J&H Aerospace Mini BOT Build Guide

Updated January 10 2021

Welcome to the Mini BOT build guide. This fantastic little airplane can be launched in 4 ways, will climb on absurdly light lift, and flies in pretty tight fields without a sweat. This model can be built in a day or two, due to the self jigging construction, which takes out the tricky stuff typically required of a balsa airplane.

To build this model, you'll need the following:

Thin CA
Medium/Thick CA
Hot glue
Xacto Knife/Razor Blade
A sanding block. I use 80 grit on one side, and 240 on the other
A razor plane (Optional)
Covering iron
Soldering iron/Lighter/Heatgun (To shrink heatshrink)
Pliers
Wire cutters/Dremel with cutoff wheel

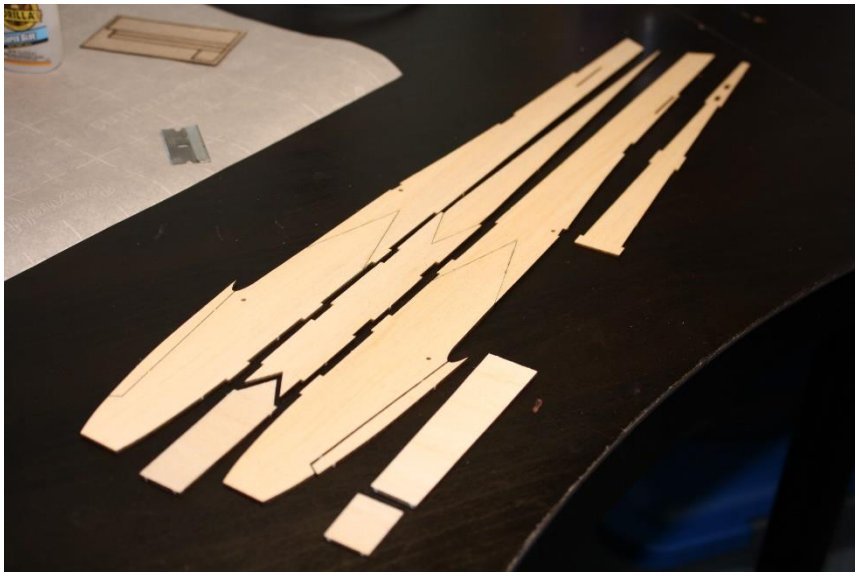
I strongly recommend reading over the Drifter II build guide to get and overall feel for assembly. The BOT goes together pretty much the same way, but with just a few more steps. The Drifter II guide can be found here: https://jhaerospace.com/wp-content/uploads/2020/07/Drifter-II-Half-Scale-Instructions-1.pdf

To begin with, check the included materials list that came with the kit, and assure that everything listed is included.

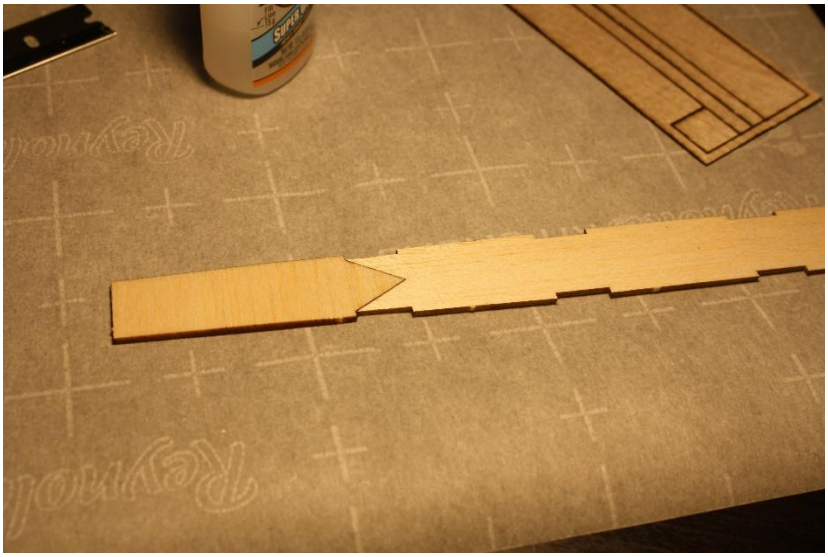
If you are intending to install an electric motor, scroll to the end of this guide ***before building*** anything to see the required differences over the standard Mini BOT.

I like to start with the fuselage, so that's where this guide will begin. You won't need plans or anything, It all self jigs together. All glue joints are made with thin CA, unless otherwise stated.

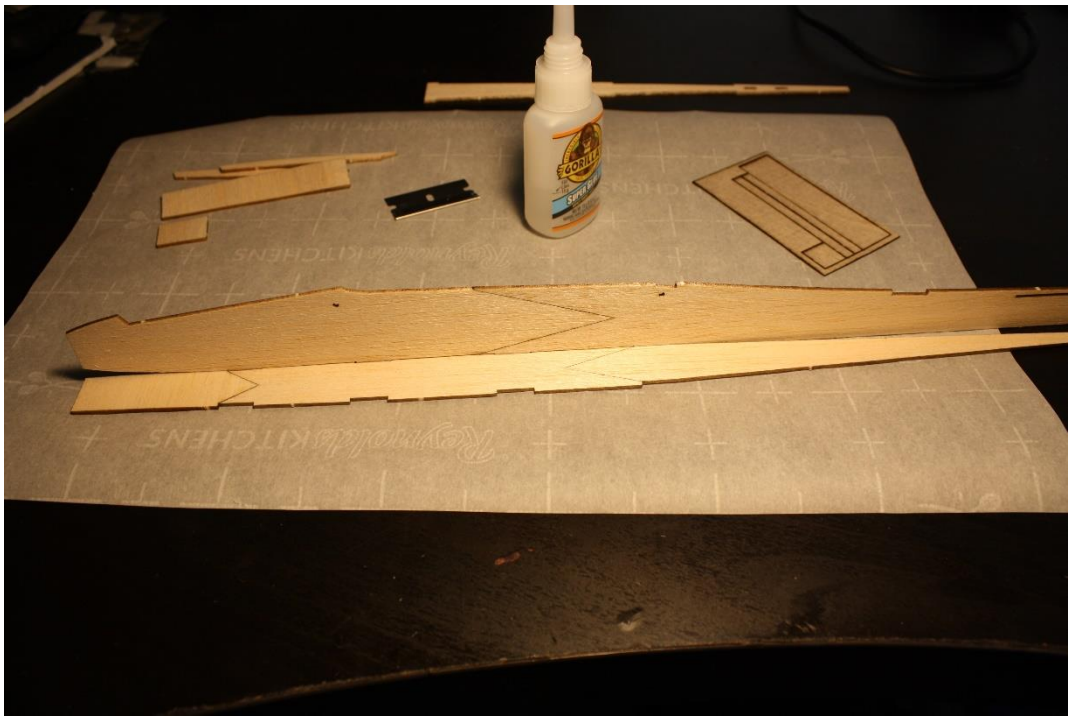
Lay out the parts as shown. The two fuselages sides are slightly different. The one with the slot slightly higher up goes on the left hand side. Be sure that this is correct, otherwise your control rods will not line up with the horns later on in the build, assuming you follow the instructions exactly. If you accidentally get it wrong, no worries, just reverse the sides the control horns are mounted on the rudder and elevator.



