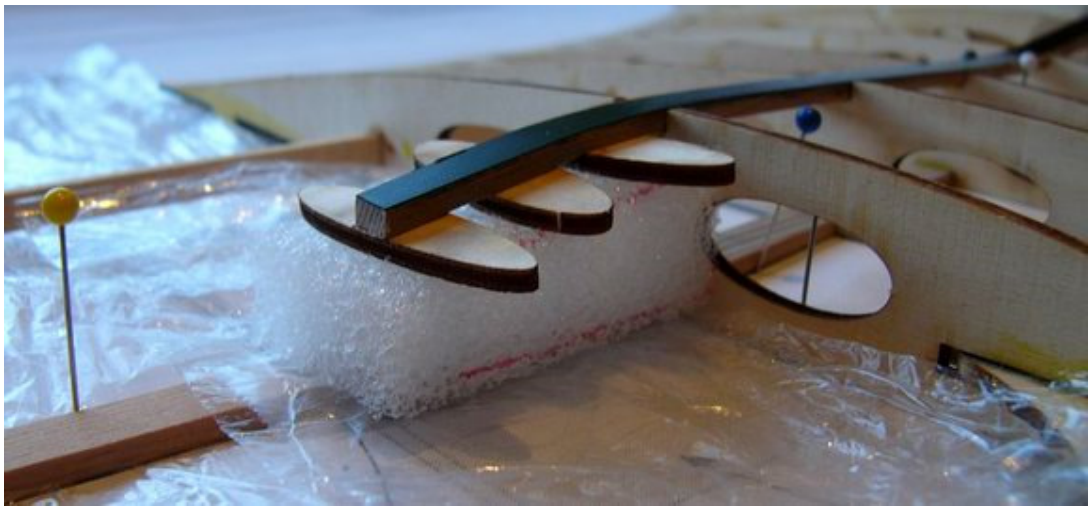
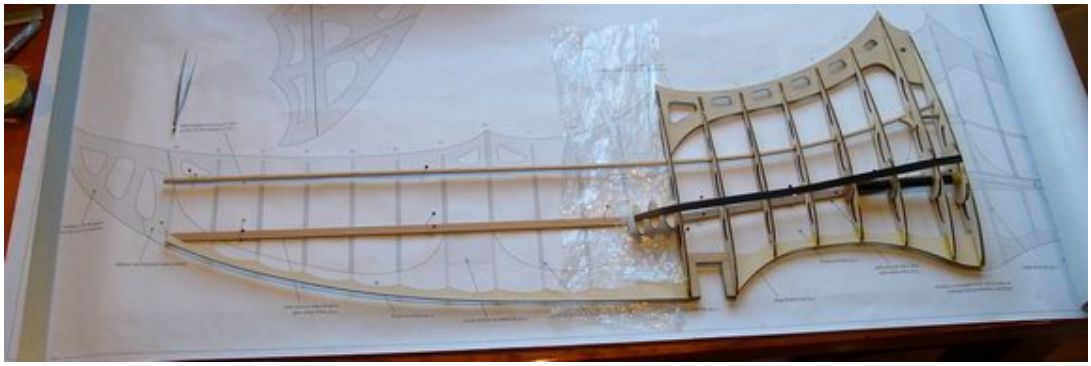
Marston Pterodactyl - Build Log - Part Two



My attempt at clamping the spar join and doubler.



A general picture of where we are upto.

Step 13 - Assemble ribs 9-19 to bottom spar, leading edge and trailing spar

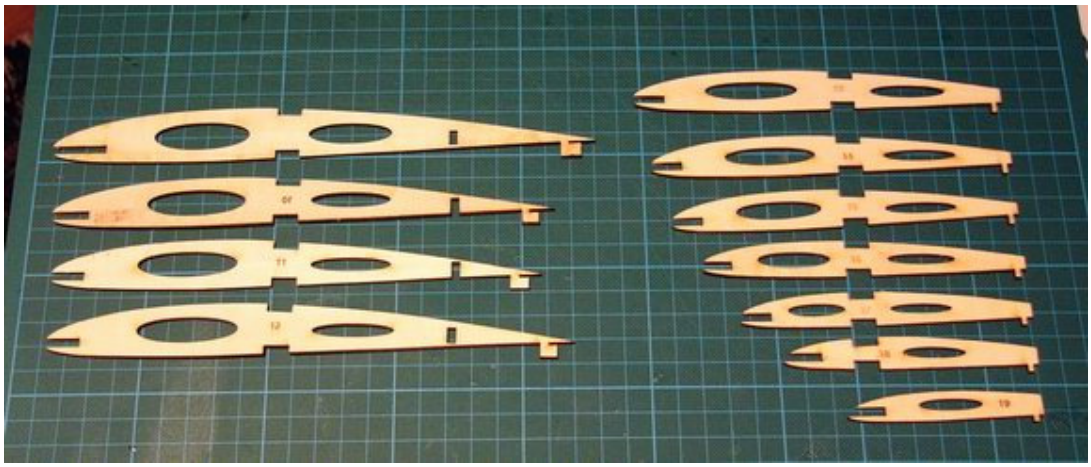
This is a big step and I think it needs to be done in a number of steps.

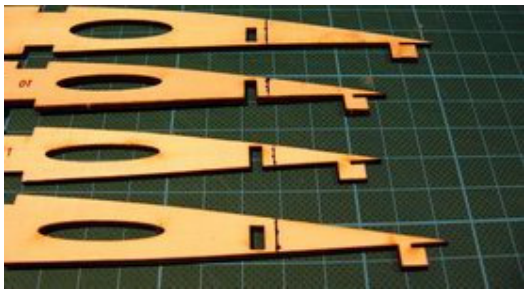
Ribs 9 to 12 correspond to the position of the flap, and ribs 13 to 19 have the aileron. Ribs 9 to 12 are full ribs (ie. they include the trailing edge and have a hole for the aft spar), the others are short and go as far as the aft spar.

It looks to me that you could construct the wing without flaps if you wanted. Although it looks like you would either need to reposition rib 12 slightly so that the rib was in the correct place for the trailing edge bit to line up wit the edge of the flap, or make the aileron to fit.

To build the flaps I am going to need to cut the trailing ends off ribs 9 to 12 once the wing is completed and I don't need the standoffs any more.

To make the job of separating the ribs and building the flaps a bit easier I am going to mark a reference line 3mm towards the rear of the rib from the aft spar slot and parallel to the spar slot. Later on I hope this will help me trim the trailing edge bits correctly.


On the left ribs 9 to 12 (top to bottom) and on the right ribs 13 to 19 (top to bottom).


Line marked 3mm aft of the aft spar.

Step 13 - Continued

I attached ribs 9 and 12 first because these ribs are more robust at the trailing edge. Ribs 10 and 11 will snap off at the trailing edge under any pressure.

So the first thing is to glue in ribs 9 and 12 to the leading edge, spar and trailing edge. First slip the ribs onto the aft spar and get them close to the correct position. Then paint on the glue, position, and clamp and add weights.

Once they were dry I then glued in ribs 10 and 11. I used the a few scraps of ply in the spar slot to fill these ribs so that I could hold them down with some cans.

Note that there is no point in glueing the aft edge of the aft spar to ribs 9 to 12 because this is going to be cut off anyway.

Ribs 9 and 12, weight applied along spar line.

I put a small block of wood to take some of the weight so the cans would not topple off.

And then ribs 10 and 11.

An interesting thing - problem?

What I noticed with ribs 9-12 is that the bottom spar cutout does not actually touch the building surface and so the spar does not fit completely into the rib.

This doesn't happen as much as you move towards the wing tip.

There doesn't appear to be much that I can do about it at this stage so I am just going to keep going.

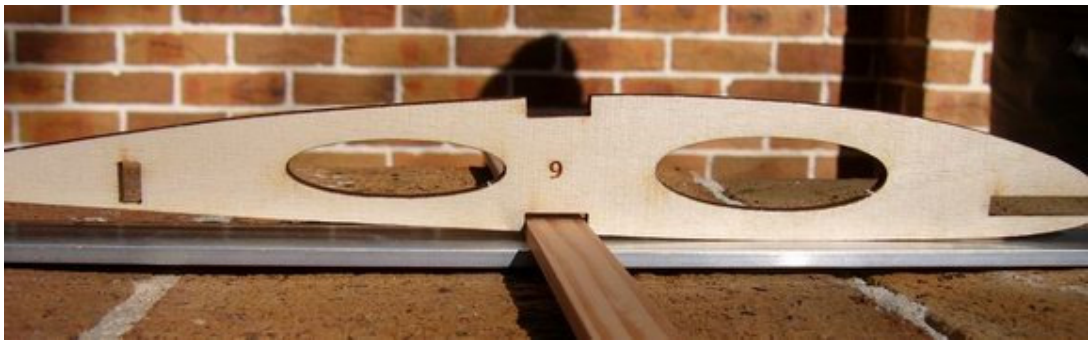
The spar appears to stick out less than the thickness of the balsa sheeting that needs to cover the ribs/spar etc. So I think that I will look at fixing this problem when I get to the balsa sheeting stage. It should be possible to get the same airfoil shape by adjusting the thickness of the sheeting.

Or perhaps I will just sand the spar a bit, I don't quite know.

It is a bit hard to determine exactly the size of this "problem" because everything is still on the board and I don't want to take it off at this stage.

Edit: I investigated this a bit further so I took it off the board and had a look. I decided that I needed to fix this now. So I removed the ribs, sanded the glue off and put a 1mm balsa shim under the spar from ribs 10 to 13. See revised earlier post for details.

Here is rib 9 resting on its standoff and the rib - but forward of the spar slot.



Outer top spar

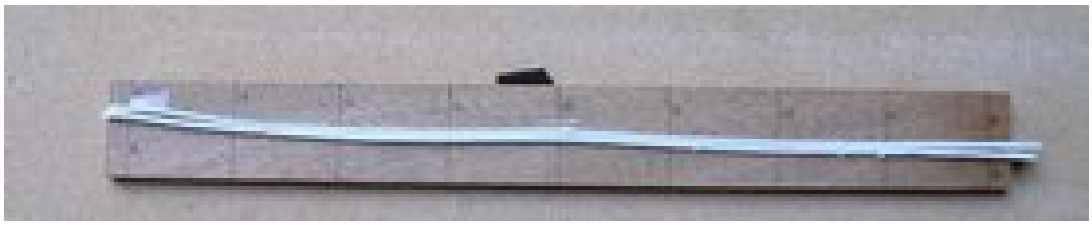
I am going to need the outer top spar shortly and have decided to bend the spar to make it easy to fit. This time I am just going to soak the spruce spar and then try bending it in the mold. The shape is not as complex as the inner spar so I though I would give plain soaking method a go. If it doesn't work I will boil the timber as before.

Again I made a mold using the section I posted back at post #57, dropped the spar into water for 12 hours and clamped up.

I will cut the spar join bevel on the inner end of the spar after it is bent to shape. Also I didn't worry about the makeing the mold go all the way to the end of the spar because the last few ribs are just straight.

24 hours later... and I can report that the spruce is as straight as it was initially... when I unclamp the mold the spruce just pops back to being straight So it looks like I need to resoak and try boiling for 7 minutes.

Same thing, but with a spar installed.


Mold for outer top spar.


After soaking spar. All to no purpose, the spruce just sprang back.

Step 13 - Continued

Now I have installed ribs 13 to 18. I did this two at a time so that I could get them installed as straight as possible. It is difficult with the curved top spar to get the ribs held down if you do more than two at a time.

With these ribs I have not glued the trailing edge, I am going to do this once all the ribs are positioned correctly and I can check exactly how the aft spar is going to fit. At this stage it looks like the aft spar is going to line up perfectly with the ribs and the bottom of the rib TE should line up with the bottom of the spar.

The shim I use under the spar (ribs 10 to 13) is working well and the ribs are positioned well on the building surface and the spar is sitting nicely in the slot.

It looks like the best arrangement is for the shim to start at rib 10 where it is completely under the spar and then at rib 13 it moves slightly to the rear of the wing.

