RECREATIONAL AIRCRAFT ASSOCIATION
RÉSEAU AÉRONEFS AMATEUR CANADA

Composite Basics part 1 of 3

Winnipeg Area Chapter of RAA Canada *February 2010*

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CALENDAR OF EVENTS

March 18, 2010	Digital Multi-Meter Demonstration
April 15, 2010	Tour of Custom Helicopter – St. Andrews Airport
May 8, 2010	Proposed trip to Brandon
May 20, 2010	Tire Kick – Lyncrest Airport

Thanks to Rick Riewe and Jill Oakes for the presentation they gave on Thursday February 18 on the building of their Land Africa project. They have the Land Africa in the RAA Hangar now and are working on the fuselage and instrument panel. They talked about the challenges of building an aircraft that comes from Portugal, the fun of translating plans written in broken English, unplanned modifications they had to make, lessons learned to date, what they would do or not do next time, installing and plumbing a Rotax engine.

Digital Multi-Meter Demonstration

Join us Thursday March 18 at the Lyncrest Flight Centre for a Digital Multi-Meter demonstration given by Tom Stoyka. The evening will start at 7:30. Tom will demonstrate how to properly use a Digital Multi-Meter (DMM) in everyday electrical work (or homebuilt aircraft building, for that matter) without blowing it to smithereens? If so, or even if you might enjoy a refresher on this subject, join us for an informative, but informal evening. We'll discuss the basics of Ohm's Law with "hands-on" analysis of a number of common electrical components and circuits you are likely to encounter. If you already own a DMM and would like to learn its functions better, bring it along. We will have 16 new DMMs available for attendees to use at this session. At the end of the presentation, you will have the option to purchase the DMM for a nominal amount, probably around $5.00 (the 9-volt battery that comes with the DMMs are almost worth that). Even at this low price, all profits from the sales will be donated to the Springfield Flying Club for ongoing operational expenses of the Lyncrest Flight Center.

Planned visit to Brandon

Harry Hill has been working with our friends in RAA Brandon Chapter, to arrange a visit to Saturday 9th of May. The general plan will be, for those driving to leave the west of the city by about 0800 and arrive at the first meeting point, the Commonwealth Air Training Plan museum at the Brandon airport at about 1015 to 1030. If there are "fliers out" they could plan for a similar arrival time. We would tour the museum, which has a web site at bcatp museum, before going for lunch as a group. At lunch we would organize, in groups as necessary, for visits to two or three Brandon area projects. Our contact in Brandon, Ken Fox, has a line on three potential visits, a Pietenpol, a Cozy and a Sportsman 2+2. We will advise of confirmation and any changes by our usual communication channels.

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."

Composite Basics by Steven Sadler

Composite construction is an interesting and fun way to build strong and lightweight structures in complex shapes. Regardless of the composite material you choose, the principals are the same. You start out with a gooey liquid and soft cloth and end up with a hard, strong structure.

Let's talk about the fabrics first. There are three fabric types in common use. These are glass, carbon fiber, and Kevlar (also called aramid fiber). With glass there are two common types: e-glass and s-glass. S-glass is stronger and more expensive.

You can make some very strong and lightweight parts using **glass cloth**. It is also the easiest material to work with. It cuts and sands readily and in my experience can form around tighter corners than carbon fiber.

Carbon fiber is the miracle fabric that is strong in both compression and tension. If money is no object and impact resistance is not the ultimate goal then carbon is the material to use.

Kevlar has extremely high tensile strength, high impact resistance and is probably the safest material to use. The fibres are soft and flexible and unlike glass, don't create sharp spears once the resin has hardened. It is also the hardest cloth to cut and can't be effectively sanded after finishing, although there are tricks to get a good finish with Kevlar. Kevlar is also pricey, although usually not as much as carbon fiber.

Each of the cloths comes in a variety of weave patterns. Historically, **bidirectional weave** is the most common. In this pattern, the fibres are evenly distributed 90 degrees to each other; As a result this cloth has equal strength in both the X and Y directions. This is a good all around cloth for most purposes.

The cloths are also available in a **Crowfoot weave** pattern. This is similar to bidirectional cloth except the weave pattern is crossed in a different way. This gives the cloth somewhat more flexibility, making it the best choice for beginners. Also the best choice for experienced users who need to form a complex shape or work around tight corners.

When you need to have maximum strength in one direction use a **unidirectional cloth**. In these, the thread count in one direction is considerably greater than the other. These are great where you need them, but be careful. If you make a flagpole out of unidirectional cloth, you probably want to wrap the finished product at 90 degrees to the grain or the whole structure may split lengthwise under load.

Non-Woven chopped strand mats – These are heavy, weak and have no place in an airplane. Ok in a boat where you are laying down mats half an inch thick and rigidity is more important than weight or ultimate strength.

So here are the materials in a nutshell: Glass is cheap, strong and easy to work with. Carbon fiber is expensive, very strong and relatively easy to work with. Kevlar has great impact resistance, is safest to work with and hardest to work with.