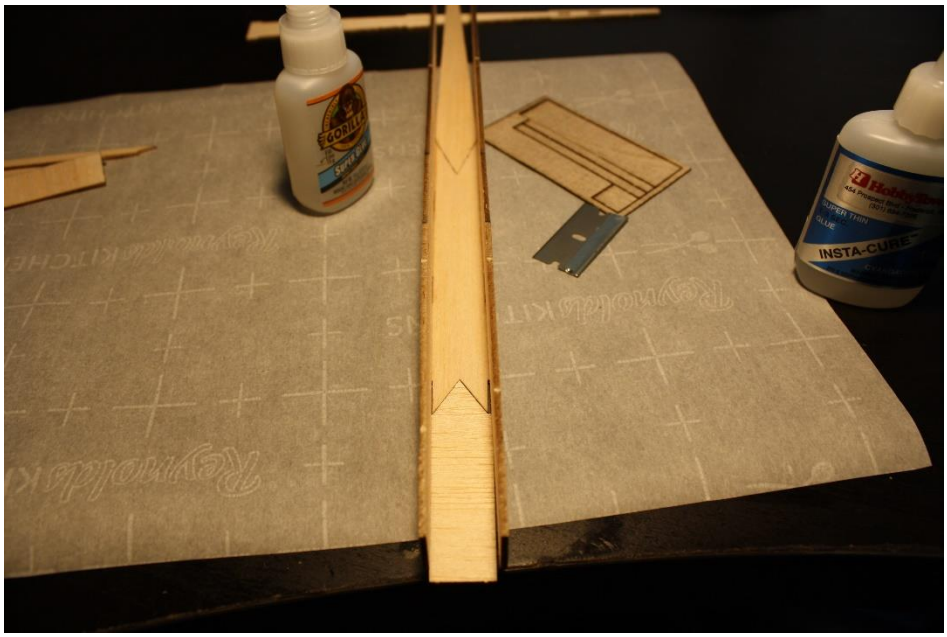
This stuff will come from 2 sheets. One sheet with most of the stuff, and then a tiny sheet with the crossgrain balsa. Locate those sheets, and you'll be good. Grab the piece of crossgrain balsa with the triangle on the end. This gets glued onto the bottom sheet as shown.



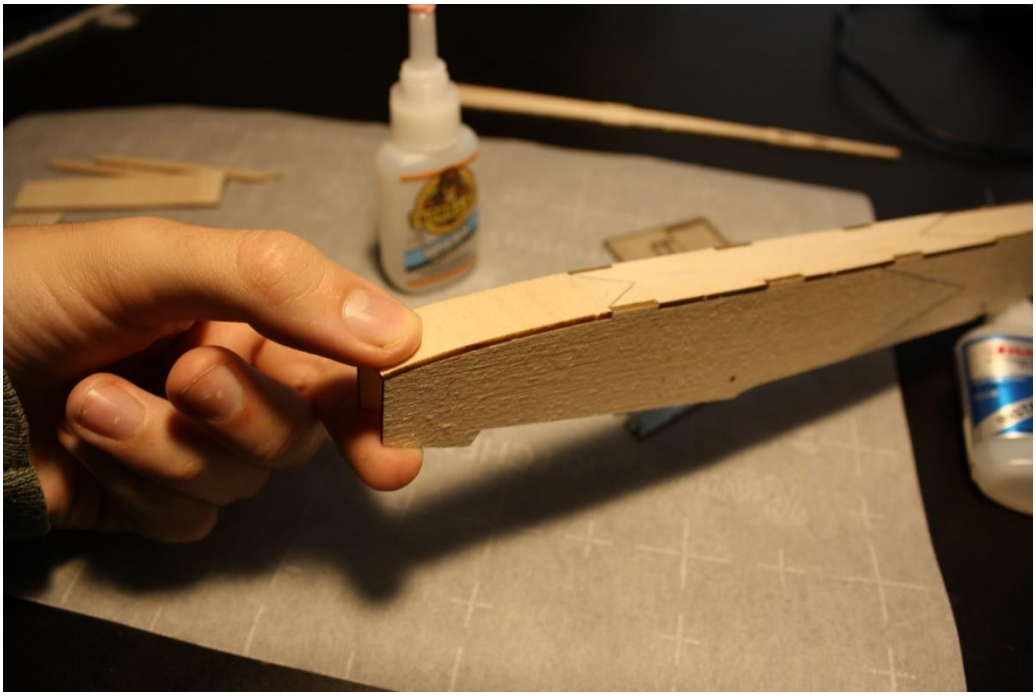
Next, glue a side onto the fuselage bottom. Make sure you get the sides correct. The one with the high slot in the rear goes on the left, the side with the lower slot goes on the right. Just glue the straight center section in place for now. Don't glue the front and back sections in place.



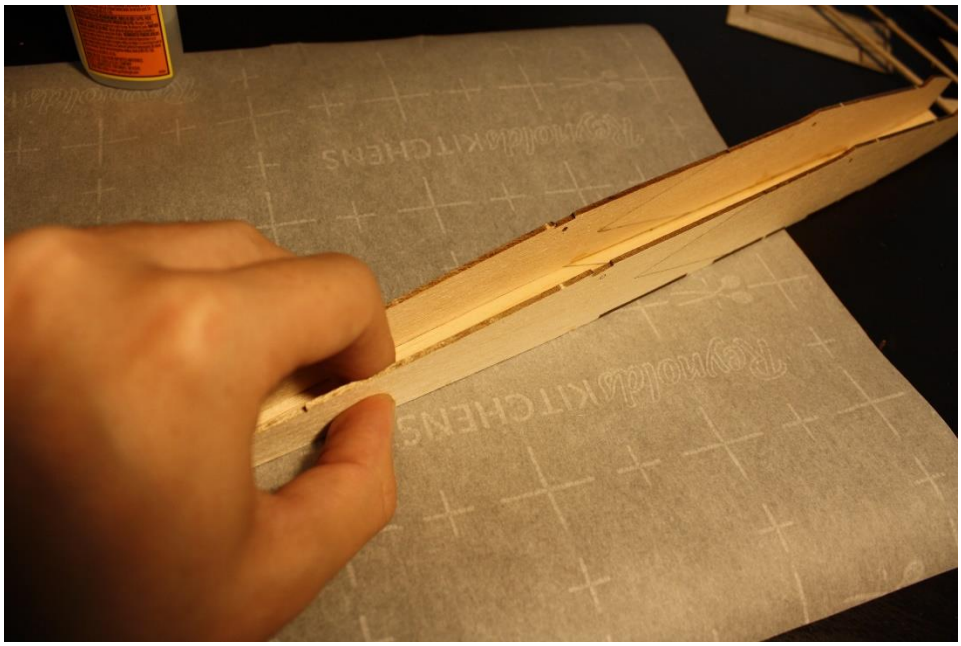
Glue the other side on in the same way, by just gluing the center section on.



Now pull the sides together in the front of the fuselage, and glue in place.