Ribs 13 to 18 installed, two at a time. At this stage the aft spar is not glued to the rib TE.

Step 13 - Continued

I think that I am going to leave fitting rib 19 until after I have the top spar in place - that way I can cut the top spar to the correct length (more) easily.

So now I am going to glue the aft spar to the trailing edge of the ribs. As mentioned earlier the bottom of the aft spar should be level with the bottom of the ribs - in my case this just fell into place with only very minor movement of ribs required.

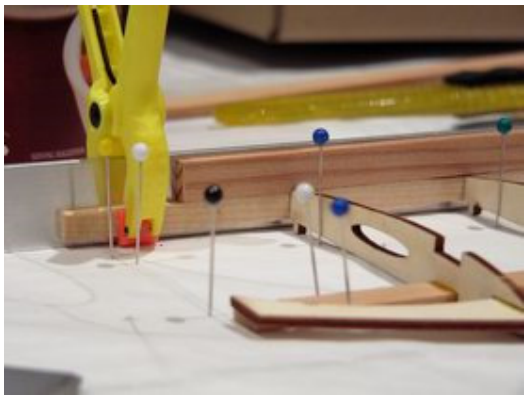
Because the aft spar is fairly flexible I thought I needed to keep it straight - otherwise it will be difficult to hinge the aileron. I use an aluminum flat clamped agains the aft spar to keep it flat (ie. in a straight line from wing tip to root) and a piece of spruce spar to ensure that it was flat on the other axis. Then I clamped the aft spar to the flat.

I applied glue to the spar and back of the ribs and then clamped the aft spar in position after double

checking that everything was straight.

Now off to try boiling and shaping the outer top spar again...

Weight of wing half now 138gms



Close up of aluminium flat use to align the aft spar, the aft spar was clamped to the flat to keep it straight.

Birds-eye view of aft spar being glued in.

And the result so far. You can see the ribs sticking out in the flap area and the nice straight aft spar for attaching the aileron.

Outer top spar - continued

I have boiled and bent the outer spar. The boiling (or steaming) is obviously the key step here because

this time the spar held its shape.

I then test fitted the spar to the construction so far and discovered that the outer spar did not just 'drop in' like the inner top spar. With the earlier success I was expecting a drop in part...

Careful examination revealed that the outer spar section I posted earlier (post 57) is not quite correct at rib 13 (a 1mm error crept in). Also the spar doesn't quite bend smoothly to the shape. Finally the spar needs a slight twist as it goes over the final few ribs.

I would suggest that you double check the mold against the ribs before starting the bending. I didn't pay 100% attention and failed to notice the 1mm error - it isn't much, but it makes the spar much more difficult to fit.

I have added an updated outer rib PDF in the earlier post to fix the problem with rib 13. Anyone who has taken a copy should get the version 2 copy of the PDF.

I decided to proceed with the spar 'as-is' and see how it goes.

Step 14 - Glue upper outer spar in place

At this stage I have yet to complete step 13 (installing rib 19 is left to complete step 13).

I cut the spar join and trimmed the length so that the spar was the correct length to join to rib 19 with all the bends etc.

Then I glued the spar to ribs 10,11&12. When that was dry I then glued it to ribs 13&14. Then to ribs 15,16&17. Finally to rib 18.

By doing this in separate lots I got the spar to fit into the ribs correctly. A bit tedious, however, the result looks good. The slight problems with the spar shape do not appear to have caused any problems, the wing still sits nicely flat on the building surface.

Once this is all dry I will complete rib 19 and then epoxy the rib 9 and inner/outer join and install the doubler.

Note: watch out when working around the ribs in the flap area. I have already knocked off the TE piece on rib 11 by accident - as I have previously mentioned the rib 10 & 11 TE bits are fragile. This isn't really a problem, but I don't want to loosing the rib alignment system until I am ready. As long as ribs 9 and 12 are there it is probably OK at this stage.

Outer top spar glueing to ribs 10, 11 & 12. Rib 9 and the inner/outer join has not yet been done.

Wing: Step 13 & 14 - Continued

Next I glued in rib 19 and joined the top/bottom spar and the leading edge. I was going to do this in two steps - but once I found I could get the spar held down by weights I decided it was easier to get everything aligned and glued in one go.

Just make sure that you get the aft spar aligned correctly with the bottom of the TE of rib 19. I also needed to sand the top spar end slightly to adjust for the angle that the spar meets rib 19.

Also don't forget to put a little glue between the bottom spar and the leading edge.

My wife suggests that I get sponsorship from the soup manufacturer after all they are getting a lot of coverage here.

Everything aligned and in position while the glue dries.

Wing: Step 13 & 14 - Continued

Now the final steps.

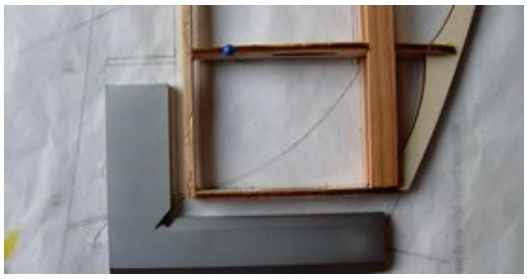
First trim the aft spar flush with rib 19 and sand smooth, with any luck the rib will be at right angles to the aft spar.

Fit and sand the 1/16 ply doubler for the top inner/outer spar join.

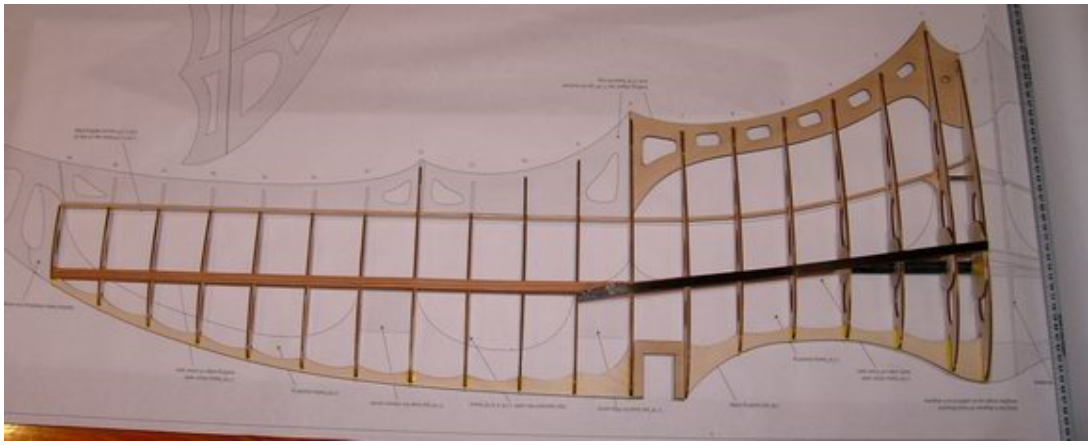
Then epoxy the top inner/outer spar join and install the 1/16 ply doubler on the underside. I used a bit of plastic film as a release and then a number of small clamps - this allowed the doubler to fit to the curve.

When the epoxy is dry it is worth filing/sanding the edge of the spar joins to remove any epoxy so that the shear webs will glue to the timber sides of the spars.

Weight of wing half now 148gms


Aft spar cut off and sanded.


Use epoxy to glue the spar join and add the doubler.


View of the wing half from above, the wing tips are yet to be added.


A front view of the wing half. This shot gives a reasonable view of the top spar's finished shape.

Where to from here?

I now have to build the other wing half to the same stage. So I will start that and just follow the same procedure that I used for this wing half. This should be a bit faster now that I know exactly what to do - although there is a long wait for the spar to dry after bending.

The next steps listed in the instructions are:

Steps 15/16 - Assemble and attach wing tips
Step 17 - Assemble ailerons

Step 18 - Assemble flaps
Step 19 - Add Shear webs
Step 20 - Add leading edge locator rods for attachment to the body
Step 21 - Build motor installation "cradles"

I am going to reorder this slightly and I am going to first add the shear webs while the wings are in the current state. The shear webs are fiddly so I may as well get this done now. This gives me a bit of time to look at the aileron and flaps in more detail.

The other thing I need to work out is the motor installation.

Motor Installation

I have purchased my initial drive system: RCer BL4-15-5 driving APC 6x4 prop with a CC25 ESC. At this stage it looks like I will be using 3S LiPo and with a Kv of 1430 this looks a good combination. Motocalc estimates total of 152W input power with 6x4 props and 226W with 7x4 props (if I could find any).

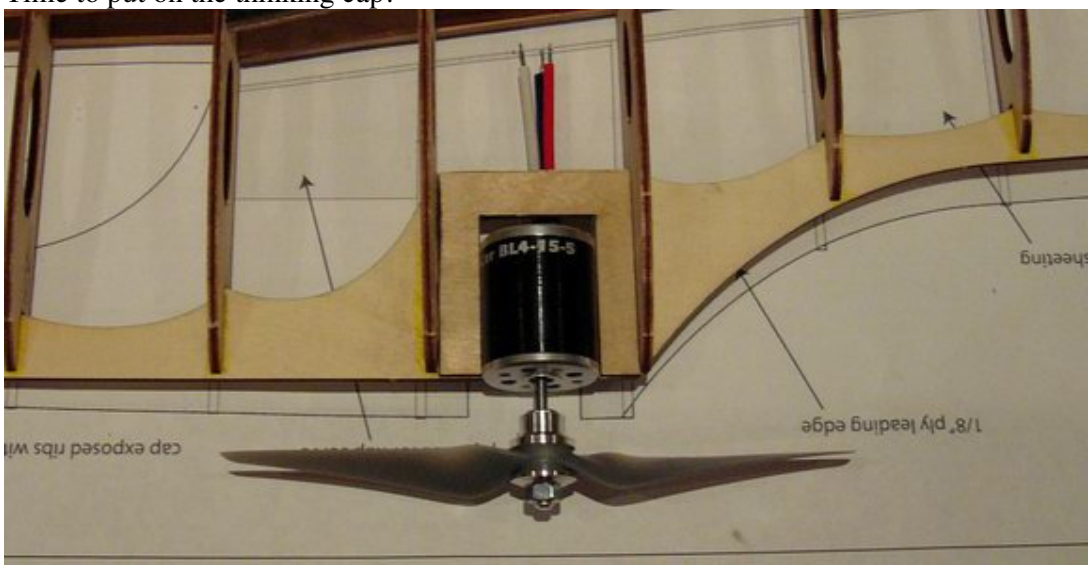
I also purchased the Hyperion collet prop adapter and it appears that I will need a washer on the front of the prop to stop the front plate of the adapter touching the prop blades and not securing the prop correctly.

The question is how to mount these motors?

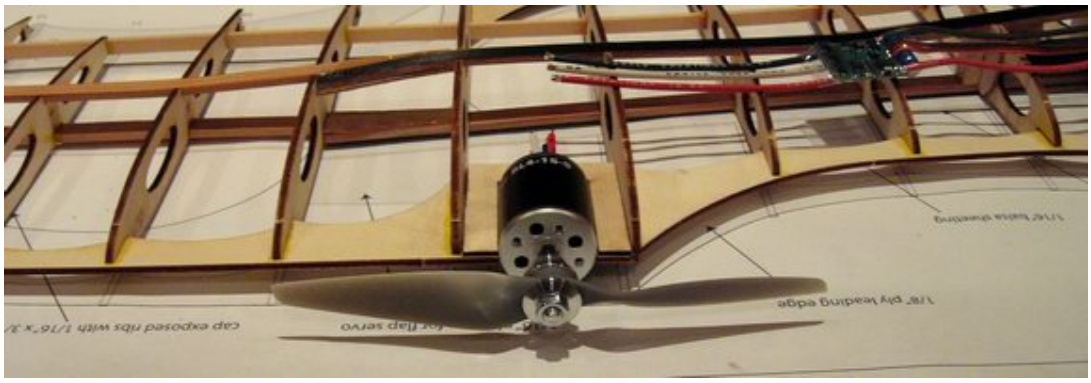
* I would like to be able to remove the motors later if required
* I need to secure the motor so that it doesn't "pull out" under power
* The mount needs to fit in with the 'shape' of the wing
* The motors need to be symetrically mounted with similar thrust lines
* I need to decide exactly how far the props should be away from the leading edge

I think I need to use the screws in the motor face somehow...

