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Creating a Carbon Undercarriage

Edited with Permission from Original article by Roy Garner and Published in RC Model World, Issue #62.

Today many model aircraft designs use a bent sheet Duralamin (aircraft aluminum) undercarriage system, being light, cheap, and reasonably strong and easy to construct. These units offer a good alternative to those constructed from piano wire. Having used these units over the years, I have found that they do have limitations, e.g. they can bend very easily or break after a period of time due to flexing and fatigue.

In addition, I can never find a commercial unit suitable for my designs; I always had to construct one and my stocks of aircraft. Aluminum was becoming low. Due to the above reasons, I started to look for an alternative method of building a strong unit easily! Being aware certain full-size aircraft manufacturers use a carbon fiber laminate for undercarriage leg construction and having the materials at hand, I started to experiment to see if a laminated u/c would work in miniature. Having an Acro Wot with what I could only class as "donkey hind legs" for undercarriage, I thought it would make an ideal subject for a replacement unit. The result of my toil was very rewarding; in fact I was delighted. I had produced a unit far stronger, more durable, slimmer and weighing 2 oz lighter than the original metal unit. The only disadvantage I could see was the cost, but the u/c still exists where upon my original 'Wotty' doesn't.

Before I go into the process of producing a laminated u/c, I must explain why I use carbon fiber and not Kevlar. Kevlar is in fact cheaper than carbon fiber. I have used Kevlar, but I find Kevlar is a difficult material to work with. It is a very difficult material to cut before laminating and when laminated, it cannot be trimmed without leaving a woolly edge. The only way I found to remove this edge is to paint the unit and cut back between coats. This process makes work and extra work we don't want!

Carbon fiber, on the other hand, is very easy to trim both before and after laminating. Carbon cuts and polishes up very smooth with sandpaper, and cutting paste the finish requires no painting; in fact in this natural condition, it looks really smart.

Measure the Projected Length. The following calculation applies to the amount of carbon fiber tape you will require to make a standard shape u/c. Before we start to calculate, we must know the size and shape of the u/c to be produced. If you are replacing an existing unit, you use the unit as a pattern. If not, we must have a front view drawing of the proposed unit. Some plans provide this. If not, draw a view using information supplied on the plan and side view. Keep this drawing; you will require it later. If using an existing unit, with a piece of string, lay it around the outer edge (perimeter), mark a line at the bottom of each side, remove and measure the string and add 1 inch. This measurement is the projected length. If using a drawing, pin it down flat on a board, place pins at each bend (See Fig. 1), lay a piece of string around the drawing from A to B + 1 inch. Measure the length of string to give the projected length.

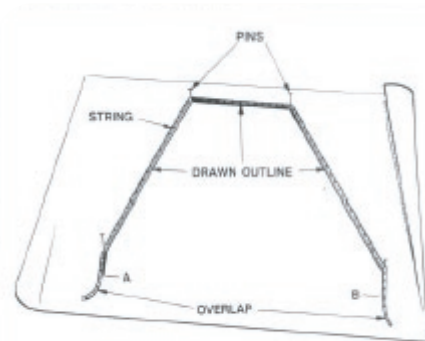


Figure 1

The next factor you require is the gross weight of your model. An approximation will do, but it's better if you are accurate. The calculation is as follows: Projected length x weight of model in lbs. (never go below three lengths, even if you have a 1 lb. Model!) Say our model weighs 6 lbs.; the projected length is 14 in. including overlap. The amount of carbon fiber tape required is: 6 lbs. x 14 inches = 84 inches (6 lengths). You can use half measures, e.g. 6 1/2 lbs. x 14 inches = 91 inches. This calculation I have found will produce a strong u/c. Remember, you can trim down the u/c afterwards resulting in a slimmer, lighter unit. With experience, one can vary the laminations and trimming to customize, but first attempts, I suggest you stick with the recommended sums.

Continue to Step 2...

Step 1

Creating a Carbon Undercarriage, Cont.

Step 2

Making the Mold. This is very easy, for this purpose you can use up your scrap plywood, hardboard or even foam. In this article I will use plywood, if you wish to use other materials, use this technique but adapt your materials to suit. Using the drawing trace down the proposed u/c onto 1/8 inch plywood, or if using a pattern draw carefully around the perimeter. Check that your drawing is symmetrical, any error here will reflect in the finished unit.

Next, draw another line on the inside parallel to the outline 1/8 inch apart if your gross weight of model is below 7 lbs., 3/16 inch apart models 7 lbs. to 10 lbs., and 1/4 inch apart 10 lbs. to 16 lbs. This gap when cut out allows for the thickness of the unit. I find it easier to tack the plywood sheet on top of a second sheet of plywood to cut out. This saves time in cutting, albeit slightly harder work. Carefully cut out the patterns along both lines, and around the outside of the shaded area in Fig. 2.