Here are a few examples of the various composite materials:

Illustration 1: Unidirectional Carbon Fiber Applied to Strengthen a Fuselage

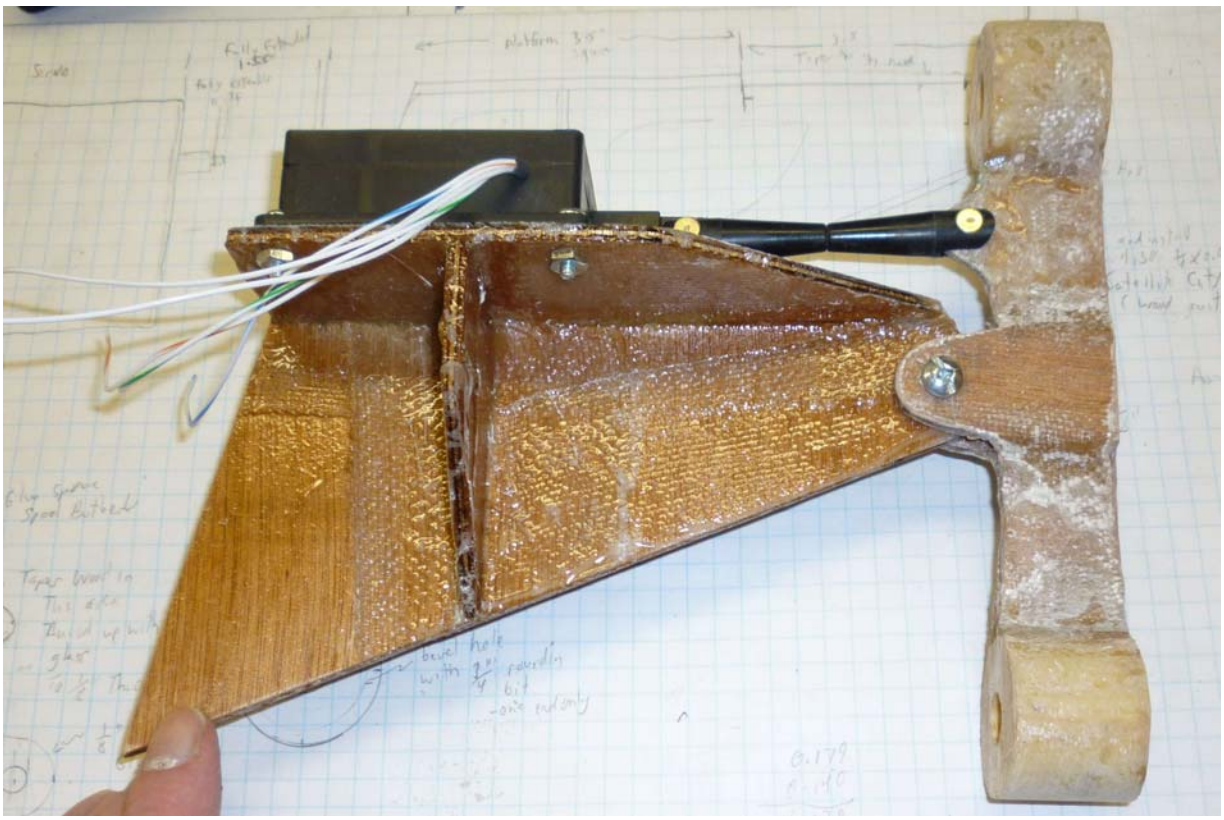

Illustration 2: Glass Cloth Reinforcing over Plywood – Light and Very Strong

Illustration 3. Fuel Tank Vacuum Formed Using Kevlar Cloth

Of course the other part of a composites construction is resin. What is the best type to use? I have found epoxy to be the best all around resin and my favourite is the West Systems product. Let's look at the relative merits and drawbacks of each of three popular resin types:

First and cheapest is polyester resin. The advantage of course is that it is cheap. Hardening time can easily be adjusted by using more or less hardener. When hard it is relatively brittle. It doesn't stick well to itself unless you use an acetone wash to get rid of the wax formed on the surface and it is generally not a good adhesive. It can't be used over epoxy because it won't stick. Most polyester resins are quite temperature sensitive. In other words, the hardener ratio you used first thing in the morning may gel in your mix container before you can pour it out on a warm afternoon. Some of the hardeners are extremely harmful to your eyes if you splash. Probably the biggest drawback to the polyester resins is that they produce a strong and lingering smell.
Vinyl ester resin is often used to make fuel tanks. It is impervious to gasoline and relatively unaffected by ethanol. Other than that it has most of the characteristics of polyester resin although it appears to retain more flexibility when cured.

Epoxy is my preferred resin for everything (except fuel tanks). It makes a great adhesive including sticking to itself and to polyester resin. It dries hard but not brittle and, with the West System epoxy makes very little mess since the resin and hardener are dispensed from push pumps (just like the ones on the liquid soap in your bathroom)

These are the basic materials used for composite construction. Next month I will describe how to use them to make useful pieces.

Steven

For Sale: RV 6 or 6A wooden fuselage jig. Excellent construction and condition. 6 – 6s and 6As have been built using this jig. For more information, contact Bob Stewart at 853-7776.

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)	☐ Yes ☐ No	
Do you give permission for your information to be made available to other Winnipeg RAA members?	☐ Yes ☐ No	

Optional Information

Do you own an aircraft?	☐ Yes ☐ No Make/model: Registration:	**Are you a member of other aviation groups?**	EAA: ☐ COPA: ☐ Others:
Are you building or restoring an aircraft?	☐ Yes ☐ 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.**