Time to put on the thinking cap!



Top view of motor mounting.


Front on view.

Wing: Step 19 - Shear Webs

The plans call for 1/16" balsa with vertical grain for the shear webs. These are installed on the trailing edge of the outer spar section and both sides of the inner spar section.

I am actually going to use a 2 ply balsa shear web with two layers of 1mm balsa laminated together at 90 degrees and then installed at +/- 45 degrees to vertical.

I made this by slicing a balsa sheet into strips at 45 degrees to the grain and then laminating them together so the grains are at 90 degrees.

The result is a strip of material with the grains at +/- 45 degrees. I have made enough of these strips to do all the webs.

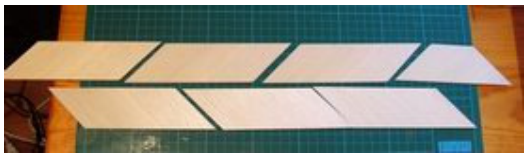
The next thing to do is to cut the shear webs out of these sheets and sand to exactly the correct size. As the instructions say "a tedious step"!

I clamp these in while the glue dries to get a good bond. I only have four suitable clamps so this is a 4-bits at a go job.

The other wing

The other wing went much faster and is now also waiting on its shear webs. I took a bit more care with the spar bending and this time the spar was a drop-in part that fitted perfectly.


Cut 1mm balsa into strips, grain at 45 degress to the cut.


Arranged so that the bottom row has grain at 90 degrees to top row.


Trim to form a rectangular piece of material. Then laminate together.


The first four shear webs installed.


Clamp in position.

Wing: Step 19 - continued

All the shear webs are now installed. I decided to follow the pictures on the Pterodactyl web site and stopped the double webbing at rib 8. I also put shear webs where the joiner tube passes through ribs 1 to 4. This involved a bit of trial and error to get the correct shape.

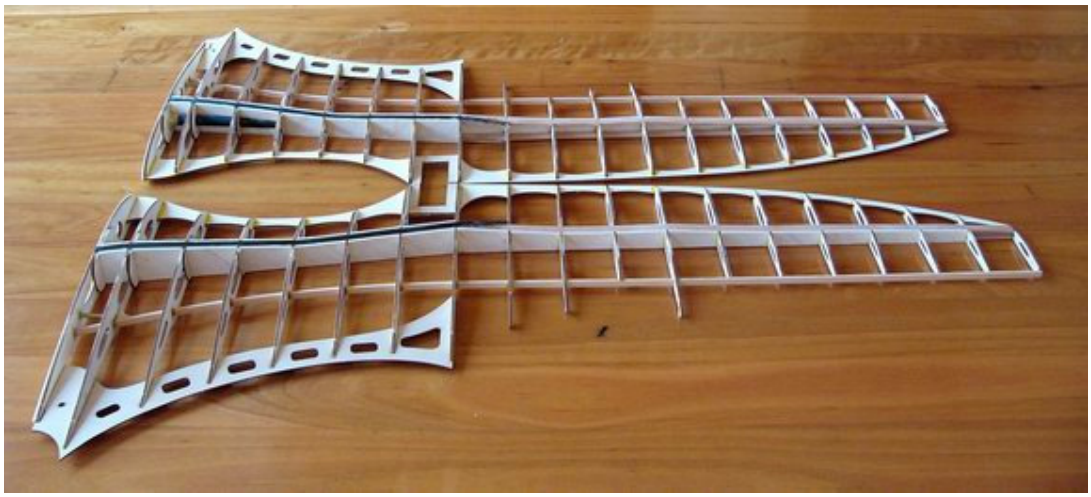
The wing feels nice and rigid now.

After installing all the shear webs I gave them a sand top and bottom so that they are flush with the top of the spar.

Take care not to knock the standoffs with the sanding block... (well, I managed to only damage one of them).

Weight of wing half now 162gms

I am working on the motor mounting and once that is sorted out I think it will be the wingtips next.


Wing halves with shear webs installed.


Joined together - looking good. Wing tips are yet to be added

First attempt at motor mount

Note: this mount is not the one I used. A much simpler, and stronger tube mount system is described in post #121. This post is left 'for the record'.

This is my first attempt at a motor mount. My idea was to make two parts, one to sit on top of the leading edge and one to sit below. Each part has two side rods and a back piece that holds the rear of the motor. On the front of the top part's side rods there is a front mount that takes the motor mount screws. The two parts are screwed together to attach the mount to the leading edge. (That's the theory...)

I started with a piece of 50mm x 40mm 1/4" balsa and laminated a piece of 1/16" balsa to the back. Then I marked where the various cutouts would need to be.

I used a Forstner bit to drill a 28mm hole in the centre to a depth of 4mm. (This is designed to hold the rear of the motor.) I put a hole in for the motor wires. Also a slightly deeper 12mm diameter hole to fit the motor case shape.

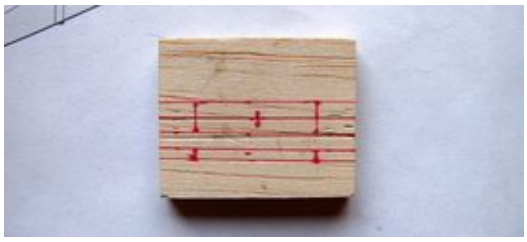
I then cut out the part for the side rods and the leading edge.

Then I attached the side rods. For the lower part I used 1/8 x 3/8 spruce and for the top part I used a sandwich of balsa-spruce-balsa to obtain a 3/8 x 3/8 rod. I cut the side rods off at the rear and trimmed the front length so that they were the correct length.

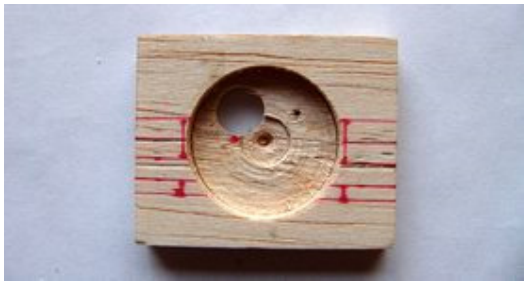
I made the front mount out of fibreglass board. Attached the motor to the mount and screwed the mount to the top side rods.

I still need to shape the rear of the mount to fit the wing shape, trim the lower rods, and work out exactly how to screw the two together.

I doesn't look quite as nice as the 'original' - but it is the best I can think of for now. I think if I can get the final shape to fit with the leading edge sheeting it will look OK. It also depends a little bit on exactly how far I want the prop from the leading edge - the more the motor needs to stick out the worse it will look.


Back with working lines


Hole for the rear motor mount.

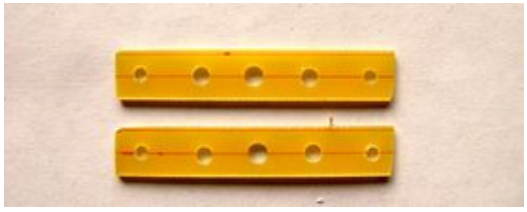

And one to let the wires out.


So then the motor should sit in the back piece.

Cut out for the the side rods and leading edge, after this sand to make everything neat.

Attach the side rods - keeping everything square.

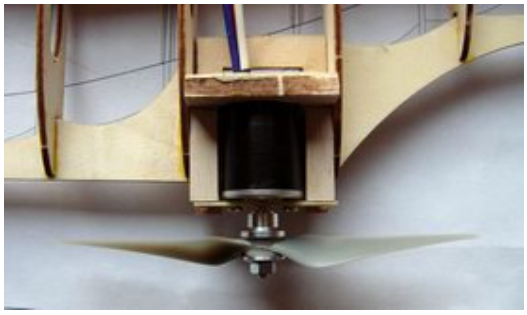
After trimming the side rods and sanding the mount should fit snugly into the motor mount area.



A pair of front mounts.

Attached the motor to the mount and attached this to the side rods for the top part.

And that is the basic mount.



Top view with prop attached.

Yep,

I am getting quite used to the shape now - at first it looked really odd, now it just looks normal just goes to show what too much thinking about something does.

I must admit this is turning out to be quite a bit more complicated than I imagined (or alternatively, perhaps I just
have poor imagination?).

My previous build, a Polecat WindDancer, was very simple in comparison to this.

The laser cut parts have all fitted well, it's just that there is a lot to think about as you go along.

Tim

About those flaps and ailerons

Here is some basic information about the flaps and ailerons.

The first thing is that the aft spar needs to be built up, and in some cases sanded down to keep the correct wing shape. I will build up with 1/8" balsa when I get to that stage. (See attached photos - green indicates built up bits, red for sanded down.)

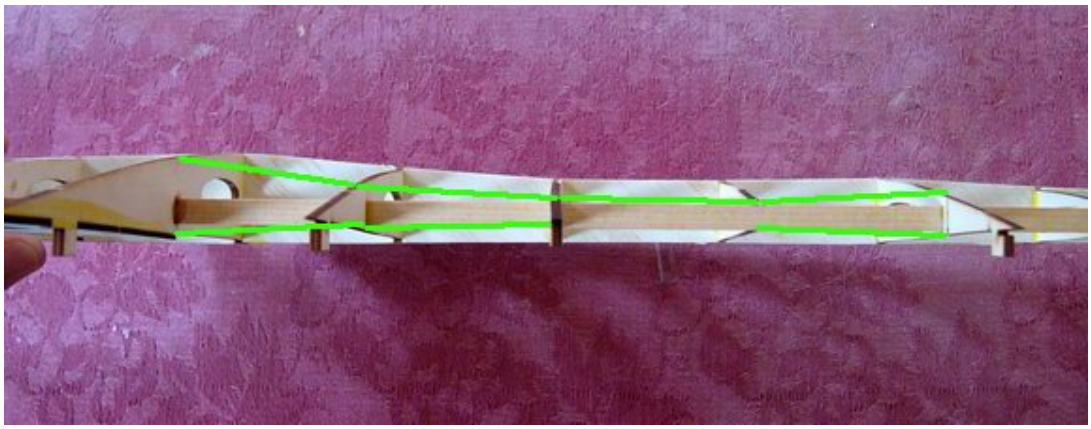
The flap needs the aft spar built up on both the top and the bottom, and this means that neither the top nor the bottom will be straight and suitable as a hinge line. So I think that I am going to use the bottom of the aft spar as the hinge line and use Dubro hinges for the flap. The flap only needs to move down, so hinging as close as possible to the bottom of the surface should work ok.

Also a side effect of this is that the flap itself is going to be interesting to construct because it doesn't have a flat side either...

The aileron is flat on the bottom and only needs the aft spar raised/lowered on the top. So a tape hinge is possible here - although getting decent up movement may be a problem. Or I could just use more Dubro hinges and locate them in the middle of the aft spar.

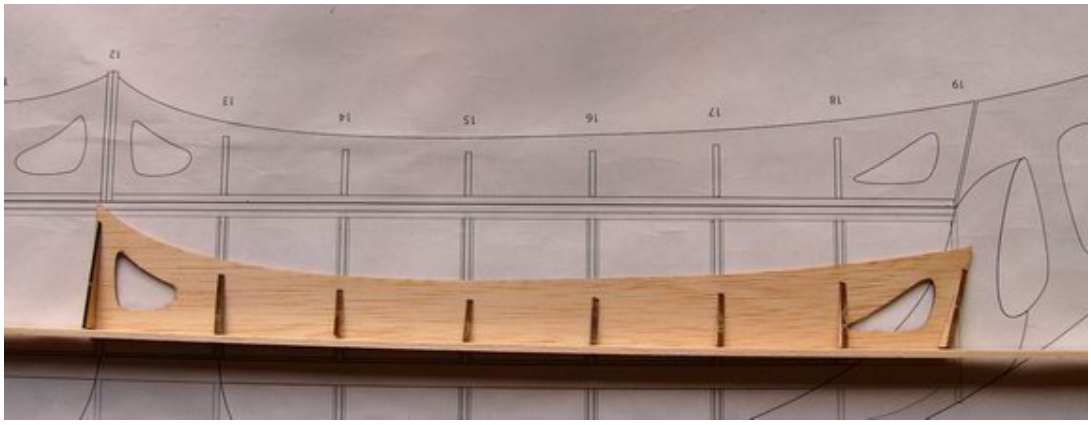
Also the aileron will be easier to build because at least it is flat on the bottom.