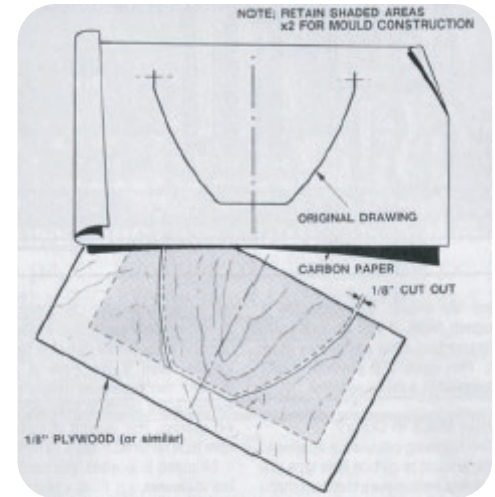


Figure 2

Steps 3 & 4

Before assembly, file away around 1/32 inch at the wheel mounting area on two of the four patterns. These two patterns are now the rearward forms in the mold; the idea is to give tow in on the finished unit, i.e. wheels point slightly inward. This gives better tracking and suspension on the u/c unit. The toe-in angle should be in the region of 1° when viewed from the top of the mold assembly. See Fig. 3 & 4.

Assemble the mold as shown in Fig. 3. The side panels are spaced with scrap wooden blocks. The width of these blocks should be the same as the width of the finished u/c thus giving 1/4 inch oversize when assembled. Glue these assemblies together. I suggest one of these units is then glued to the base, the other screwed on. This allows adjustment for wide or smaller models.

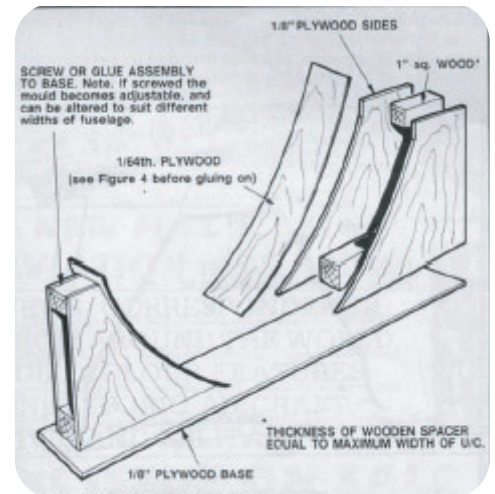


Figure 3

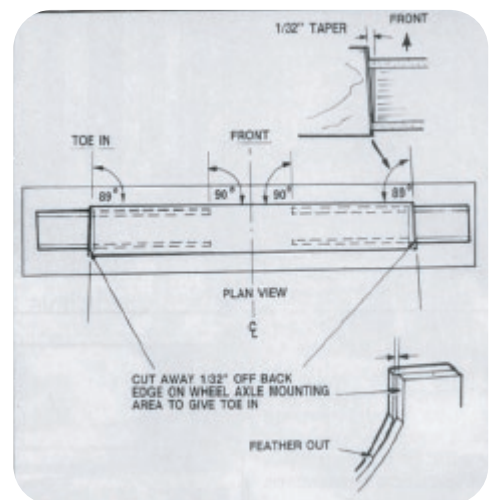


Figure 4

Continue to Step 5...

Creating a Carbon Undercarriage, Cont.

Step 5

Check from above that all is square and that the toe-in points forward. Allow to dry. When dry, line the mold with 1/64 inch plywood. The male mold (Fig. 5) assembled similar to the female mold. Check for fitment into the female mold before allowing the glue to set. On the rear edge glue on 1/32 inch plywood skins (to match toe-in) then skin the mold with 1/64 inch plywood.

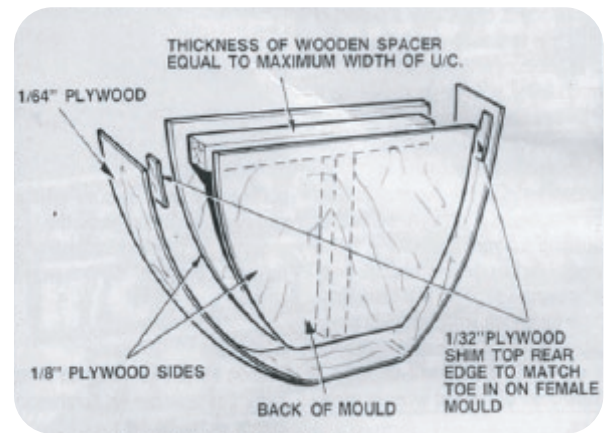


Figure 5

Molding the undercarriage. Preparation. Both the male and female surfaces require protection from the resin. This is done by tacking Non-porous Release film strips onto the molding surface. Cut the Carbon Tape into projected lengths, to make an undercarriage for say a 7 lb. model. Cut two of the seven lengths as follows, one length cut a third off and one length into half.

