



Composite Basics part 3 of 3

Winnipeg Area Chapter of RAA Canada

May 2010

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CALENDAR OF EVENTS

May 20, 2010

Tire Kick – Lyncrest Airport

June, July and August

no meetings, events or newsletters planned but suggest checking the www.lyncrest.org website for activities happening at the airfield.

RAA Meeting Thursday May 20, 7:30 pm,

Please join us Thursday May 20, 7:30 pm at the Lyncrest Flight Centre building. Many hangars at the airport will be open for us to tour a variety of aircraft. Coffee and doughnuts will be served, and lots of talk about what's happening this summer. All guests welcome.

Lyncrest Airport Clean-up, Saturday 15 May

The Springfield Flying is conducting their annual spring clean-up this Saturday. The grass around our building also needs to be cut. If you can spare a couple of hours of your time, your help would be greatly appreciated. They will be meeting about 10 am.

Red River Centennial Air Fair at Stevenson Tech College 19 June

The Red River Centennial Air Fair is planned for 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 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 are 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. Landing fees and the requirement to have a transponder have been waived by Nav Can for this event. The Chapter will assist with other arrival arrangements at Winnipeg International for those who would want to fly in as part of our display. Watch for advertising on this "promising event." The link for information and the registration form for individuals wishing to fly into the Air Fair will be sent to you separately.

Brandon Visit - May 8 -2010

On May 8, about 12 chapter members drove or flew out to Brandon to visit with the Chapter there and to visit the British Commonwealth Air Training Plan (BCATP) museum on the airport. We have made this kind of visit before, the last one perhaps too long ago. And our Brandon friends have visited us.

I was involved in setting up the visit from our end. My first contact and main contact throughout was Ken Fox. He did the leg work on setting up the visit in their chapter area. I also was in touch with John Robinson, their Chapter President, when Ken was away on a trip. In my estimation, all our friends in Brandon did a great job for us.

The basic plan was to drive or fly out to the Brandon airport to arrive around 1015 to 1030, to meet our hosts at the BCATP museum and to tour the museum. By my count, seven drove out, in three vehicles, and three flew out. Driving were Tom Stoyka, John Blackner, John Klassen, Grant Pronishen, Don Hutchison and me. Flyers were Jim Oke and Bob Stewart in Jim's RV-6A and Ben Toenders in his Champ and Peter Moody in his Fleet Canuck

I met another Brandon contact from earlier days in John McNarry, who I believe had been their leader for some time and who was our tour guide at the museum. He is one of those multi-talented people whom I can only envy. He teaches heavy equipment mechanics at the Brandon community college. He was building a Pietyenpol to be powered by a Model B engine that he had rebuilt. But he got involved with the museum and that has taken all of his free time.

The museum is the only one dedicated solely to telling the story of the BCATP, the British Commonwealth Air Training Plan wherein many, many thousands of aircrew from the Commonwealth and from other countries were trained. Hundreds of aerodromes were built across the country in very short order. And several hundred hangars were built at these stations. As I

recall, and to some extent experienced, the typical training station would have about six hangars, most if not all "doubles". They had two bays, each about 120 feet across. The hangar doors opened wide enough to accept aircraft with greater than 100 feet spans, such as Canso and Lancaster. However, the training stations were unlikely to see such aircraft and they would have, depending on their training roles, Tiger Moths, Cornells, Harvards, Yales, Fleet Fords, Cessna Cranes, Ansons, Bolingbrokes and more, probably. The Brandon BCATP museum is housed in one of, if not the last, wartime hangar in essentially original configuration. A large part of John McNarry's time is spent in keeping the hangar safe and viable.



Tiger Moth



Mk 1 Avro Anson under restoration



Hurricane



Cornell

The museum holds examples of many of the aircraft named. Some are airworthy and others will be made so. But others will be for display only. The restoration tasks are enormous. There are also many vehicles representative of those used during the war, such as refuelling tenders and shop mules (aircraft tractors). There are photographs and copies of newspaper articles from the time as well as lots of other artefacts, ranging from aircraft radios and other equipment to servicemen's personal kit. In all, a great place to visit and John gave us an excellent tour and insider's view.