The basic construction for the flaps and ailerons is balsa top and bottom with the rib trailing edge triangles to form the shape. I need to cut the correct shape for the edge next to the hinges from some stock. Obviously I need to work out the mounting mechanism and the location of the control horn so I can install appropriate reinforcements.



This is the flap area viewed from the rear. The aft spar needs to be built to shape where the green lines are.

The aileron area viewed from the rear. Green & red indicate where I need to build up and sand down.



This is the flap & aileron construction system.

Tim,

I am curious if any side angle or downthrust is called for in positioning the motors with this twin arrangement.

Any thoughts on how you are going to fixture the motor alignment on your final assembly?

Keep up the great work!

PS. I do not like soup either. I cannot think of a better application for cans of soup than what you have found here

Scott

Scott,

All very good questions!

I am waiting for an email reply from Ron Marston on these (among other) issues.

I don't expect there will be any thrust adjustments - but I will report back when I know.

I spent last night discussing the project with some friends and the concensus was that my motor mount was too complex and probably not the best solution - so I am looking at other ways to do this.

Tim

Ok, I have not gone silent - I have just been a little short of time and had a lot of work commitments over the last week (and next few weeks).

The details of the motor placement are:

- motor shaft about 1/8" above the LE ply
- 1/2 degree of down thrust
- front of motor 1/4" beyond LE
- prop about 3/4" beyond LE

Overall the motor will stick out a little more on the underside of the wing than it does on the top - at least at the rear of the motor.

I am still thinking about the mount mechanism I will use. However, wingtips are next and I hope to get these underway shortly.

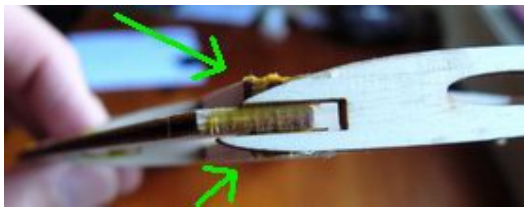
Tim

Wing: just before step 15

Before looking at the wing tip I am going to sand the upper and lower spar between the outer two ribs. This is required so that the sheeting will fit.

I just rounded off the spars on the edges shown in the photos below so that a small piece of balsa sheet would fit smoothly over the ribs and down to the leading edge.

This looked like it would be a bit easier if done before the wing tips were attached.


These are the bits of the spar that require sanding.


This is the finished job.

Wing: Step 15/16 - glue wing tips together and attach

Each wing tip is constructed of two 1/16 balsa parts glued together and then built up in thickness with bits of scrap to match rib 19. The wing tips need to be attached at a 5 degree upward angle.

Way back near the start of the thread (post #23) I glued the two wing tip halves together - so that is already done. These appear to have a tendency to warp so I have been storing them under light weights on a flat surface.

Now is a good time to sand these pieces so that they are exactly the same size and also to take off the carbon from the laser cut.

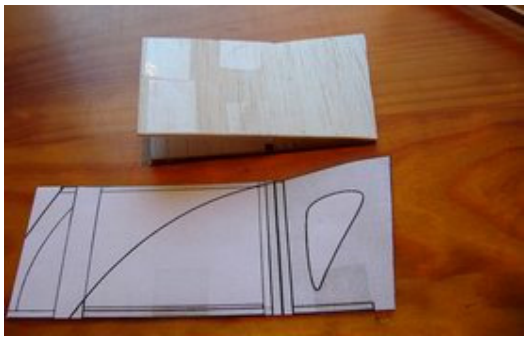
Eventually there will need to be some rounding of the leading edge and sharpening of the trailing edge - but I am going to leave that until later.

My next step was to work out what the complete rib 19 airfoil looked like - the wing tips need to be attached so that LE and TE line up. I cut two parts from 1/16 balsa that are the same shape as part of the wing and aileron and that cover the area between rib 19 and 18. I also cut some balsa parts that are identical to the rib 19 and rib 18 TE 'triangles'.

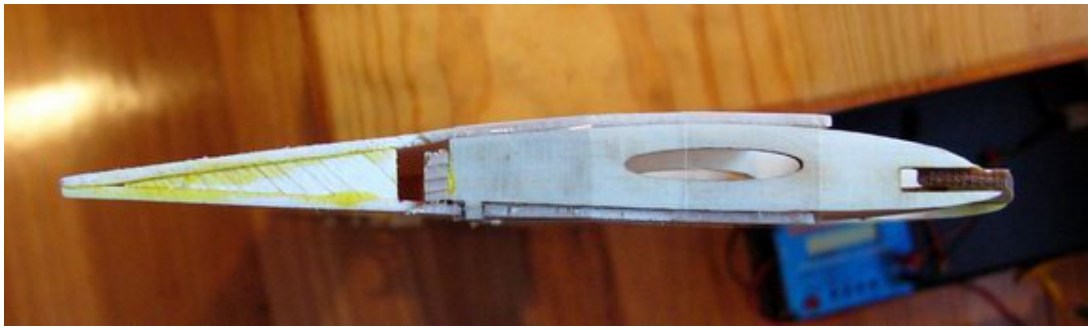
I then cut two small holes in the bottom balsa sheet where the rib standoffs go through and then glued the triangles in the correct place. I sanded the TE of the top sheet to match the join angle and glued this on. In other words I constructed the 'aileron' part of my assembly just like the aileron will eventually be constructed.

Now this assembly can be taped to the ribs, with the bottom of the 'aileron' following the shape of the ribs. And then we see the complete airfoil at rib 19.


A pair of wing tips after sanding.


This is the constructed 'aileron' and sheeting. I just use the plans as a template to cut the balsa.


And here is the bottom with the notches for the standoffs.


And this is with the unit attached. So now we can see the complete airfoil at the tip attachment point.


Just a quick check to see what we are looking for. The wing tip lines up with the LE of the wing and the TE of the aileron.

Wing: Step 15/16 - continued

I cut a 6mm strip of 1/4 balsa and glued it on the top of the wing tip next to where the rib attaches. This will serve to reinforce the join on the top, I will add some reinforcing to the bottom of the join later.

First I sanded the balsa strip to match the shape of the wing tip and allow for the aileron. Then I sanded a

5 degree bevel into the now reinforced wing tip end. To do this I cut a 5 degree wedge from some scrap foam and used this to hold the wing tip on a 5 degree angle while I sanded. I also checked to ensure the wing tips were exactly the same size after this and sanded the slightly larger one down a bit.

When attached to a vertical surface the wing tips both had the outside tip at the same height of the board. So that looked ok.

After checking against the airfoil shape it appears that if the bottom edge of the wingtip is aligned with the bottom edge of the TE of rib 19 and the front aligned with the LE the wingtip is in the correct position relative to the aileron.

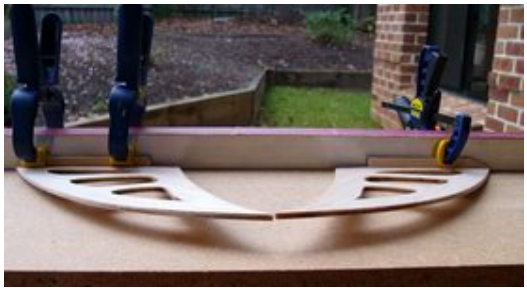
If anything I want some washout in the wing tip so raising the TE slightly is a good idea. Additional washout can be added during sanding.

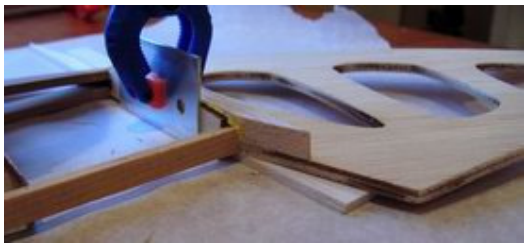
So I put the first wing onto a flat surface and put some weights on, then I put a piece of 3mm of scrap next to rib 19 and used this to locate the lower surface of the wing tip. The rib 19 standoff is about 2.5mm high, so the 3mm material just raises the TE of the wing tip a little.

Then out with the glue and a clamp... double check the front to back alignment, I should have done this before gluing - but it was spot on...

Once this is dry I repeated the process with the other wingtip, using the first one to double check the outboard tip is the same height off the table.


Balsa strip attached.

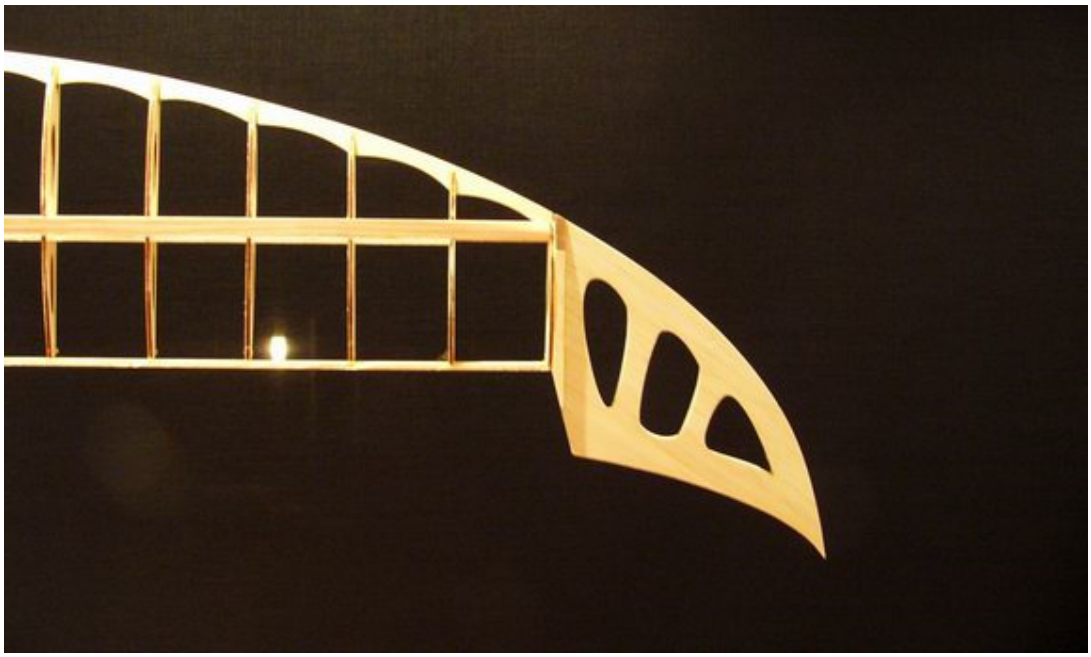

5 degree angle sanded onto the end of the wing tip and the two tips checked for the same angle.


Use a 3mm spacer to hold the bottom of the tip in the correct position.


A very thin (1mm) piece was required on top of the 3mm to get the LE correct.


Check alignment.


A close look at the TE of the aileron and the wing tip. The wing tip is slightly higher - so a little washout. Sanding will eventually smooth out the transition, and add a bit more tip washout.


And that is the wing tip in position.

Wing: Step 15/16 - continued

Once the glue was dry I flipped the wings over and glued some strips of 1mm balsa to strengthen the bottom of the join.

Then sand the balsa to match the airfoil shape and also the thinning of the wing towards the tip. I cut a paper template of the top sheeting so I could check how this was going to work. It looks like the sheeting will fit as shown.

Weight of wing half now 170gms

Sorry about all the 'it looks like' - but I am reporting as I go along and I am only going to find out later if I have got any of this right...


The 1mm balsa used to build up the bottom of the rib/tip join.


Sheeting template cut from a copy of the plan appears to fit nicely.


The top balsa needs to be sanded at a slight downward angle to allow for the sheeting.


The finished (at this stage) top balsa.


The underside also sanded to shape. I think a small bit of sheeting will also be required here.