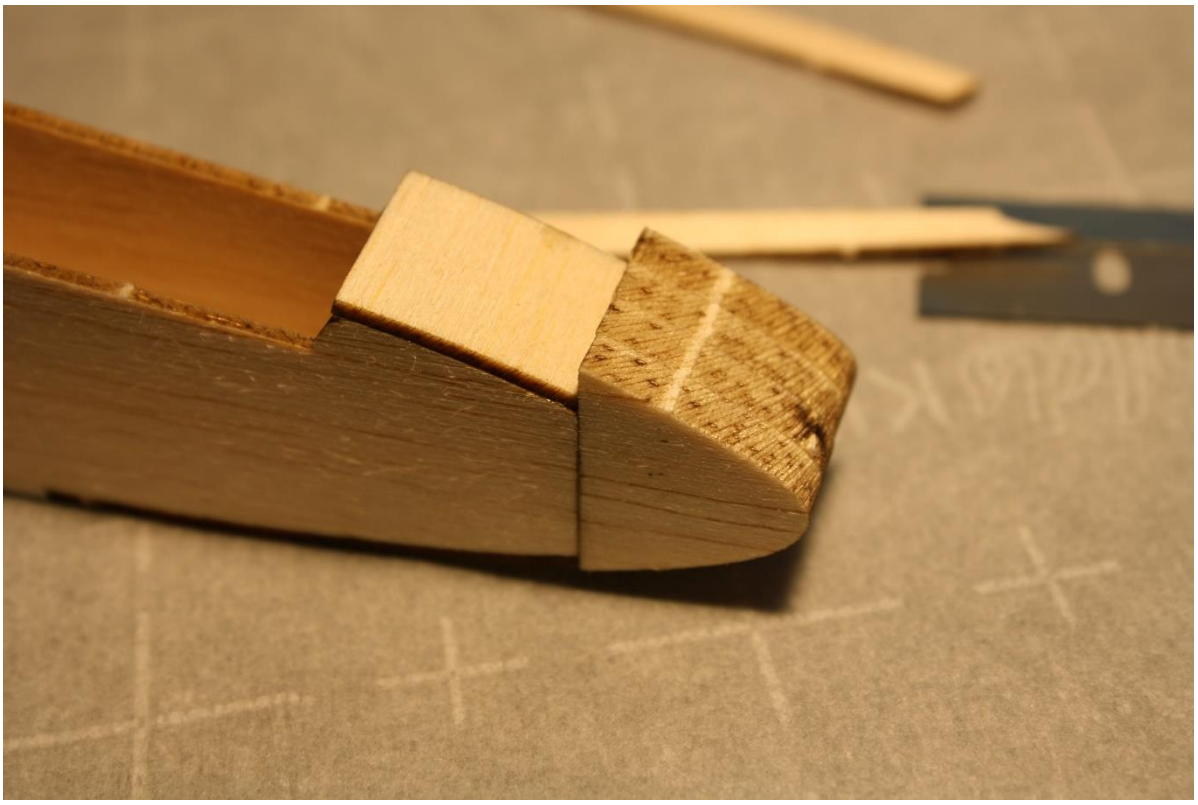


Now move on towards the back. I glue the rear section in place a few inches at a time. Start with gluing the beginning of the rear (closest to the trailing edge of the wing), and work your way towards the tail. Try to keep the sides at 90 degrees to the bottom of the fuse. When you get towards the rear, it gets pretty tight. This is where it's useful to have a fine applicator tip. If you can't get down there, apply the thin ca from the outside of the fuselage. It'll wick right into the wood.

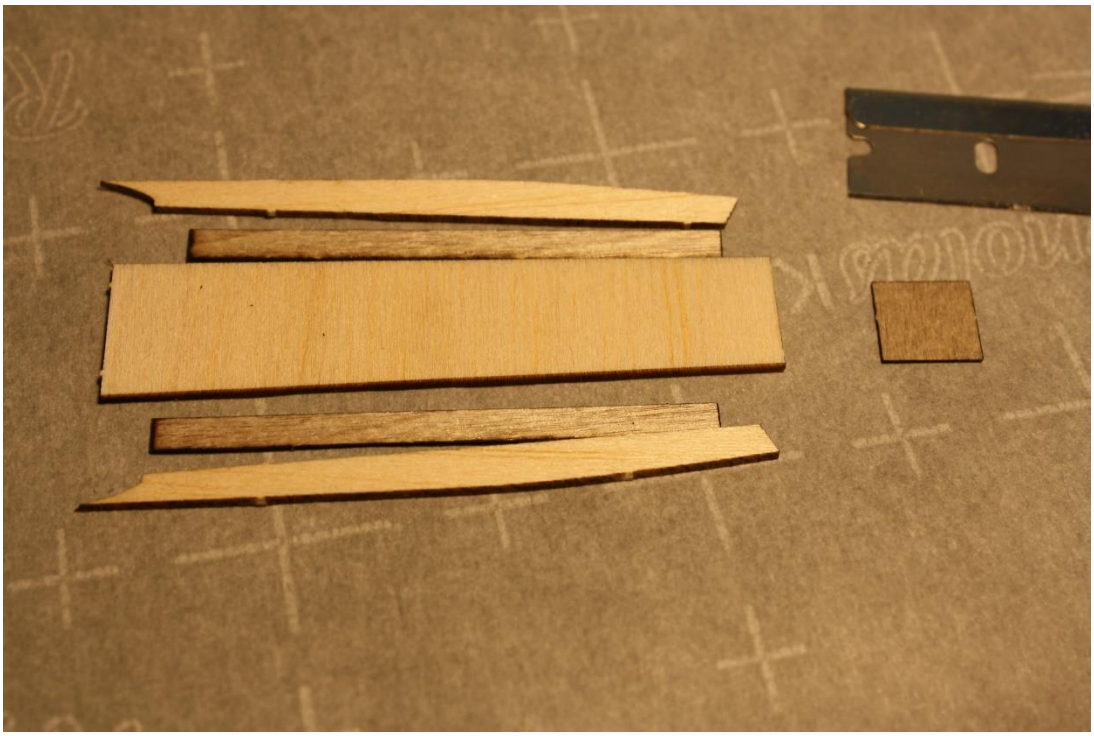


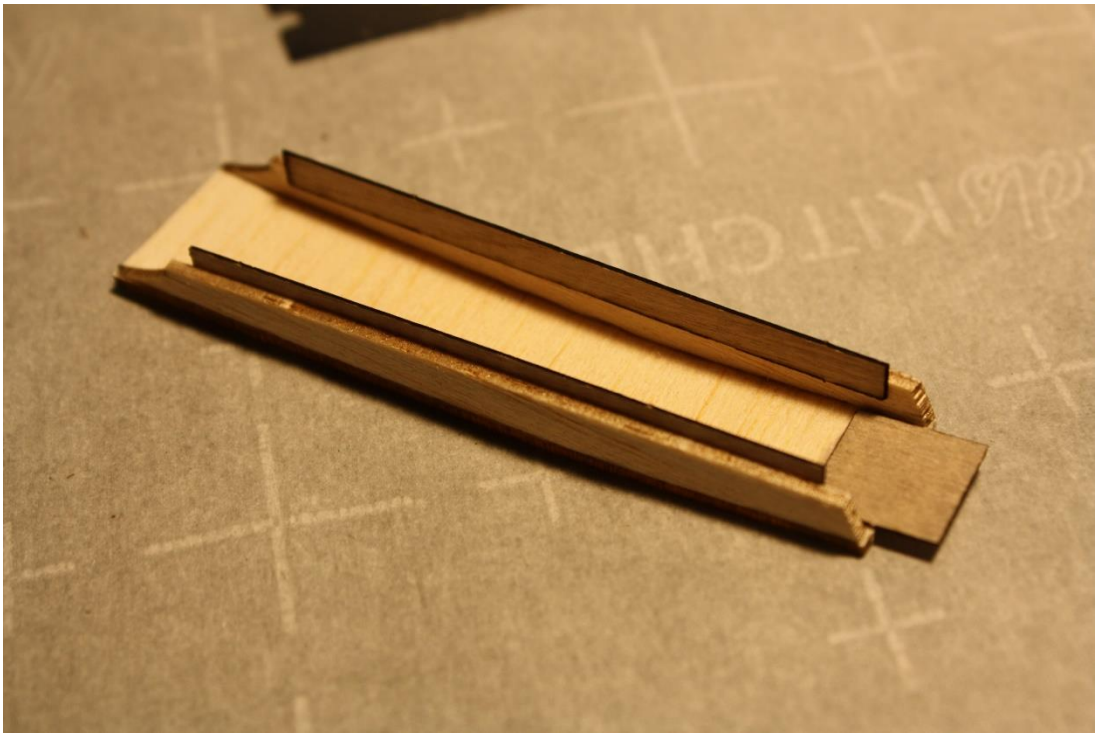
Now grab the top sheet. There are a few ways to glue this on. If you want, use medium or thick ca, apply glue on all of the mating surfaces, and put the top sheet on. I prefer a different method. Place the sheet on, hold it in place, and run some thin CA along the joints. It'll wick right in. I start at the back and work my ways forward.