Before mixing the resin, use a barrier cream on your hands and also protective gloves. Mix the resin exactly as the manufacturer instructs. Using a stiff brush, coat the inside of the female mold and lay in one projected length of Carbon Tape. Using a stipple action, wet out the tape with resin. Apply a second and third laminate of Carbon Tape in the same manner. Next, lay up the two-third length; center it in the mold. Next the one half length, followed by the remaining third. Then one complete length. With the remaining half length, cut it up and use on the high stress areas, the axle mounting and angle bend, leg/mounting surface. Then apply final carbon layer.

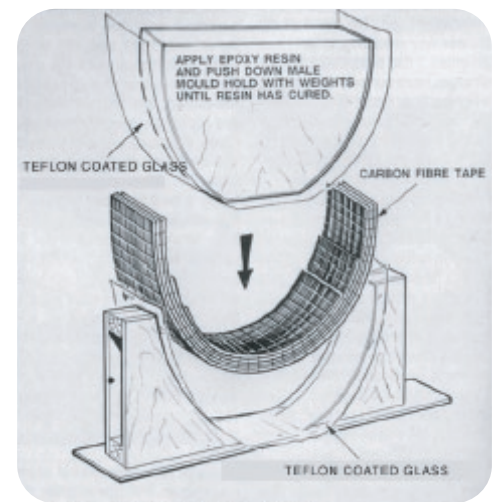


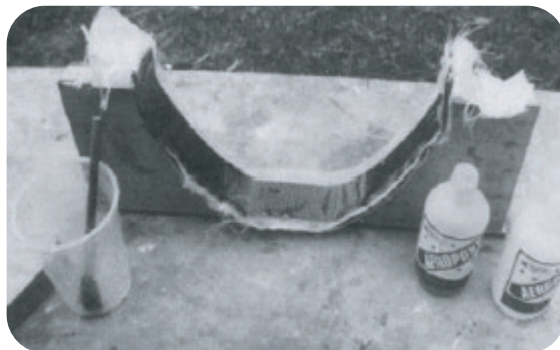
Figure 6

Carefully lower down the male portion of the mold onto the laminate check correct way round (toe in). When seated, place weights on top of the male section and allow to laminate to cure, at least 24 hours. To release the mold requires a shock tap with a mallet. Peel the Non Porous Release Film off and you should have a glossy smooth molding. Mark out the trimmed shape of the u/c on the molding with a scribe. Cut to shape with a hacksaw and smooth edges using sandpaper. As aforementioned, you can trim the unit down far slimmer than the metal equivalent; mind you with wheels on. Take care you don't end up with a unit looking like a spider wearing Doctor Marten boots! You can also use a Dremel tool with a reinforced cutoff wheel to trim the carbon fiber. Be sure to wear a dust mask and do the cutting where the dust created by the cutting can be tolerated.

I wish you success and I hope the end result will be as pleasing as mine was. You can't beat a nice pair of legs! Happy Landings! The Remaining Figures are of the Mold and the Finished product. Take a Look!

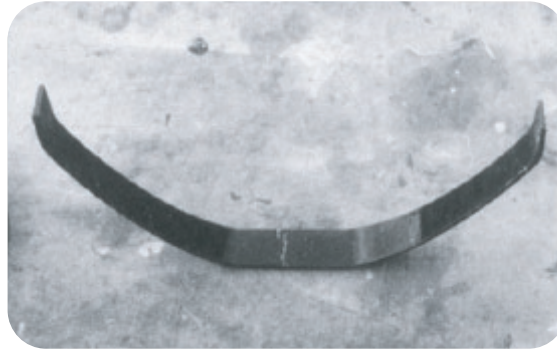
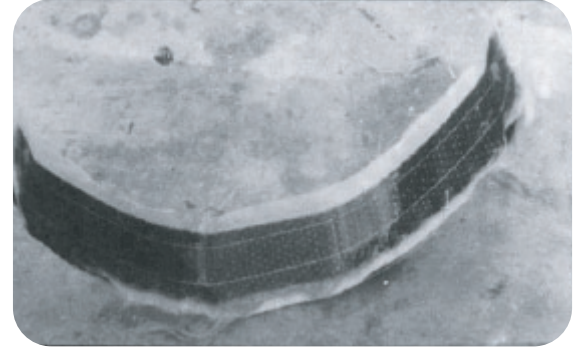
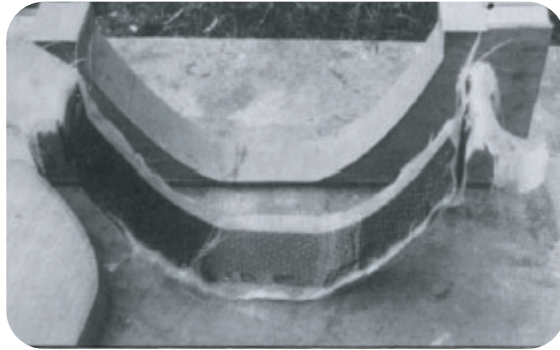
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Mold



Creating a Carbon Undercarriage, Cont.

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finished
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