Wing: general

This isn't covered explicitly in the instructions, but at some point you need to build up the aft spar in places so the spar height matches the rib heights. (See post 89).

So at this stage I glued some scrap 1/8" balsa in place and did a rough sand to get the right overall shape. Fine adjustment I will leave until later.

Notes:

(1) This may be easier if left until a little bit later once the rib-flap TE pieces have been removed.

(2) If you are going to use hinges like the Dubro ones then you should probably cut the slots in the aft spar prior to adding these filler bits.


Initial material glued in.


Sanded to approx. the final shape.

Wing: flaps and ailerons revisited

My next step is to mount the servos, build the flaps and ailerons, and get the linkages to work.

The official way to do this is to use tape hinges on the top of the aileron and the bottom of the flap. The servo control arms stick out of the bottom of the wing and the control rods go back externally to the control horns on the surfaces.

I am going to try to construct entirely internal servo & linkages so that there are less external parts to get

damaged etc.

To do this I am going to use tape hinges on the bottom of both the ailerons and the flaps and drive the control horns on the top of the surfaces. The control rods are internal to the wing and exit on the top near the T.E. This will require the control rods to go through the shear webs and so I will add some doublers to these webs once it is all done.

I am also going to move the flap servo one bay outwards of the recommended position so that I don't have a hole in the shear web in the same area as the inner/outer spar joins.

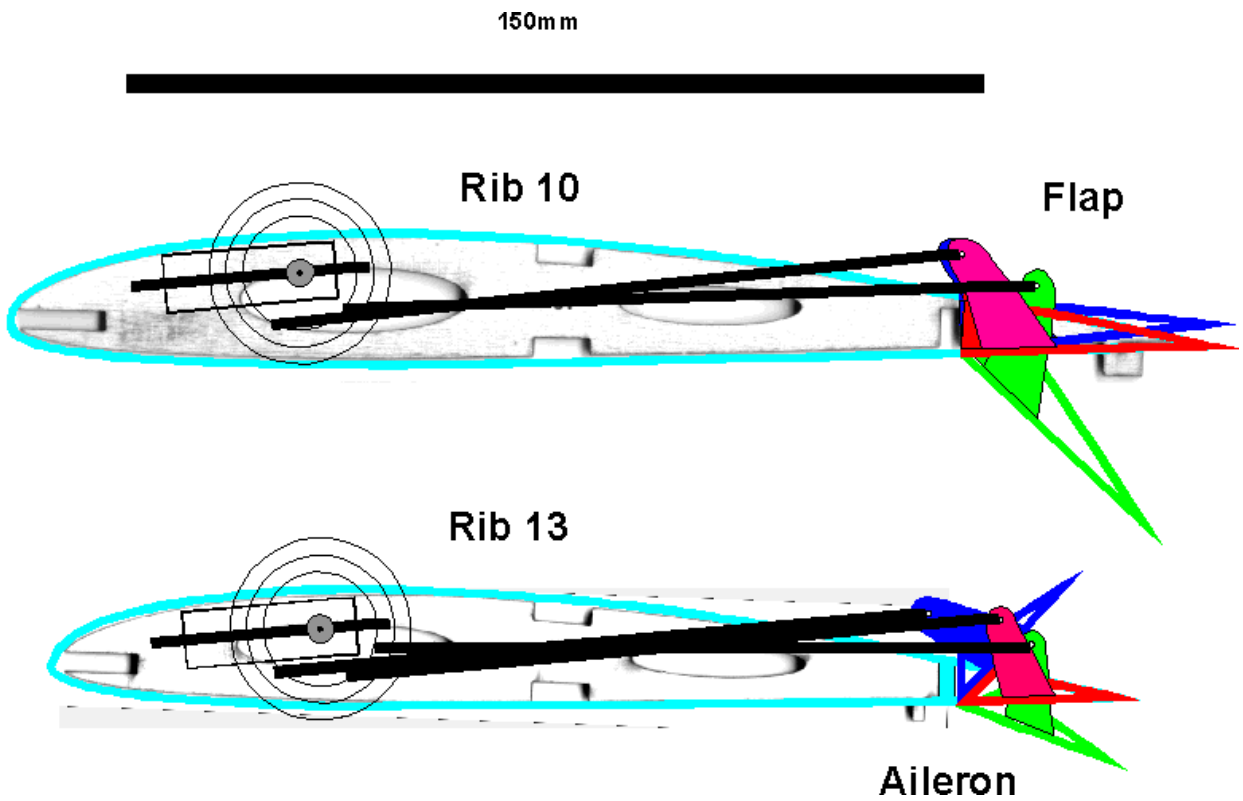
With any luck this will become clearer as I go along.

I am using the recommended HS5125MG wing servos and will need to use the inner most hole on the servo arm to get everything to fit.

To check that this is possible I have drawn up the assembly (see below).

It looks like I should be able to get 45 degrees up/22.5 degrees down on the ailerons and 5 degrees up/45 degrees down on the flaps at maximum travel. I think that this should be more than enough travel.

The plans only call for down movement in the flaps, but I want to have a little up available for 'future use'.



Linkage and servo mounting. The control surfaces are shown as: blue = up, red = neutral, green = down.

Wing: install servos

To install the servos I made a 'U' shaped cradle out of 1/8 x 1/4 spruce and then added 3mm of balsa to the top. The 'U' is the exact width (30mm) of the servos.

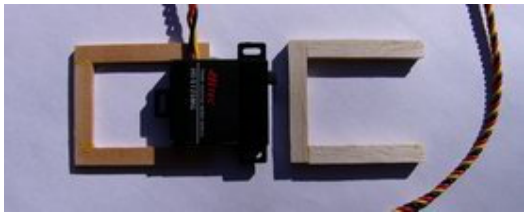
Then I screwed the servo into the spruce side of the cradle. This holds the cradle to the correct shape and keeps it flat.

Then I sanded the cradle so that it fits between the ribs and glue in place. The ribs shown the the drawing in the previous post is the smaller rib of the pair that the cradle fits into. So the servo needs to be at right-angles to the smaller rib. The servo arm must swing parallel to the rib and be vertical. I want the servo to be just under the sheeting to get the maximum space for the arm. By installing the outer edges of the spruce level with the top of the rib the curve of the rib allows the correct space for the servo.

I fitted a correctly cut down servo arm and checked the operation of the servo over its range to make sure the arm was moving parallel and straight.

Then I removed the servo and sanded the balsa parts of the cradle to fit the top of the wing shape.

Because I have moved the flap servo out by one rib part of the cradle and servo are going to be visible unless I alter the shape of the wing sheeting slightly.

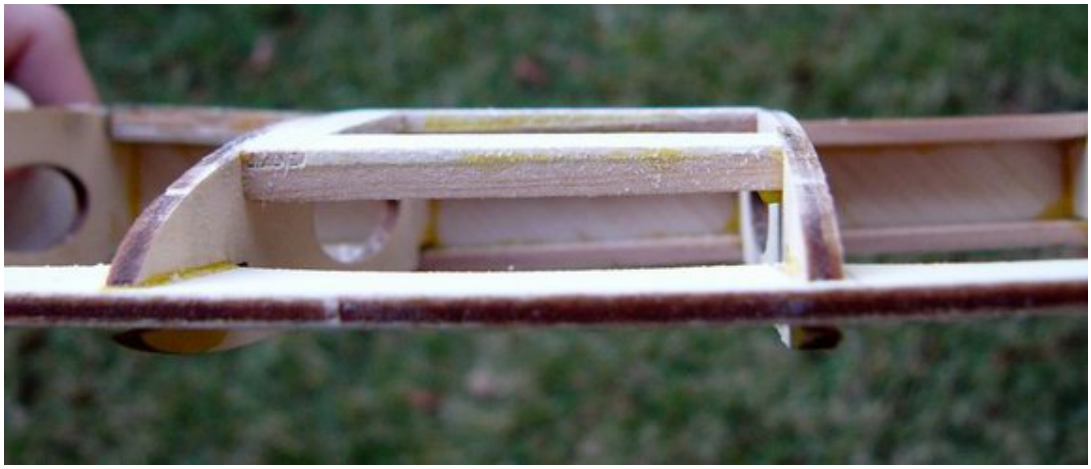


Left is the initial spruce cradle, then with the extra balsa on the right.

Attach the servo to hold the cradle straight and square.


Glue in position.

View from underside, servo arm parallel to rib.


And then sand the balsa to fit the wing shape.

Wing: Step 17 - Assemble ailerons

The aileron and flap meet at rib 12 and so you need two rib 12 TE bits - one to close the end of the aileron and the other for the flap. One of these is attached to rib 12 (unless you have already knocked it off by mistake, in which case don't loose it ☺) and there is a second on the ply sheets. The additional one is 1/16

ply and the actual rib part is 1/8 ply.

I elected to use the 1/16 ply part on the aileron and the real rib TE bit on the flap.

So I sanded the balsa aileron surfaces as the first part of this step, also I sanded the rib 12 TE that I am using. Also sand all the other rib TE bits - slightly tricky because some of them are small...

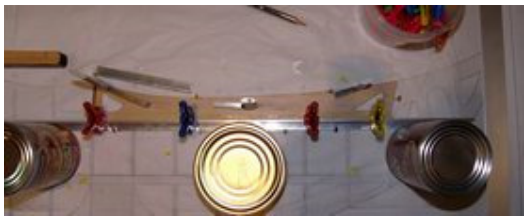
Then I put the bottom surface on the plans.

At this stage I would suggest using a pencil to transfer the rib positions onto the inside of the surface. I did not do this for the first aileron, it would have been much easier if I had thought of it first...

Then glue on the rib 12 TE - keep it nice and square. The cut a length of 1/8 balsa that is the same width as the height of rib 12 TE (about 9.4mm - so say 10mm, a bit bigger is ok, less is no good!). Then glue this in position.

Next run along and install the rib TE parts in the right spot. Try to keep them vertical and also square front to back - I paid particular attention to rib 13 TE bit, because this is where the control horn will attach and I want the horn to be vertical. I also sanded the inside edge of rib 13 TE where the control horn will attach.

Once this is dry sand the outside to smooth off any rough edges. I left the balsa strip slightly long on the outside and at this stage sanded it to match with the rib 19 TE bit.



Rib 12 TE in position and the balsa strip. I used some right-angle aluminium extrusion to get it staight and square.

Then rib 13, which I did by itself, and finally all the other bits.

Wing: Step 17 - continued

Looking at the aileron from the rear you can see the shape that the balsa end strip will need to be sanded to. The rib 15 & 16 TE parts (about the middle of the aileron) are only a few mm high, compared to the rib 12 which is about 10mm high.

This also shows the amount of bend that will be required in the aileron top sheet as it fits.

It may perhaps be easier to make a template and get the balsa nearer the correct shape before attaching it. I will see how we go with this method first...

But there is going to be a lot of balsa dust from this part... although perhaps a knife to trim some of the balsa first will speed things up.


Aileron viewed from the rear showing the heights of the rib TE parts when installed.

Wing: Step 17 - continued

At this stage I cut the TE section of ribs 9 to 12 off so that I have the aileron and flap bay with a neat straight edge. (Put these parts in the left & right box...) I also sanded the area on the aft spar where ribs 9 to 12 go over the aft spar.

Then I clamped the aileron to the aft spar in its correct position. I used the join between the aileron sheet and the rear insert as an alignment point for the bottom of the aft spar, and also checked the lateral position using the flap sheeting as a spacer. (Obvious I suppose, but I almost forgot to allow for the sheeting thickness...)

Then I used a large drum sander on a Dremel at its lowest speed to take off most of the balsa and to get close to the correct line all the way along the top of the ribs, from the TE bit to the main wing. Finally I finished with hand sanding - I used some fine paper attached to a small offcut of largish diameter conduit that made sanding the curve easier. Once the basic shape was sanded in it was fairly easy to finish the shape by eye.

I also constructed the other aileron so that I could check them back-to-back to ensure that the sanding was the same on both ailerons - this should ensure that both ailerons end up the same shape and section.


Aileron and flap bay with all ribs detached.


