all the corners and edges are rounded. It is a frustrating and pointless exercise to attempt to lay up a sharp corner or edge. The cloth will pull up and away and leave an air pocket underneath. With crowfoot weave cloths a somewhat sharper corner is possible and by vacuum bagging you can get closer to a sharp corner or edge. However, you cannot lay up a truly sharp corner. To keep your work structurally sound and your blood pressure lower round all corners and avoid points. If you absolutely, positively need to end up with a square corner or point, it is better to lay up extra cloth on the corner and then grind down to an edge after everything is hard.

To know if your corners are rounded enough lay up some cloth on the mold without resin. If it drapes over the mold easily, it will work when the resin is added. As a matter of fact, the cloth will follow contours somewhat better when wet. (Sort of like a T-shirt...)

So, Lesson 2 – Round off edges and corners. Test the cloth before adding resin.

If you look near the left and right edges of the mold in the picture there are wide, shallow depressions. This is where the cloth on the ends will overlap the front cloth. Without this, there will be a high spot where the cloth overlaps. This is especially important for this mold since it will be covered with Kevlar which cannot be sanded down cleanly.

Lesson 3 – Plan how you will lay the cloth when you make the mold and allow for the extra thickness.

Finally, if you look closely at the picture, there are areas that are white rather than blue. These are areas that were gouged or sanded too aggressively when the mold was worked. To build up the area, filler was added. This can be as simple as drywall mud for an application where the mold will be removed when the lay-up is complete. However, drywall mud is too heavy to leave in an

airplane – If the mold is going to form part of the finished structure do any filling with LePage Poly Instafill. This doesn't sand as nicely as drywall mud but it is very light. Keep in mind that this will not provide any structural strength, it just shapes the mold.

Resins – Things to Know

There are many different types of resins, all with slightly different characteristics. The good news is that you don't need to know everything about all of them. Here are some basic things to consider when working with resins. Most of this information can be found with an internet search although sometimes the information can be a little hard to decipher.

Toxicity. Less is usually better – You don't want to have to wear a full hazmat suit every time you open the can

Viscosity. Thinner is usually better – Resins have different "gooiness". Thicker resins are harder to work in to the fabric and tend to create heavier structures. Heavier resins are fine for motor boats and swimming pools but an aircraft needs to be light.

Setup Qualities – My experience with West System epoxy is that it tends to stay a non tacky liquid until it nears its setup time. Vinyl ester resin tends to get gradually gooier and gooier. This means that things start sticking together early (like the fingers on your gloves) and makes working generally more awkward.

Chemical Compatibility. Read and understand the manufacturers instructions – Epoxies will usually stick to ester resins but not the other way around. If you are gluing things together, epoxies are the best choice. Read the manufacturer's literature and follow it. With a good epoxy resin you can bond a lot of things together including any composite fabric, aluminum, other cured composite parts, some plastics, and many more. As an example, I once glued an aluminum fitting to a wooden boat. Two years later I decided to replace the fitting and was surprised that the wood came apart (in big chunks) before the aluminum could be separated from the boat. So, the resins work, if you follow the instructions. If you are building tanks for storing liquids, like a fuel tank, be very careful to read and understand the compatibility charts.

Ultraviolet Light – Watch out! Don't leave unpainted composite parts in the sun. Epoxies are particularly susceptible to weakening by ultraviolet light. (Kevlar Fabric is also weakened by sunlight.)

In General – Follow the manufacturer's instructions. You can make a very expensive mess by using the wrong ratios, not preparing the surface properly, and other mistakes. The manufacturer's literature typically contains half a dozen advice statements that basically boil down to: "Don't do this because it won't work". That advice is there because someone tried it and it didn't work. Don't relearn the mistake with your own dollars.

What Resin Should You Use? There are a lot of good products out there. Epoxy is generally preferred over ester type resin for most usage. The downside being that it is generally more expensive, more sensitive to UV light and it is weakened by ethanol. Of the epoxies T-88 epoxy is more popular in aircraft use and a lot of people use it and are happy with the results.

My preference is West System Epoxy. It dispenses with hand pumps so you have a lot less mess than using measuring cups. The manufacturer also has a complete line of additives for bonding, adding abrasion resistance, filling and finishing, and more.

The picture below shows the West System one gallon kit with pumps. Getting the right ratio of epoxy and hardener doesn't get any easier – one pump on the resin can and one pump of

hardener gets you a perfectly proportioned mixture.

Next month we will go through a lay-up process where fabric and resin are combined. This is the point where a lot of people get frustrated with composites when they aren't prepared for the process. Fortunately with preparation and a little knowledge it is incredibly satisfying to watch soft cloth and liquid come together to form hard, strong, complex, and yes, beautiful, pieces.



Steven Sadler
Part 3 next month

2010 Membership Form

Winnipeg Area Chapter RAA

Trial (\$25)

Student(\$25)

Full (\$50)

Required Information

Name		OFFICE USE ONLY
Mailing Address		Renewal Date
Phone(s)		Chq. Cash Other
E-mail		Initials
Are you an RAA national member? ⁽¹⁾	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Do you give permission for your information to be made available to other Winnipeg RAA members?	<input type="checkbox"/> Yes	<input type="checkbox"/> No

Optional Information

Do you own an aircraft?	<input type="checkbox"/> Yes <input type="checkbox"/> No Make/model: Registration:	Are you a member of other aviation groups?	EAA: <input type="checkbox"/> COPA: <input type="checkbox"/> Others:
Are you building or restoring an aircraft?	<input type="checkbox"/> Yes <input type="checkbox"/> No Make and model of project(s):	What Pilots licences and ratings do you hold?	

Please make cheques payable to: RAA - Winnipeg Chapter
Mailing Address: RAA c/o Steven Sadler PO Box 703 LaSalle Mb. R0G 1B0

Notes:

- 1) RAA Winnipeg contributes \$15 per member towards the insurance program maintained by RAA national. This program provides liability insurance to cover local chapter events. The \$15 does not provide membership in RAAC.