Go back to the front of the fuselage. On that crossgrain parts sheet, grab shortest piece of wood. Glue it to the top of the fuselage on the front. Sand the front of the fuselage flat. Grab the 3/16” sheet, stack the noseblocks up, and glue them to the front of the fuselage. Your noseblock will fit a little better.

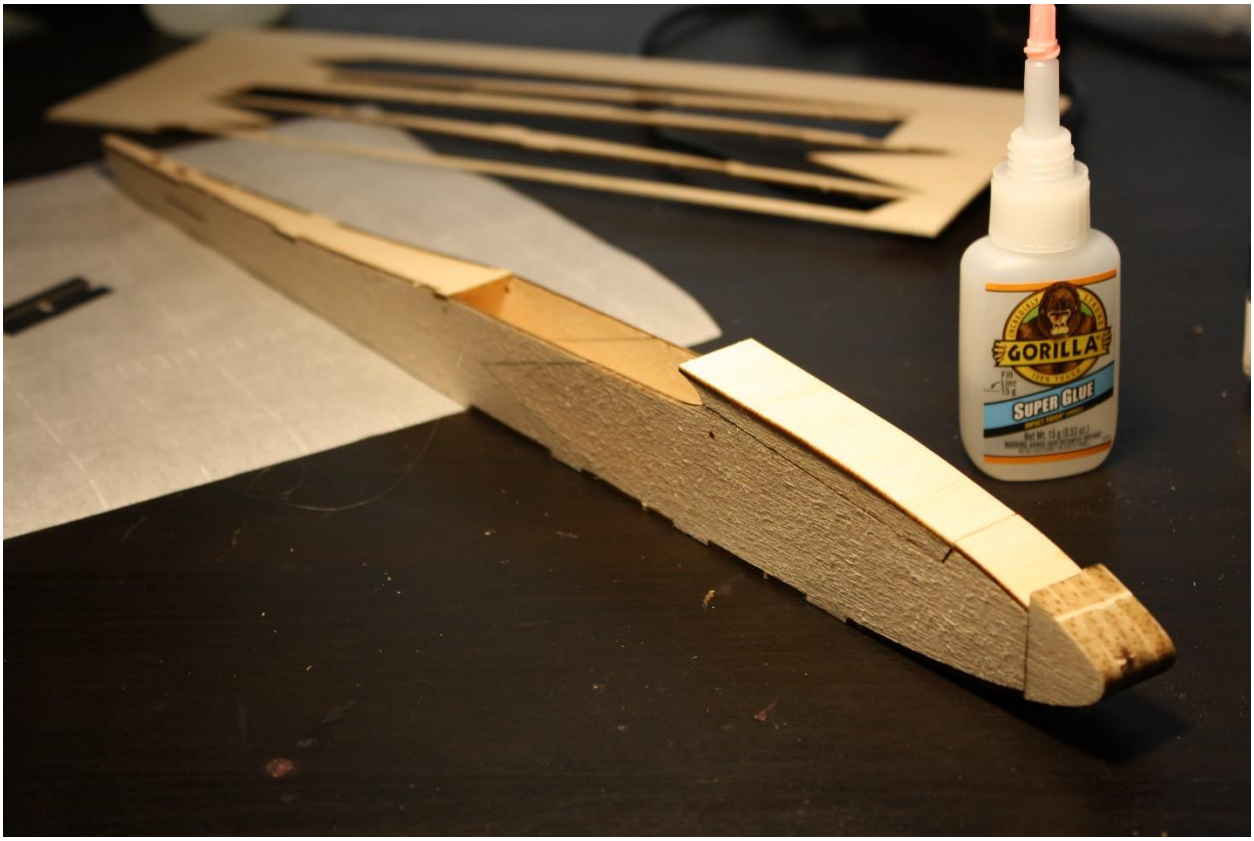


Grab the longest crossgrain piece of balsa, the little canopy rails from the fuselage, and your sheet of 1/64” ply. Assemble as shown.





That’s the basic fuselage done! Next up is the wing.

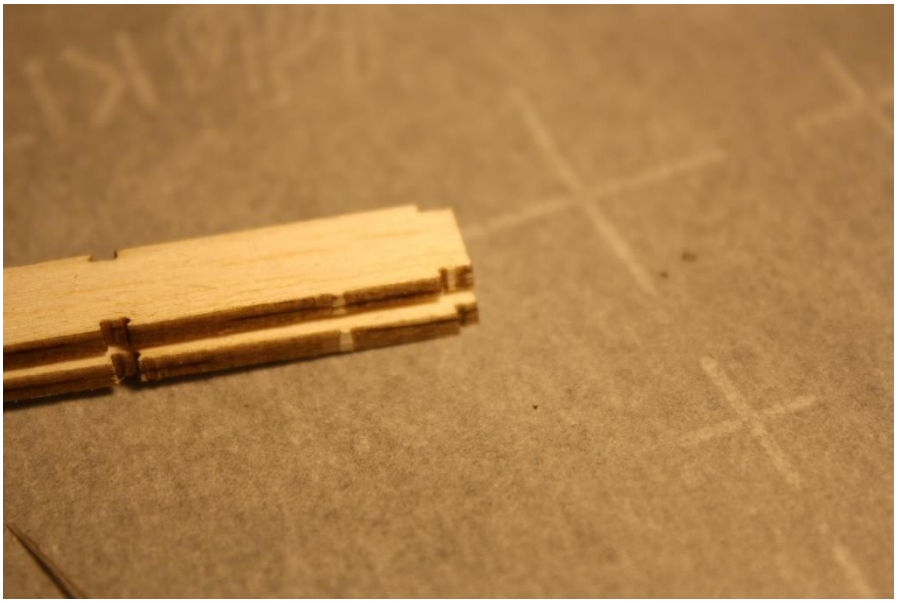


This is the parts sheet for the center section spars and leading edges. The side of the spars on the left is what will point towards the center section of the wing. There are two kinds of spars, and there are two of each. One has slightly wider slots at each edge, so pay attention to the numbers of each part when you do the install. SP1 is the bottom spar, SP2 is the top spar.

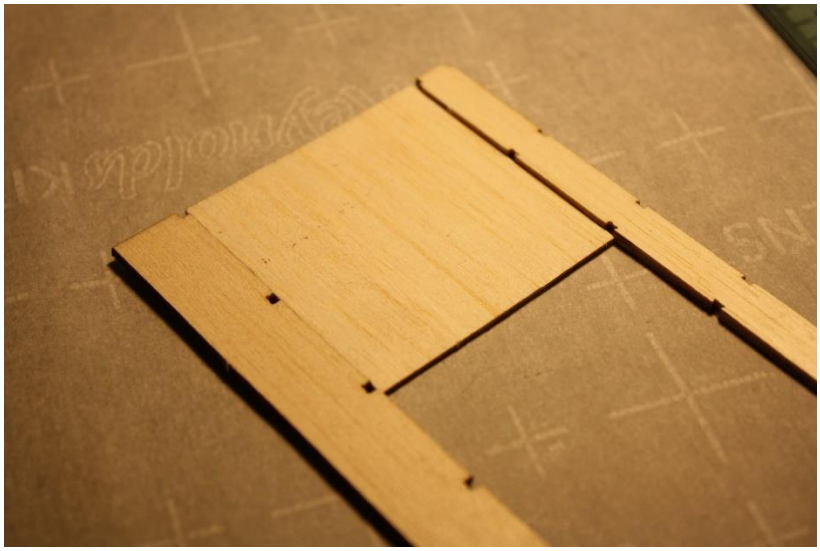
The same applies for the tip spars. There is one set per parts sheet here, so you only need to worry about which one goes on the top and bottom. As before, SP1 is the bottom spar, and SP2 is the top spar (To avoid confusion, tip spars will be referred to TSP1&TSP2 from now on).