Aileron clamped in position and ready for initial sanding.


Aileron and aft spa after initial sanding, yet to be completely smoothed out.


The ailerons back-to-back to check the sanding is the same.

Wing: Step 17 - continued

This next bit is a slight variation to the 'standard' build.

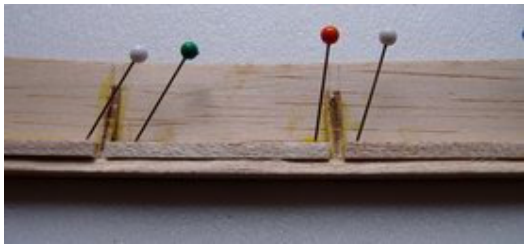
Because I am going to bottom hinge the ailerons I need to sand a 45 degree bevel to allow for 45 degrees of up travel.

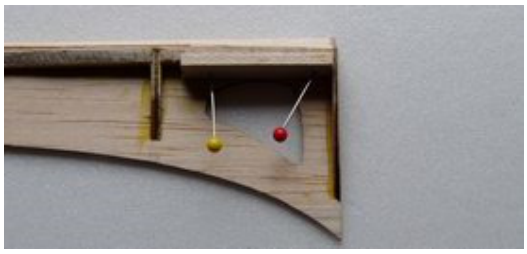
The construction of the aileron with only 1/8" balsa as the front end of the aileron is that this is not thick enough to sand a 45 degree bevel. So I added 1/8" strips of balsa between each of the ribs and a further 1/8" strip of balsa on the section at each end.

On the end that has the rib 12 to 13 gap I made the 3rd piece of extra balsa 5.5mm shorter than rib 3 to allow for the control horn mounting.

Once this was all dry I sanded the 45 degrees in. This was a bit more difficult that I expected because the top of the aileron is concave, with the middle only 5mm high and the ends about 10mm, it was very difficult to attempt to sand this by eye.

So I made a 45 degree bevel sanding block to ensure that the bevel was uniform across the entire aileron - the result looks good. There is still sufficient surface to glue the top of the aileron to the bottom.


First add a extra 1/8" balsa between all the TE rib bits.



Then add a third thickness in the two end panels, the gap is to allow for the control horn.

My 45 degree sanding tool - sand paper is attached to the aluminium face that you can't see in the photo.

Sand on the bevel to allow for 45 degrees of up aileron travel.

Wing: control rods & horns

I made the control rods and horns to hook everything up. As I was about to do this I realised that I had made a slight error in the drawing in the earlier post and left out the aft spar from the aileron configuration so I have updated that drawing.

For the control horns I used the drawing to cut two each of the aileron and flap control horns from 1/16 ply.

Each control rod I made from two Dubro 2-56 Kwik-Links (#109), a threaded coupler (#111) and a length of 1.5mm CF rod. I used the drawing and cut the CF rod to the correct length. Then I used some wet&dry paper to lightly sand both ends of the CF rod (under water). I sanded the inside of one of the Kwik-Links, also the inside of the coupler. Then clean them all with some acetone.

Finally mix some epoxy with micro-ballons and glue the CF into the sanded Kwik-Link. When this is dry repeat to glue the CF into the coupler. With the coupler I use a pin to put epoxy into the coupler and then press the CF rod in, wipe off any excess that pops out.

About the only difficult part is to make sure the parts are all in a straight line while the glue dries. I just use a few lines on some paper and some thing balsa shims to get the alignment correct.

This is the system I used on my WindDancer and it has worked very well.

It may not be obvious, but what I do is put the coupler with the screw on Kwik-Link and the control surface end when the rod is installed. This way I can adjust the control rod using the screw thread adjuster easily.

Control horns. Two layers of 1/16" ply and a paper template.

All the parts for a control rod.

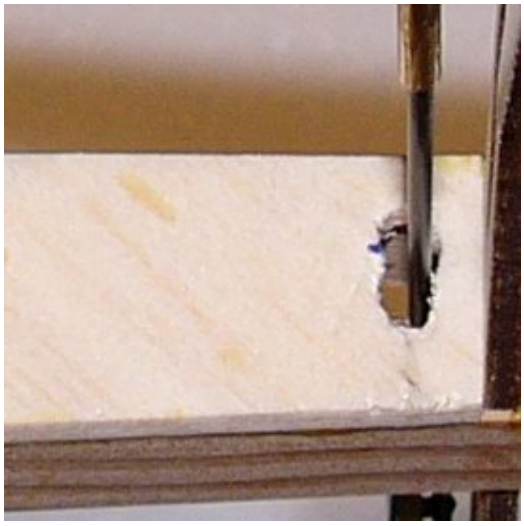
First part of the glueing, after this the couplers are glued to the other end.

Wing: Step 17 - continued

Again using the diagram I worked out where the hole in the shear web needs to be to allow the control rod to go from the servo to the aileron.

This came out as 4mm from the rib and about 6mm high and 3mm wide. So I marked this position onto the shear web and cut out an elongated hole. (I then thought it wasn't quite bit enough and enlarged it slightly without checking with all the parts - I should have trusted my initial measurements they turned out correct, as usual check first...)

After I have the ailerons and flaps operational I will need to add doublers for the shear webs where I have cut the holes.



Hole in the shear web - I will tidy this up after checking the position of everything.

Wing: Step 17 - continued

Now using a three scraps of 1/16" balsa I put some 'sheeting' onto the bottom of the wing that I can use to temporarily hinge the aileron. Three attachment points should be enough to see if it all works.

Then I temporarily mounted the control horn onto the aileron using a small piece of Depron as a wedge, hinged the aileron onto the three temporarily sheeted areas, and installed the servo.

Hook up the receiver and see what happens...

Everything looks excellent. Aileron movement is perhaps a bit short on up movement, but only by a very little. The geometry gives natural 2:1 differential and uses the full servo travel. The servo arm and most of the control rods fit within the wing. It looks like this will do the trick! (On the EVO I used travel range of +/-75 and the servo neutral at +25.)

Now I am going to repeat the process for the right wing's aileron and at the same time start on the flaps to see what they look like. Once I have all the ailerons and flaps working together I will glue in the control horns and apply the top sheeting to finish them.

There are also some slots to cut in some of the wing sheeting at a later stage, but I will show that when I get there.

I must admit that this appears a bit tedious, but one of the things that I like about building rather than ARF (based on my very limited experience) is that you can get all the servos and stuff installed and working properly at an early stage and this makes for a much neater finish.

Having said that this is taking a lot longer that I expected...


Attach some balsa 'sheeting' to the bottom of the wing to allow the aileron to be hinged.


Hinge the aileron and install the servo and control rods. (Bottom view)

Full up travel that is available.

And the down travel, pretty much exactly as per the diagram.

Wing: Step 18 - Assemble flaps

In the 'official build photos' it looks like the flap is constructed the same way as the aileron - with the bottom surface completely flat.

However, as far as I can see a flat bottomed flap is not going to match the wing section that well. So I am going to construct a slightly curved bottom flap that matches the wing... this may turn out to be a bad idea when it comes to getting a working hinge, but I will see how it goes.

So I cut some 3mm balsa to approximately the correct shape for the back of the flap. I cut the balsa just a bit bigger than the balsa flap sheet. Then I clamped this piece to the aft spar (which already has all the fill in pieces installed see post #97) and marked a line that followed the bottom of the spar and fillers. Mark the rib positions on the bottom of the balsa (this is on the bit you are going to cut off), the rib positions help you align everything later. Then with a sharp knife cut along this line - label the bit that you cut off, this will be required later.

Then I clamped them back onto the spar and sanded to get the bottom edge to be an exact match, then clamp the two pieces of 3mm balsa together and make sure they are the same.

Then cut just a bit less than 1/16" off the inside edge (rib 8 end) of the balsa piece to allow for the 1/16" ply flap end.

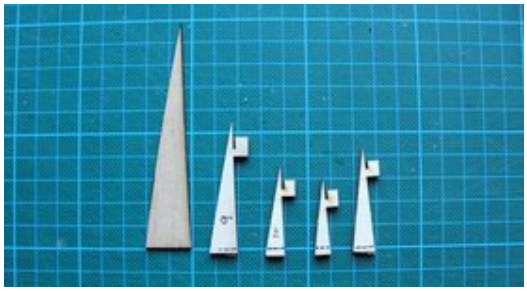
Then locate the rib TE pieces for each side, and the extra bit that matches the TE shape of rib 8. Cut off the standoffs and also cut along the line that is 3mm from the aft spar. Sand everything, including the two balsa sheets that form the top and bottom of the flaps.

Check that the vertical edge of the 3mm balsa piece is parallel to rib 8 when the balsa is in position against the aft spar.

This is the balsa clamped in position and the line drawn along the bottom of the aft spar.

So this is the balsa with the line just visible on the 'top' (which is actually the bottom....)


Clamp back onto the aft spar and sand to get everything the same shape. Also put the two flap backs together to makes sure they are the same.


These are the rib TE pieces, with the standoffs still attached and the 3mm line marked.


And these are all the parts ready to go. Note the thin curved sliver between the flap bottom sheet and the back.

Wing: Step 18 - continued

Mark the position of the ribs onto the inside of the bottom flap sheeting so that the TE rib pieces get installed in the correct position.

Now place the curved cutoff piece of balsa onto the building surface, put the bottom flap sheet on top. Pin the sheet at each end so that it holds to the curved shape. Use the rib locations marked on the sheet and also the cutoff piece to get the correct alignment. Put the flap back piece on top of that. The curve on the bottom of the back piece should match the curve on the sheet. The rib 8 ply piece should also be put into position.

Glue these pieces in position. Use the short end of the rib 8 ply piece to align the flap back piece - it is not at right-angles to the bottom of the flap. The flap back piece serves as the guide for the alignment of the rib 8 ply piece (see the last point in previous step). So these two parts align each other - easier to see in practice than to describe.

Then glue the rest of the TE pieces in.

After everything is dry I sanded the glued edges and checked for fit.


The bottom flap sheeting held in position with two pins. You can see the pencil lines with the rib positions.


All the flap parts glued in place.

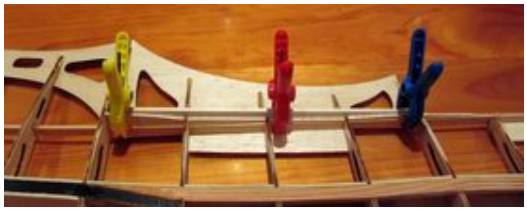

Check for fit with the wing and aileron.

Wing: Step 18 - continued

Repeat the procedure used on the aileron and clamp the flap to the aft spar and then sand the top of the flap to the correct shape. At the same time sand the top of the aft spar filler pieces to get a smooth transition over the wing and onto the flap. Check the two flaps 'back-to-back' to make sure they are the same.

I found that using the top balsa sheet also allowed me to check that the shape of the top of the flap was smooth so that the sheeting would fit properly.

Then make a hole in the shear webs for the control rod and make a temporary hinge for the flap. Check that the appropriate control movement is possible and that the flap control horns are correct.


Clamp to the aft spar and then remove excess material and shape to match the wing.


Check flaps are the same. Don't ask me how the rib TE pieces ended up in slightly different positions!


Finished shape.


Install the control rods and temporarily clamp the control horn in place.


Adjust servo centre point for correct neutral position.


Check available down travel - certainly more than enough...

Wing: Step 18 - continued

Prior to gluing the control horn in I sanded the back of the flaps as follows:

- I put an imaginary hinge line on the generally flat bottom of the flap and marked the line as it ran onto the thicker ends of the flap. I then sanded a 45 degree bevel onto the flap along this line. This will allow the flap to hinge down correctly. I hope the photo makes this clear.

- I then sanded a slight bevel from the imaginary hinge line to the top of the flap to allow the flap to move up slightly. This will ensure that the flap can be trimmed at the correct neutral point without any problems and also permit a small amount of up flap travel if required. I suppose this is just a precautionary measure - in theory the flaps only need to move down.

Then sand the top sheet both sides and smooth off the curved edges etc.