Following the museum tour we, visitors and host chapter members, went to lunch for food and more aviation conversation. There were 22 at the lunch table.

Being fed and ready, we then carried on with the project tour. Ken Fox provided maps and a briefing on the routes. I will just list the projects here and let others offer their observations.

Brian McKiernan's Cozy, a three seater development of the Long-EZ, all composite. It is "nearing completion" with the engines hung.



Cozy



Lycoming O-320 engine in the Cozy

Francois Carrard's Sportsman 2+2, once the Glastar I believe. An interesting combination of structure methods; a steel tube cage around the cabin which also has hard points for wing attachment and main landing gear leg mounting, while the fuselage skin is a light fibreglass moulding. The wing is a fairly typical all-metal build-up but has extruded spars which eliminate all the fitting and riveting associated with most such wings for amateur-buils.



Sportsman 2+2 composite fuselage



Wing Construction

Dave Walker's Mini-Max Eros. This is a small single-seater of wood construction to be powered by one of the smaller, two-stroke, Rotax engines. When I walked in the shop my first thought was "that looks like a neat little airplane for just going flying".



Mini-Max Eros fuselage and tail



Forward section

Following the project visits, we headed for home at 6:15pm. Six of those going by road met for supper in Neepawa, since we departed from Dave Walker's place in Erickson. More conversation and exchange of ideas moving towards the end of a great day. Our thanks to Ken Fox and the other fine people in the Brandon Chapter for an excellent day.

Harry Hill

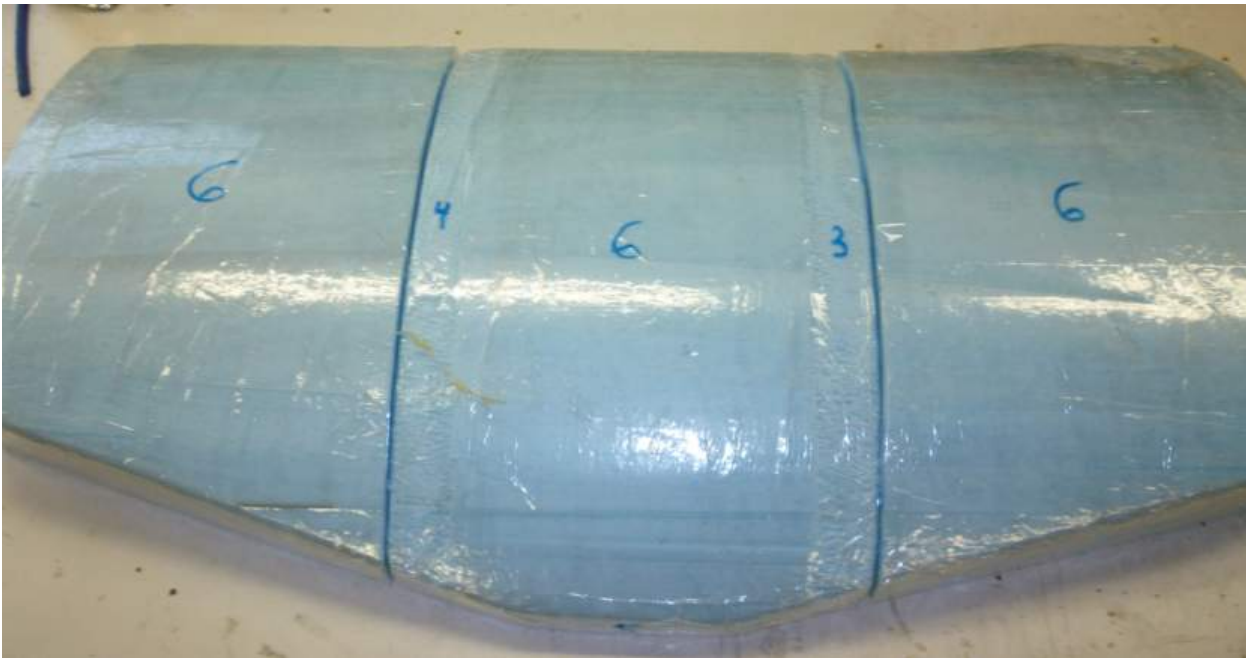
Composites Basics - Part 3 by Steven Sadler

This month we are going to look at how to lay-up fabric on a mold to get a strong, lightweight finish.