You'll need a few sheets of wood for the wing. You'll need the sheet of 3/32" balsa, the sheets of ribs (1/16"), the sheet of 1/32" balsa, and the sheet with trailing edges, turbulator spars, shear webs, angle gauges, and a few other things (1/16" thick).

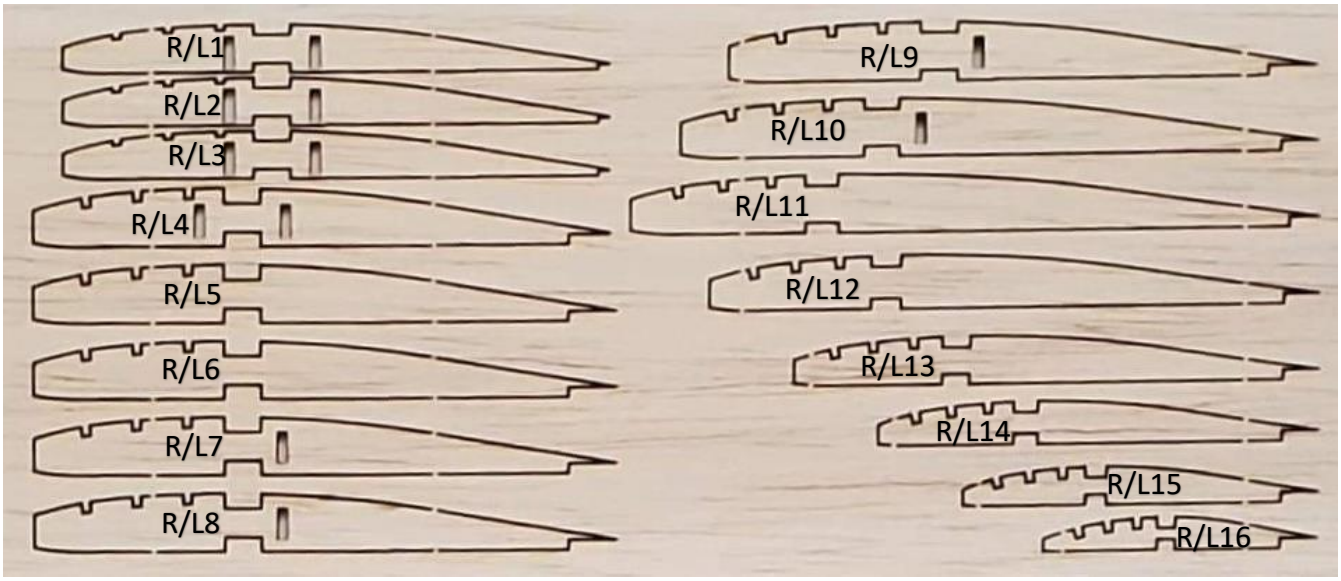
For now, pop out two of the 3/32" wing spars (SP1&SP2). Make sure you pick out two right next to each other (again, SP1&SP2). As seen in the photos, these spars aren't identical. The top spar(SP2) has a slightly wider slot, to allow for the ribs to slant over. You'll see what I'm talking about in the photo.



Layout the ribs, 1/32" balsa, trailing edges, and spar (S1) as shown. The 1/32" balsa sheet is the 2nd widest one (S1, Scroll to next page to see labeled parts sheet). It'll be very clear which is the right one when it comes time to dry-fit. ***Pay attention to the slot locations!*** The 3 slots closest together are the root, so make sure they are on the side of the 1/32" balsa! If not clear, look closely at the next few pictures. Glue the 1/32" balsa to the trailing edge, and then to the main spar. I find it easiest to do this with the 1/32" balsa butted up next to a ruler. This keeps everything at the right depth.

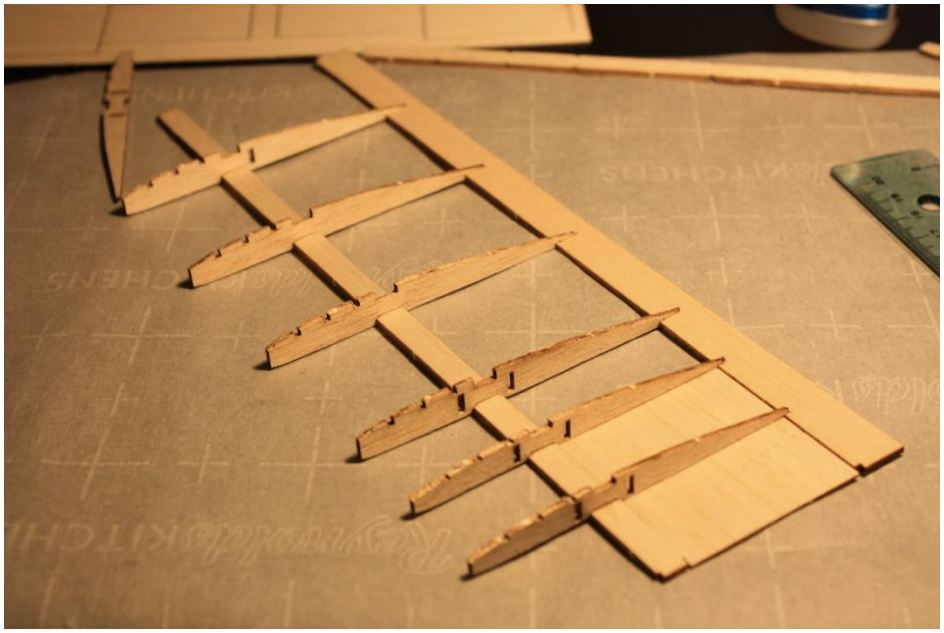


All ribs are mirrored along the center of the sheet, so they are symmetrical, hence R/L (Right/Left). Rib one is the root of a center panel, heading outwards to the last rib at the tip rib 16. You might find it helpful to mark the ribs with a soft pencil or marker for reference, or you can always come back to look at this photo to figure out rib numbers.