To fit the top sheet I marked a line about 8mm in from the rear curve and sanded from this line to the rear of the flap. The top sheet should then fit on leaving a 1/16" thick tailing edge (ie. just the bottom sheet thickness).

Then I glued in the control horn, make sure is is vertical and on the same axis as the control arm on the servo - and also at the correct offset from the rib. This takes a bit of getting right because of the curves on the flap. I found it easier to clamp the flap to the aft spar and then check the control horn by eye. Use some bits of scrap balsa to add support for the control horn and sand these go get the alignment correct.

Finally cut a slot in the top sheet to left the control horn through then glue the top sheet in position. I just used bits of tape to hold it all together... there is probably the possibility of warping the flap at this stage, especially on the trailing edge, so take care with the tape to make sure everything is still OK. Because the flap is curved on almost every face I can't see any way to check until it is all glued. So I just did it by eye, checking later it looked fine.

Finally, sand all the glue lines etc. Check that the up movmement on the flap is still possible. Sand as required. In my case the laser cut top sheets were not quite the correct size (they actually need to be slightly longer due to the curves and because they are on the hypotenuse) so I used a bit of scrap to fill in the small missing bit.

Looking back to the start of the thread I see that it has taken 5 months to get to this stage. I don't think that all the time is due to the complexity of construction, rather finding the time to do the work. Also bits of the thread read like instructions and other bits are comments on what I did - still at least is has been interesting this far (for me anyway!)

Weight of each flap 8gms

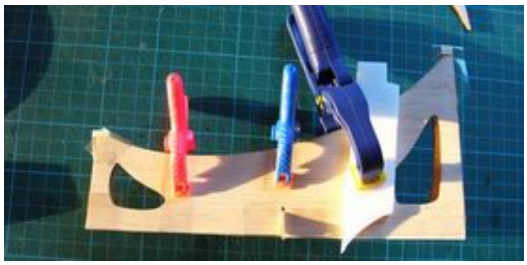
Note: take great care to protect the trailing edge tips on the flaps. They are very fragile, especially when the top sheet has been sanded. The slightest tap will damage them.

The edge of the aluminium is the hingle line. The bevel on the lower edge of the flap is visible just above the aluminium.

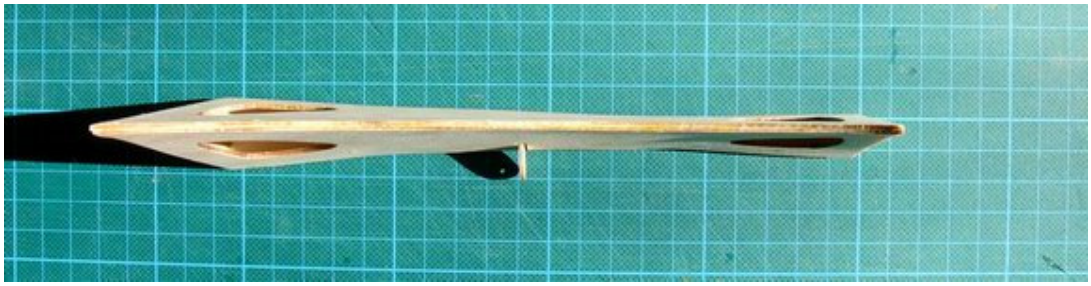

Make sure there is some scope for up movement.


Sand the inside trailing edge of the top sheet.


Glue in the control horn, cut slot for the horn on the top sheet.


Glue and tape. I used some clamps to hold the middle of the sheet onto the ribs.


A finished flap.


Looking at the trailing edge you can see the shape.

Wing: Step 17 - continued

First I did a quick check with both the flap and aileron attached to the wing to check the operation of both surfaces together.

Then finish the aileron as per the flap:

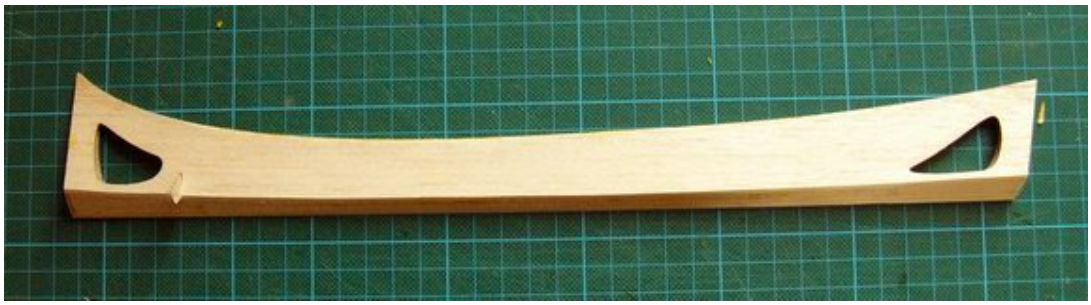
- sand top sheet all over
- sand inside TE of top sheet
- fit control horn
- cut slot in top sheet
- glue on the top sheet

I clamped the assembly to a piece of right angle aluminium to keep the aileron straight.

Then trim & sand the top sheet back to the 45 degree bevel.

Weight of each aileron 7gms

This is good for a laugh! This is an aileron with the top sheet clamped on. I used some scrap 3mm Depron to stop the clamps marking the balsa - you can't see the aileron...



Finished product, one aileron.

And a TE view just for good measure. Not as much 'curve' as the flap...

Wing: Step 19 - Shear webs

This has already been done, quite a few posts ago. I think that was a good decision.

At this stage all I need to do is add doublers to the shear webs that have the holes in them for the push rods. If you stick to the suggested mechanism for the control linkages (ie. on the outside of the wing) you don't have to worry about this.

So I cut and sanded some doublers and also cut the holes in them for the pushrods. Then I glued the doublers in.

Once everything was dry I used a small file to smooth off the holes so there are no sharp edges for the stress to take advantage of.

Also I am about to get to the sheeting stage so now is probably a good time to check all the shear webs are sanded smoothly to the rib profiles. I will do this before I go any further.

This is one of the doublers after gluing and before sanding down. You can just see the smoothed out hole.

Wing: Step 20 - Wing locator pins

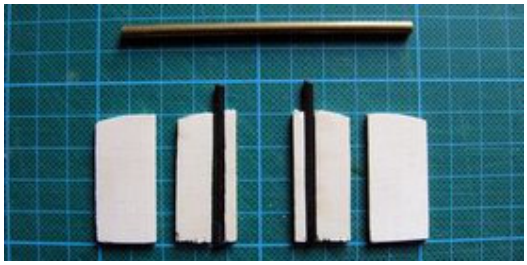
The next step is to install the wing locator pins on the leading edge of each wing half. These are specified as 1/8" CF rod that protrudes 3/8" - 1/2" beyond the leading edge and is parallel to rib 1 and about 1/4" out.

In my case because I altered the wing join slightly I need to get the rods slightly closer to rib 1 to ensure that the rods and their eventual housing tubes do not interfere with the 'neck mounting'.

So I will move the rods closer to rib 1and about the same distance apart as the original design. I am also using 3mm rod.

This is just a case of using a bit of scrap 1/8" ply to build up around the rod, a top plate to cover the whole lot and epoxy it all in place. So off we go...

When all done sand to shape where required. If I was doing this again I would try and sand the LE airfoil shape into the ply bits before gluing.



All the parts required. Two small lengths of tube shown at the top will be gluing into the body as the locating points for the CF rod.


Parts glued in. I 'hen pecked' the ply before gluing with epoxy to get a good bond.


After sanding and all done.

What next?

The offical instructions from here are:

Step 21: Build the motor cradle
Step 22: Sheet the upper leading edge
Step 23: Install servos, motors etc.
Step 24: Sheet bottom leading edge.
Step 25: Cap exposed ribs
Step 26: Cap exposed spars
Step 27: Sand until pretty! Congratulations the hardest part is done.

I am going to alter this procedure slightly so that I can keep the wings nice and flat when the sheeting is installed. So I am going to proceed as follows:

a) Install the servos with their arms but no control rods
b) Sheet the bottom leading edge (excluding the motor area)
c) Install speed controllers etc.
d) Sheet the upper leading edge (excluding the motor area)
e) Install the motor mounts and motors
f) Sheet the motor area
g) Remove the remaining standoffs
h) Add the rib and spar caps
i) Sand until pretty.
j) Don't get too excited - the 'body' looks like it has its interesting bits!

I can do things in this order because I have changed the standard servo mounting arrangement and the servo arms are entirely within the wing. My idea here is to be able to do what appears to be the most complex sheeting (the upper surface) with the wing firmly on the building surface.

Because the motors hang out 'below' the bottom surface I will leave them to last, once the motors are installed you can't put the wing flat on any surface.

Motor mounts

I have an improved motor mounting scheme over what I showed a number of posts ago - I will get to that later.

Electronics

Almost all the electronics in this 'bird' are built into the wings. I will explain exactly what I am going to do in a post just after this one.

Balsa for Sheeting

I have purchase some special light & super-light balsa for the sheeting.

In the inner area (from ribs 1 to 9) I am going to use light (6lb) balsa and on the outer sections super-light (5lb) balsa.

I think that this may prove to be quite an interesting part of the project.

The instructions suggest soaking in water for 20 minutes to make the balsa pliable and then fit to the "tricky compound curves"... time will tell how this works out.

The balsa I have is in 100mm wide sheets, so I am going to need to join the sheets in a few places to make material to fit the required shape.

Also I think making a cardboard template for the sheeting is going to be really useful.

Centre of Gravity

The CG on the Pterodactyl is 1.5" to 1.75" in front of of the centre line of the wing joiner. This is actually quite a way forward. The instructions call for weight in the head to get the Pterodactyl to balance. My initial work leads me to suspect that this is certainly the case and therefore I am try to keep all the weight as far forward as possible. (That is one reason that I mounted the servos as far forward as they would go in the wings.)

It will be interesting to see where the wing balances once it is all complete.

On wet sheeting - I've found out through experience that I should not glue down wet sheeting. When I have it has shrunk as it dried and become wavy. I now wet the wood then hold it in place (wide rubber bands work well for wing sheeting) until dry. Then glue it down.
I don't know if this is feasable on this model though.
I have a wing with one wavy side and one smooth side.

Nice to have someone confirm what I suspected. I was going to proceed exactly as you suggest - dry it to shape and when it is all dry then glue.

As you say the interesting bit will be to see if it works here...

Thanks,
Tim

Right. My project is an Electrostreak. The wing sheet is not really a compound curve.
Also I used 1/32 sheet then had to go back and install sub ribs because the original ribs were not close enough together.

Motor Mount - second attempt

My first attempt at a motor mount met with a thumbs down when I showed it to a few people. Too complex & heavy, also the thrust is taken on screws into end-grain material.

So here is the replacement.

A cylinder of 1/64" ply into which the motor will be held with a thin smear of RTV (i.e silicon sealant). I have been assured that this will hold the motor in fine. The motor mount position on the wing will be notched to accept the cylinder of ply and will produce a strong motor mount.

I cut a length of 17mm wide 1/64" ply. Then sanded down the starting edge of the ply that is where the 2nd layer will start. This avoids a sharp step. This is easy to do because you can see the internal ply layers become exposed as you sand.

Wrap the motor with sticky tape to stop anything getting glued to the motor at this stage.

Wrap the ply around the motor and mark where the overlap starts. Also mark the point where 3 turns are complete. Trim the ply to the length required for 3 turns.

Now a number of alternative gluing systems were suggested, but I decided to use the PU glue that I normally use for laminating. So I put the ply down with the sanded starting point face down on the bench and put on a thin layer of PU glue from the overlap point to the end of the ply. Then a very light spray with water.

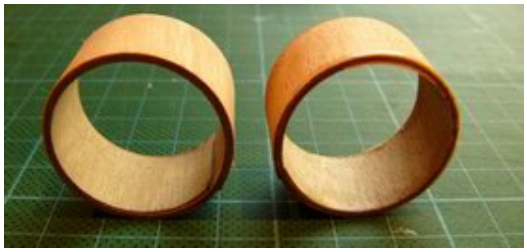
Now I wrapped the ply onto the motor keeping the ply as tight as possible. I added a length of strapping tape to the end of the ply to allow me to keep the ply tight as I got close to the end.