Cutting the Fabric

Let's assume that you have your mold ready and your resin picked out. The next step is to cut out the fabric. Ordinary scissors work for fibreglass and carbon fiber, but not for Kevlar. Kevlar requires high quality scissors. Even with good scissors you may need to sharpen the scissors frequently to keep the edge sharp. Aircraft Spruce sells "Kevlar Scissors" although there is nothing particularly special about them. They are just a pair of rigid, high quality scissors. I have found that you can get a good cut from a good pair of scissors from the fabric store.

Before you start cutting, take a close look at your mold and figure out where each piece of cloth will go. I like to number where each piece will go directly on the mold as shown in the picture below.



Cut and number the fabric to match the mold numbers. Each piece needs to be cut oversize by at least an inch on all sides to allow the pieces to overlap. Normally at least 3 layers of cloth are used. Where there is a high stress point such as where an attach bolt is used, more layers are required. The only exception to the 3 layer rule is for reinforcing wood pieces where as little as one layer can be used if it is a lightly stressed piece. The picture below shows a complete set of cloth pieces to make a fuel tank. As you can see, each piece is numbered to match the numbering on the mold.



Final Preparation

Now is the time to step back, look at everything again and make sure everything is ready. Once the resin is mixed the clock starts ticking and the resin will setup whether you are ready or not. So make sure that you have everything ready. My checklist includes:

1. Hands and forearms coated in barrier cream.
2. Box of nitrile gloves.
3. Plenty of mixing containers and stir sticks (I use tongue depressors for mixing). Make sure that the containers are compatible with the resins. Ester resins and MEKP will eat through a lot of plastics but are usually OK in wax paper cups. Epoxies don't get along well with wax so it should be mixed in plastic or metal containers. (I use plastic beer cups).
4. Resin and hardener. If you are using West Systems epoxy make sure that the hand pumps aren't jammed. For other resins make sure that you have measuring cups and eye droppers for the resin and hardener.
5. Goggles, and a bucket of water (for your eyes) especially where MEKP is used as a hardener.
6. Wearing clothes that you will never wear in public again (Once you get resin on your clothes, and you will, it doesn't come out)
7. Work area at the right temperature – Too hot and the resin will setup fast.
8. Small, extra pieces of cloth at hand. Somehow, there always seems to be a corner that needs that one extra piece to finish. Having some pieces ready is just a good idea.

When everything is ready, mix the first batch of resin. Keep in mind that it is far better to mix a small quantity of resin with a low level of hardener than to have the resin harden prematurely. With some experience, you will get a good idea of how fast the resin hardens.

It is really important to keep an eye on the room temperature. The reaction will take place much, much faster on a hot afternoon than on a cool morning.

There are several ways to keep the resin from hardening too quickly:

1. As mentioned previously, mix small batches. The more you mix, the faster it hardens.
2. Use minimal hardener. Always follow the instructions regarding hardener quantities. Most resins have a minimum ratio of hardener. Use too little and the resin may never fully harden. Others resins only allow one ratio, so reducing hardener ratio isn't an option.
3. Spread out the resin immediately after mixing. Resin in the mixing container hardens much faster than resin spread out over a large area.
4. Keep the room cool.

Regardless of the resin used, it is important to thoroughly mix the hardener and resin. Mix clockwise, then reverse direction, making sure to scrape the container sides with the stir stick. Also make sure that the stirring stick scrapes over all areas of the bottom of the container. Take at least 30 seconds mixing. A full minute is better.