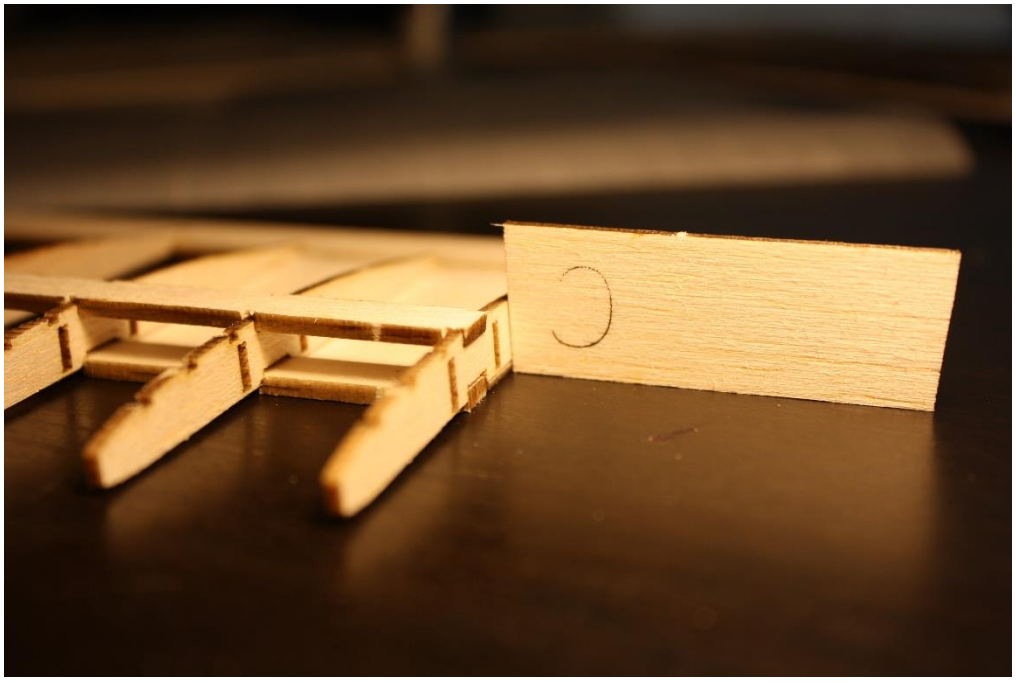


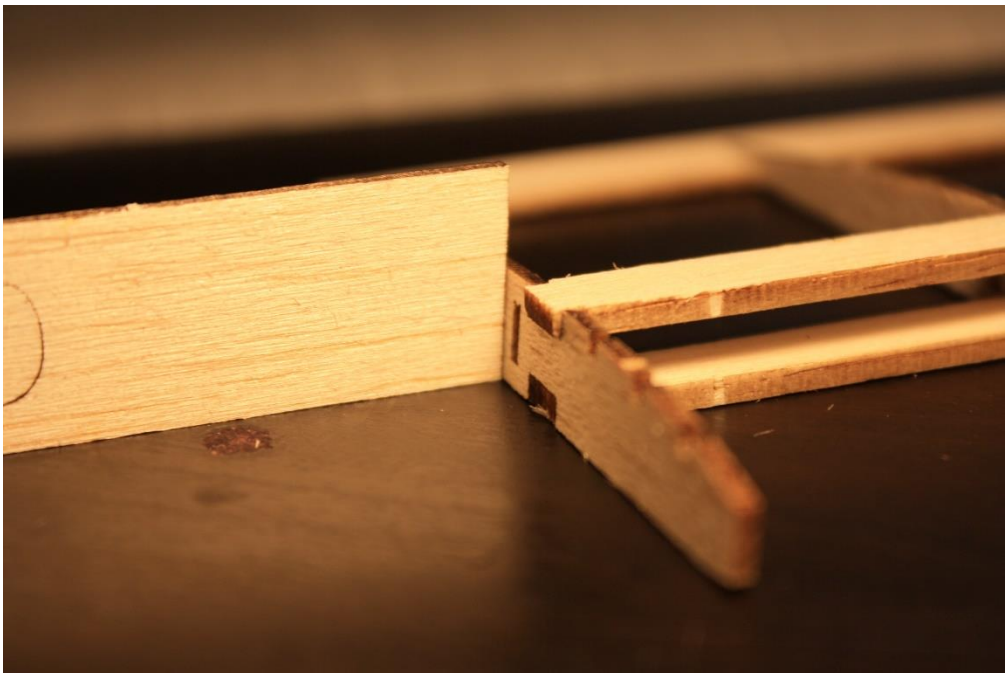
Same deal for this 1/32 sheeting. Both sides are symmetrical, so they can be interchanged between right and left wing panels.

Glue ribs 2-7 in as shown. Keep them vertical. The ribs 2&3 go on top of the sheeting.

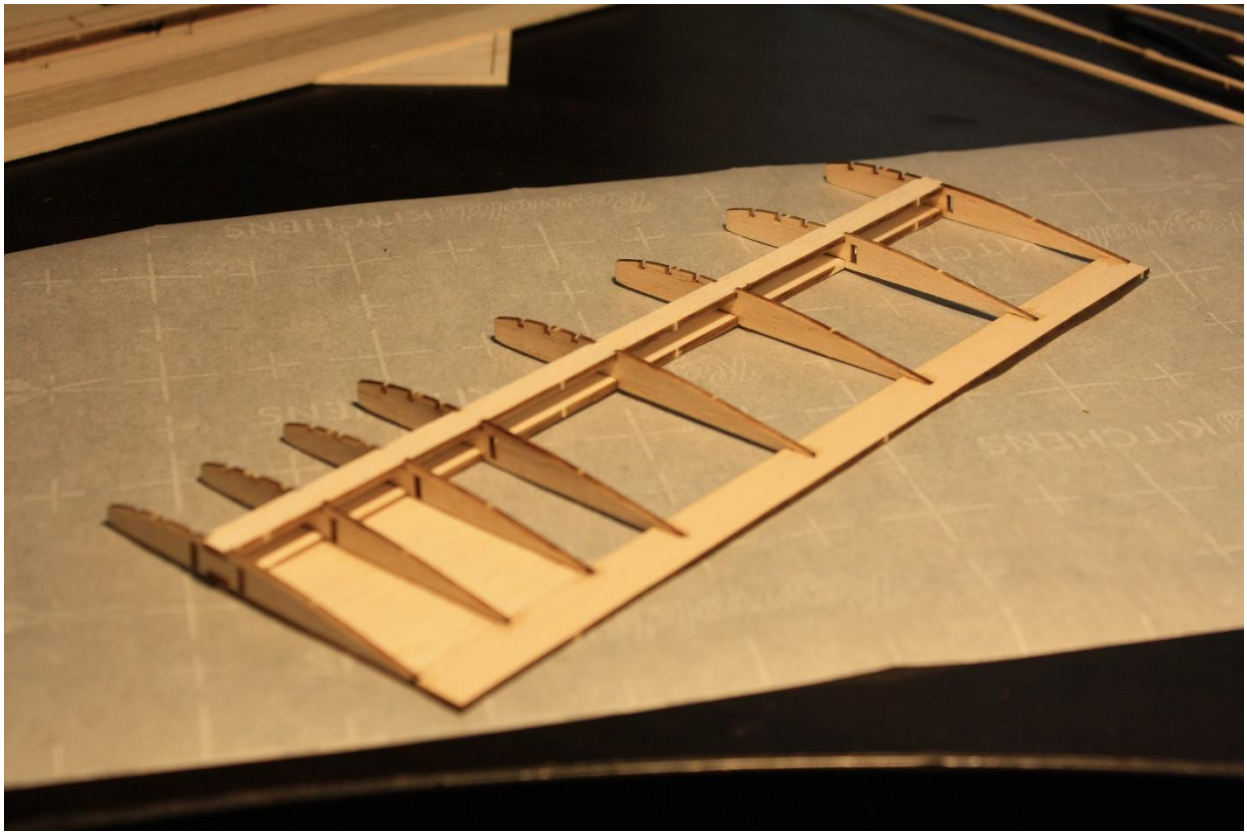


Dry fit the ribs at each tip (1&8), and dry fit the top wing spar(SP2) on. Do not glue it in place yet. Grab the angle gauge. For the rib on the sheeting (rib 1), use the side of the gauge closest to the C (Center) cut into the gauge. Once you have the rib at the right angle, glue it to the top and bottom spar, and sheeting. Now go to the outer tip rib (rib 8), and do the same. Use the other side of the gauge (Farthest from the C), as the outer dihedral is steeper than the inner. Once this is all done, glue all of the ribs to the spars top and bottom, as well as the trailing edge.