Then I used a couple of rubber bands to hold the whole thing under pressure while the glue dried.

When dry sand the edges of the tubes and make them the same size.


This is the sanded starting point of the ply.


Using the motor as the mold with the ply wrapped up tight and held with tape and rubber bands.


This is the result before sanding the edges to clean them up.


The tubes on the motors.

Motor Mount - continued

It is easier to work on the wing before any sheeting goes on so the next thing I did was to notch the motor mount area to take the tubes.

The important information (from Ron Marston) for the motors is this:
Quote:
I mount the motors with about 1/2 degree of down thrust, relative to the leading edge ply. The face of the motors extend about 1/4" beyond the leading edge of the wing, and the props are about 3/4" beyond. If you mount them closer it will increase turbulence and noise.

I mount the motors slightly above the leading edge ply (about 1/8"). There's more airfoil above the l.e. than below. The motors still hang out a little more on the bottom of the wing than the top (at the motor's rear end bell).

With the motors I have (Warp-4's) the best position is where the ply tube lines up with the rear of the motor. Then the front of the ply is 6mm behind the LE. In this position the prop is just a bit further than 3/4" beyond the leading edge.

So I marked where the ply cylinder needs to go and with a file made two notches on each motor mount.

The notches don't quite have straight sides because of the curve of the cylinder and because the motor shaft is slightly above the leading edge ply.

The last thing I need to do is check that both motor mounts have the shaft at the same position and sit in the 1/2 degree down-thrust position. A small amount of adjustment may be required to achieve this.

When I finally glue these in position I will use some scrap balsa to reinforce the join between the cylinder and the leading edge.


The notches in the leading edge motor mount area


Vertical view showing the position of motor & prop.


The cylinder/leading edge join.

Electronics

Now is also the time to seriously think about the electronics and how to connect them all up. The 'obvious' stuff is shown in the diagram below (note: my flap servos are in non-standard positions):

- Two servos per wing half, these will require extensions to get them to to the wing join area;
- one motor and ESC power wing half. These also require a short power extension on the input to the CC25s to get them to the wing join and also the input signal to the CC25 is not quite long enough.

The power is from a UBEC and I don't quite know yet whether to install this inside one of the wings (between ribs 1 and 2) or somewhere else (ie. in the body). I will need to bring out the CC25 power somehow so that I can reprogram the CC25 in-situ, however the BECs are not going to be used when flying.

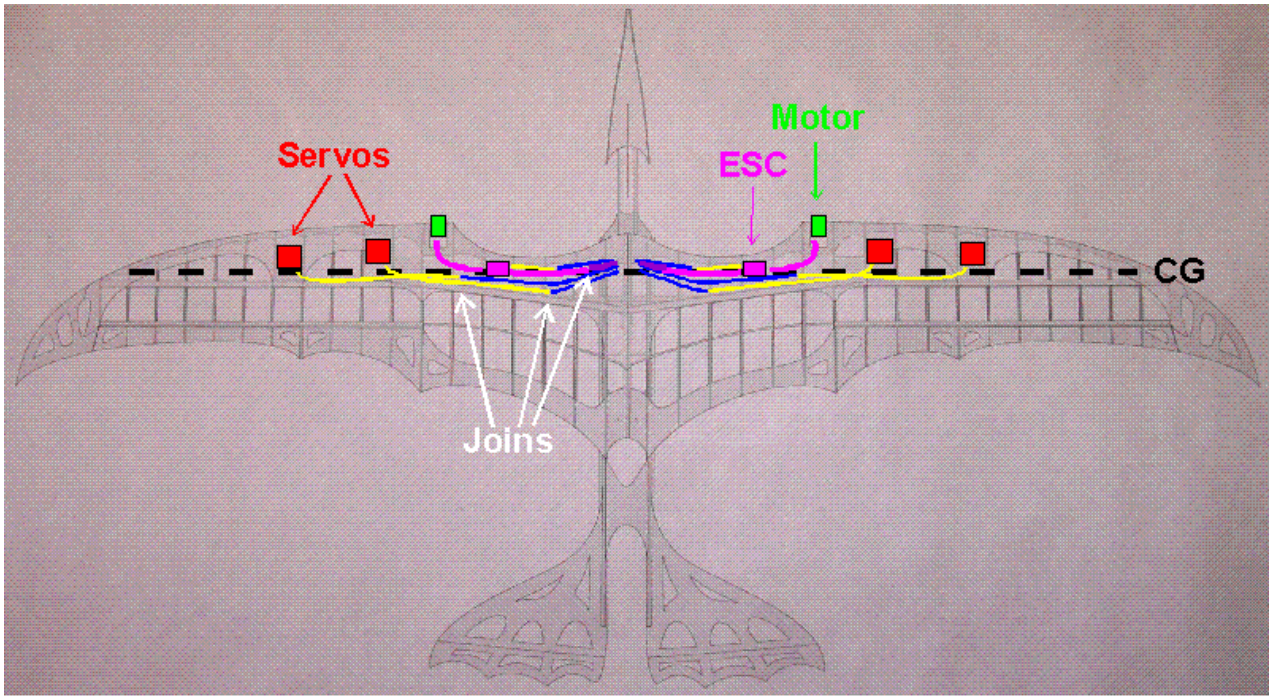
There is also the receiver and two servos for the V-tail to install as well as two 3S Li-Po batteries. There is no suggested positions for any of this in the plans...

The body is about 65mm wide and looks like it was designed to take LiPo packs that were about this width and relativly short - today's LiPos are generally longer, which is not going to help the CG. So I have ordered two 16C Align 2100mah 3S LiPos that are 34x102x20mm and weigh 142gms each. These have a similar form factor to the Polyquests and should give a reasonable flying time. I am going to connect these in a 3S2P arrangement, however I will wait until I receive the packs and see what they look like in terms of balance before deciding.

I have in the past had some problems with getting reliable receiver operation and I am starting to think that I need to get the body constructed so that I can hook up all the electronics and check the radio operation before it is all stuck inside the wings. This would have the added benefit that I would find out how the CG looks...

Another issue is whether to have one connector installed between the wings that goes together when the wings are connected and a second connector coming out of one wing with all the signals. (ie. all the servo signals plug in via a single plug into one wing and then go to the other wing via the inter-wing connector). Or have a connector into each wing with two cables inside the body. Having a inter-wing connector would make things more fool-proof and probably less cluttered inside...

Lots to think about here...



Basic wing connections.

[/QUOTE] I will need to bring out the CC25 power somehow so that I can reprogram the CC25 in-situ[/QUOTE]

To program the Phx25's youll only need access to their power lead and the lead that plugs into the receiver for the Castle link. Plug the Castle link into the PC, start the software, then plug a battery into the power. Only program one at a time.

I have successfuly mounted a 16/15/6 using a balsa tube formed by wrapping damp 1/32 balsa twice around the motor, waiting for it to dry, then tacking the exposed edge with thin CA. Remove the motor, glue it up and attach it to the airframe.
Your method is elegent and much stronger.

---

feathermerchant,

I have just realised what you are saying. (Sorry a bit slow here..)

It sounds like I don't actually need to power the CC25 using the servo lead. You are suggesting that I can power the CC25s using the battery input and with just the servo signal connected to the Castle link.

I had just assumed that you shouldn't have the battery power connected when programming the ESC. I have no idea where that idea came from.

I will keep this in mind.

Tim

Slight detour...

A slight pause here, then there is going to be a detour. The initial pause was caused by work commitments, with any luck these will return to normal shortly.

(First the pause.)

I am still waiting on a cable for my LiPo balancer to allow me to charge the LiPos and then I can test the electronics. I purchased the Align 2100 3S LiPos (I think that these are the same as the Hyperion 2100 CL packs). These will fit side-by-side (ie. 68x102x20mm) and fit exactly into the width of the body. This will make more sense once I post some photos of the construction.

(Then the detour)

I have also decided to construct most of the body next and then go back and complete the last steps on the wings once I have had a chance to look at the way the body and wing fit together.

When constructing the body I am going to lighten the tail as much as possible to keep the overall flying weight down. Given the position of the CG every 1gm of weight in the tail requires another 2gm in the nose for balancing. (I have added the CG line to the diagram a few posts above.)

To this end I am going to:

- Replace the 5/16" (~8mm x 1mm) CF tube longerons with 6mm x 0.5mm CF tube covered by CF

socking. This will be explained shortly, once I have worked it out myself Thanks to Salto (Graham) for the ideas here. The execution is up to me...
- Take a little more material off the tails themselves.
- Probably go back to tape hinges on the tail (although I prepared for plastic pinned hinges the tape hinges are much easier to manage, and lighter).

I need to get some more epoxy and a few other bits and pieces then I will be right to proceed - there should be some more progress this weekend.

Tail: CF Longerons

The Pterodactyl uses two CF tubes as the longerons with the V-tail attached to the tubes and the tubes attached to the sides of the body.

These CF tubes are specified as 5/16" tubes. To reduce the weight a bit I am going to costruct some stronger lighter weight tubes using 6mm x 0.5mm tube covered with an cross weave CF sock. The cross weave CF will reinforce the tube and resist torsional forces and stop the 6mm tube bursting.

In addition to saving weight, the final tube will be a better match against all the 1/4" balsa it has to attach to. This should make the tail look a bit neater.

So the first step with the body is to construct these tubes.

The procedure is as follows:

- Trim the tubes to a bit longer than the final requirement, say 660mm (26 inches).
- Cut a length of heatshrink tube to a bit longer than the CF tube. About 1/2" longer at each end is about right.
- Scuff up the outside of the 6mm tube.
- Cover the 6mm tube with the CF sock and pull tight, tape the ends of the sock.
- Mix up the epoxy, you need a slow setting time to allow for working, 30 minute epoxy is fine. I mixed up about 15mls of epoxy and that was about right, there was a little bit over - you don't want to run out in the middle!
- Wearing gloves use your fingers to wet the sock with epoxy and use a paper kitchen towel to run up and down to ensure the sock is wetted out. Don't rush this step. Spend enough time to make sure that all the CF sock is wetted with epoxy. Because the towel will soak up the epoxy don't do that part until you have given the whole lot a good workover by hand - make sure you do the very end bits as well (ie. where you are holding it).
- Now this is the bit I learnt as I went along. At this stage the CF sock will no longer be tight. Pull the ends and work the sock until it is tight.
- Put a heatshrink tube over the whole lot. As you pull the heatshrink tube over the assembly it will stretch the CF sock and keep it tight. Whatever you do, **do not** pull the heatshrink 'backwards' - if you do it will bunch up the sock and create a lump.
- Again pull the ends of the sock and try and get the sock as tight as possible.
- Starting at the middle of the tube use a heat gun to shrink the tube to compress everything.
- Work from the middle to the ends, as you go the excess epoxy will be squeezed out of the ends. **Do not** skip bits, otherwise you will end up with a bulge in the final tube. Twist the tube and work the heat gun backwards and forwards...
- Watch out for overheating the heat shrink tube, you don't want a fire or holes in the tube. The trick here is that you need a bit more heat than normal, because the tube cools when it touches the sock/epoxy.
- Leave the whole thing to set.
- When the epoxy has cured cut off the heatshrink tube.

The result should be a nice and strong CF tube.

In my case I started with a 660mm x 6mm x 0.5 OD tube weighing about 10gms and ended up with a 6.6mm OD tube weighing 14gms. This is compared to a standard 660mm x 8mm x 1mm CF tube at around 18gms.

So the pair of standard longerons (24.5" long) would weigh 35gms and mine are 28 gms. Allowing for the position of the longerons relative to the CG this is an overall weight saving of about double this, or about 14 gms in AUW.

I don't know if this is worth the effort - but it has been an interesting diversion - and with weight every little bit counts.


This is the original 6mm tube and some of the CF socking.


The sock is now on the tube and taped at the end. Above the tube is the heat shrink tube.


Gloves on and mix up the epoxy. You need a container that is large enough to get your fingers into. I use the bottom part of a paper party cup.


The best part! work the epoxy into the sock with your fingers.