The Lay-up

Start by pouring out the mixed resin over the surface of the mold where the first pieces of cloth will go. I like to lay-up the larger pieces of cloth first. Use the stirring stick to spread the resin into a uniform layer on the surface of the mold. You want a generous coat of resin for the first layer. When the mold has a uniform layer of resin, apply the first piece of cloth. Hold the cloth with two hands and drape it over the mold, laying as close the final position as possible. Dragging the cloth over the resin should be avoided.

Once the cloth is laid down, make any final position adjustments. If necessary, pick up the whole piece of cloth and re-lay it to get it into position. For small adjustments, the cloth can be pushed or pulled into position. Be careful about applying too much mechanical action right at the edges as the cloth will start to unravel.

Once the cloth is in position start working the resin into the cloth. This can be done with a metal grooved roller, the stir stick, or your fingers (inside gloves of course). I find I get the best results just using my fingers. Tap and rub the cloth surface until it is uniformly wetted. Mix up more resin and add to the surface as required. Continue adding resin and cloth until all layers are added. As layers 2, 3 or more are added try to wet the cloth by tapping and rubbing more and adding less resin. For the last layer try to finish the wet out without adding any additional resin. Patience is the watchword here. Adding lots of resin will make the wetout go faster but the part will be heavier and weaker. Keep pushing the last layer of cloth into the resin until everything is uniformly wet but not glossy.

Mistakes Big and Small

As with any technology, knowing the difference between the trivial goofies and disaster is key. Here is my top 5 list of mistakes in order of importance.

1. **Resin that won't harden.** This is caused by insufficient mixing, improper amount of hardener, or (for shame) forgetting to add the hardener. This is the cardinal sin of composites. When this happens the piece is scrap. And no, you can't fix it by adding hardener over top of the resin.
2. **Resin that sets up before the lay-up is complete.** This will cause bulges in the cloth, weak spots and just plain ugliness. The cure is to cut out the affected area, sand down a tapered area and do another lay-up in the affected area. The issue can be prevented by one of the methods mentioned previously. Generally, once the resin container gets hot in your hand you have either run out of time with that mix of resin, or you are just about out

of time. Better to throw out the resin in the cup and mix a new batch. Be careful! Resin can get hot enough to start a fire so don't dump into a garbage can with flammable stuff in it.

3. **Bubbles.** Areas where the cloth has not laminated together or has been pulled apart by working will develop air bubbles. These are significant weak spots and must be sanded or cut out and laid up again. This condition is almost always fixable but will require extra work. The best prevention is a careful examination of the whole work piece once you think you are finished. I like to look at everything as soon as I am finished the lay-up, then take off my gloves, go get a drink of water, put a new pair of gloves on and examine the piece again. It is surprising the number of defects that can be seen by taking a short break and then looking again.
4. **Excessive Resin.** Too much resin makes for a heavy and weak part. Fuel tanks need to be completely liquid tight and require a rich resin mixture. Just about everything else needs enough resin to saturate the cloth and no more. If the surface is glossy there is too much resin.
5. **Hairs and Strings.** As the cloth is worked fibres will unravel from the edge of the cloth and either stick out from the fabric or get wrapped around gloves, spreaders and any other tool you are using. Strings sticking out of your piece are pretty much a non-issue. Once the lay-up has fully hardened it takes a grand total of about 2 seconds to sand them off. So do not spend a lot of effort dealing with strings at lay-up time. The strings that accumulate on gloves and tools are annoying and get in the way. There are two ways to deal with them. One: Keep a short 2 x 4 standing on edge in your work area. As the strings get on your gloves, just lay the string across the end of the 2 x 4. The string will come off your glove and stick to the wood. The second way of dealing with strings is just to change your gloves. The strings will go in the garbage with the old gloves.

Cleanup

The chemical most often used for resin cleanup is acetone. It works well but is toxic, absorbed through skin and flammable. For most epoxies, vinegar works just as well and is a lot safer to be around. Use the vinegar on your hands as if it were liquid soap, rubbing it on and rinsing off. Gloves, mixing container and stir sticks go in the garbage so don't bother trying to clean them. That ends this instalment. Part 4 will explain how to clean up goofies and finish composite parts.

Steve Sadler

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. Other	Cash
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
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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.