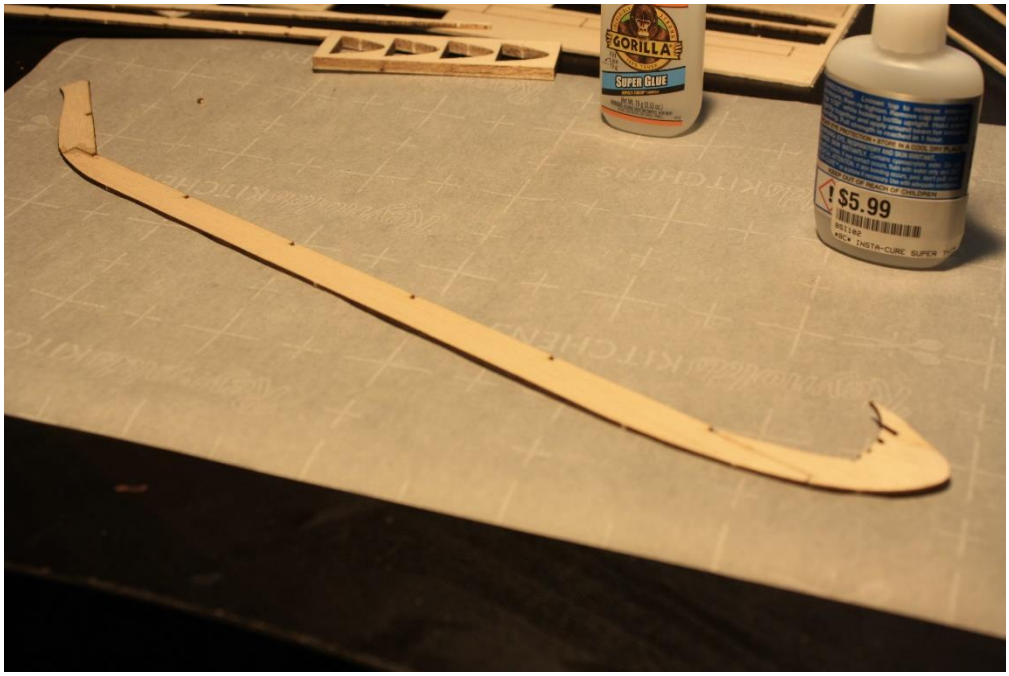




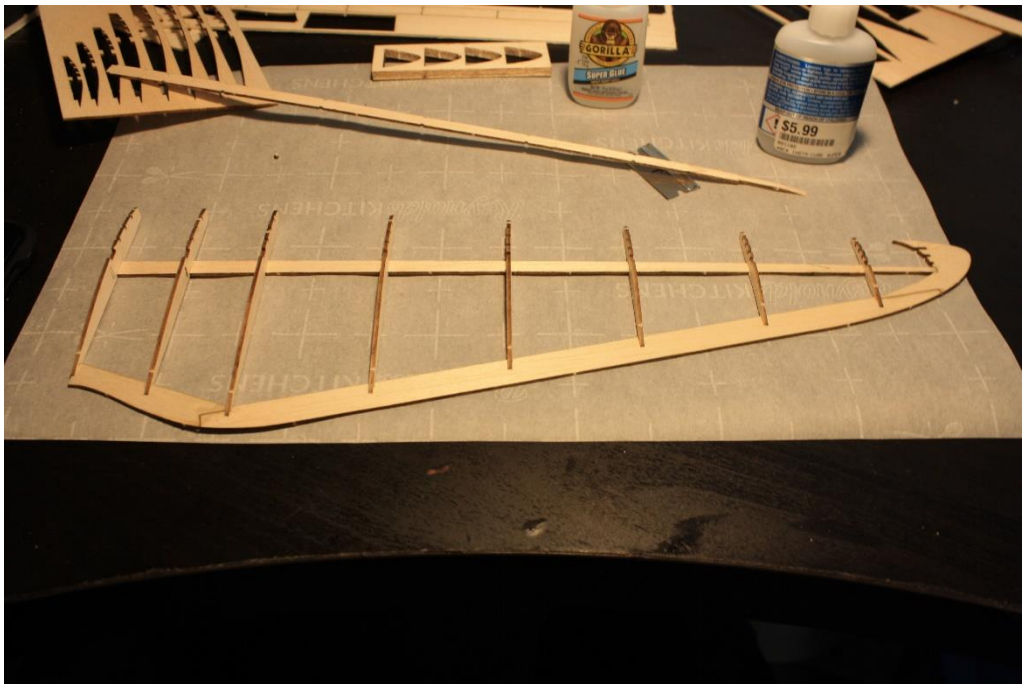
It should now look something like this:



Moving on to the outer wing panel, assemble the trailing edge as shown

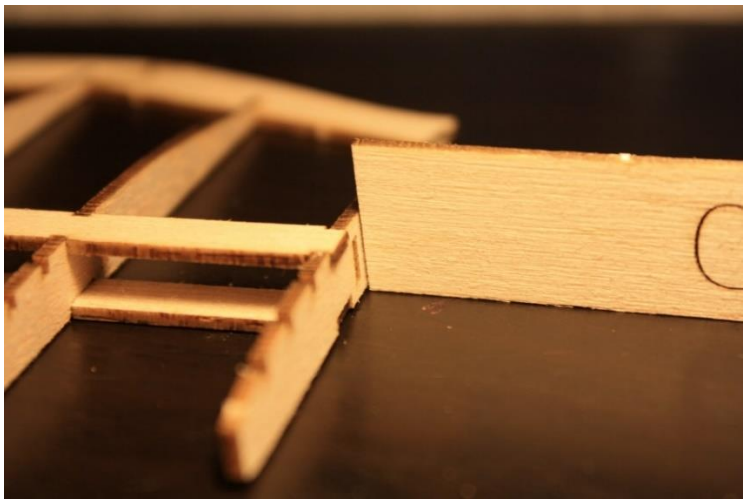


Grab your 1/16” wing spars. Like before, there is a top and bottom wing spar(TSP1&TSP2). The top spar is the one with the longest slot at the wide end. Get the bottom spar(TSP1), and glue it into the farthest aft slot in the wingtip. Grab your wing rib sheet, and dry fit all of the wing ribs (9-16). Rib 9 at the root, rib 16 at the tip.



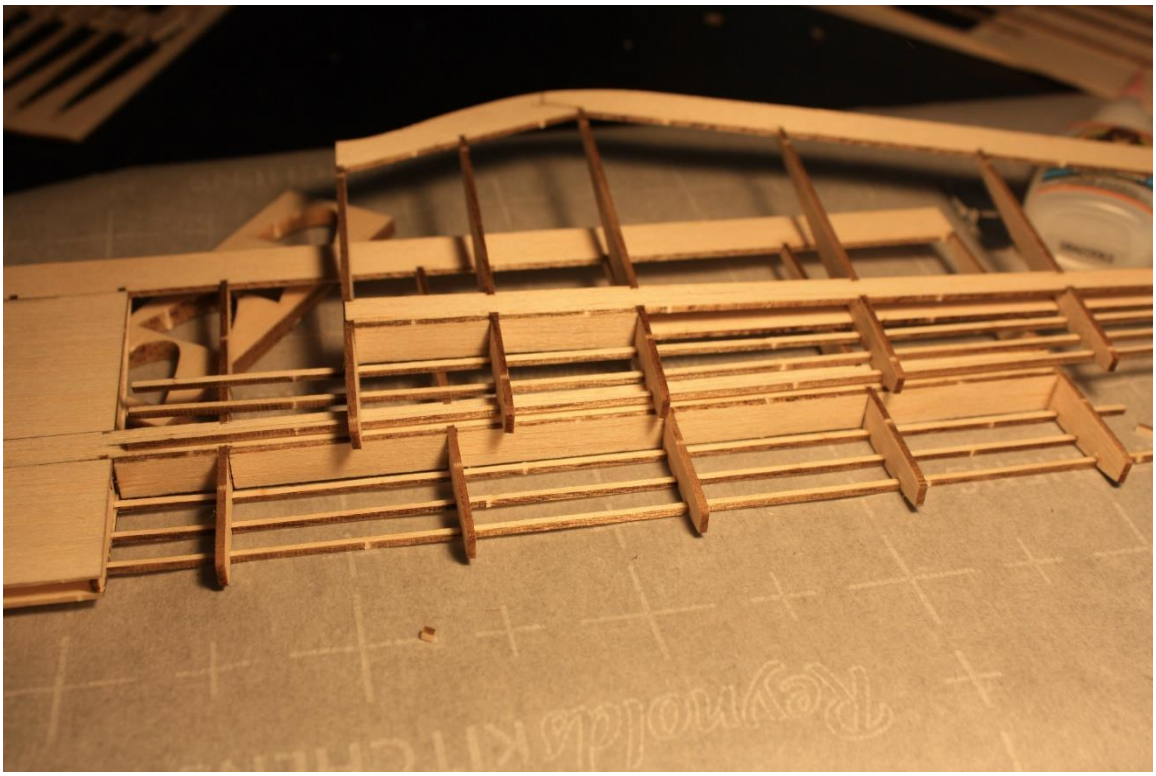
Get the top wing spar (TSP2), and round off the bottom of the tip as shown, then, slot the spar into place.

Grab the angle gauge, and tip the rib (Rib 9) to the angle on the gauge, on the side opposite of the C. Once at the right angle, glue the rib to the top and bottom spar, and trailing edge. Make sure rib 9 is pushed all of the way into the slot in the trailing edge. This will ensure the root is the correct chord , preventing gaps late on. Then glue the rest of the ribs to the spars and trailing edge, again, making sure to keep them pushed all of the way into the slots in the trailing edge. It's not as critical now, but try to keep them in place while the glue cures.

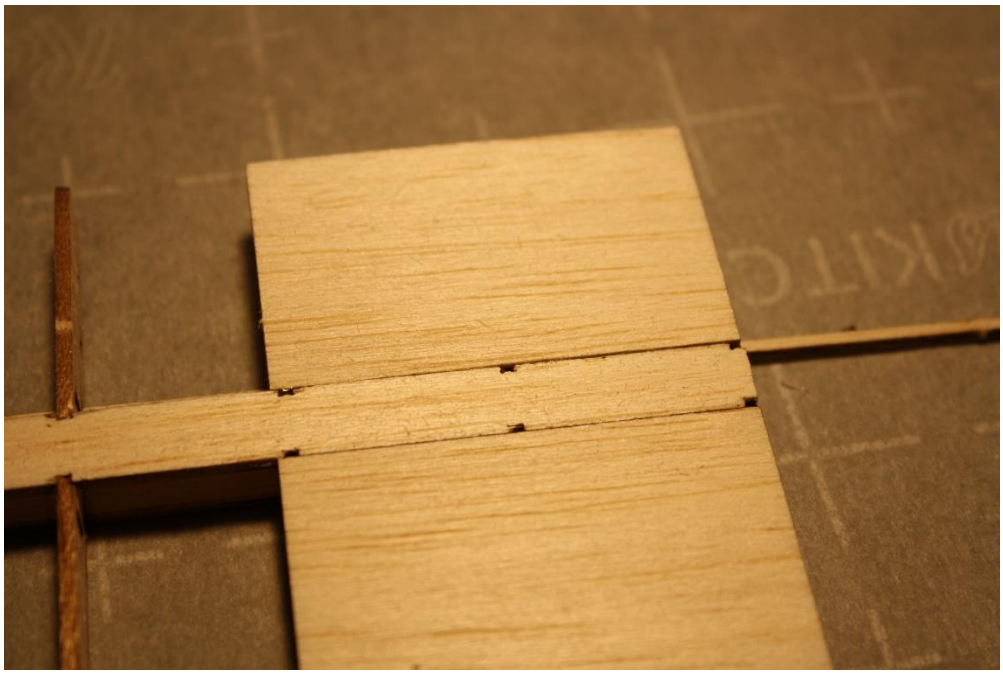


Go out to the wingtip and glue the top spar to the top of the bottom spar as shown.

Now is a good time to glue in the shear webs. They are all sized to be almost perfect straight from the laser, so if something isn't fitting almost immediately, you might have the wrong piece of balsa. You'll have to sand a slight angle into one edge of the webs at the outer dihedral breaks. Ignore the turbulator spars, it's much easier to glue the shear webs in now since the turbulators aren't in the way.

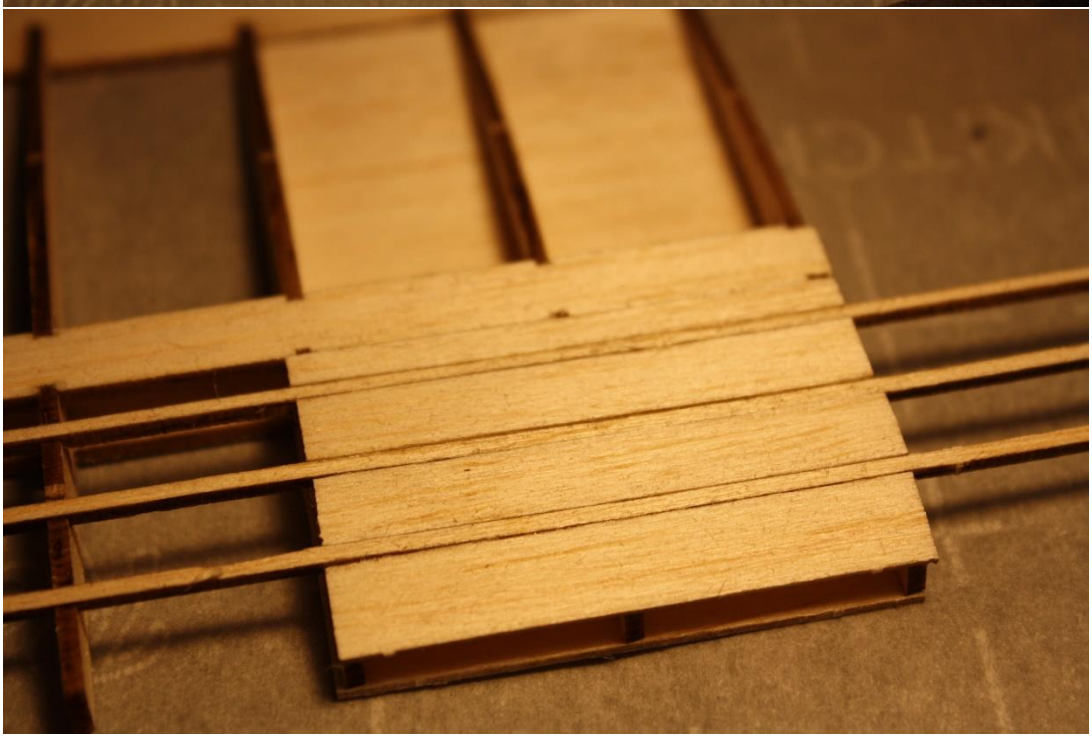


Go back to the inner wing panel, and glue the 3rd longest (S2) piece of 1/32” balsa to the bottom of the 3 ribs, and to the main spar.

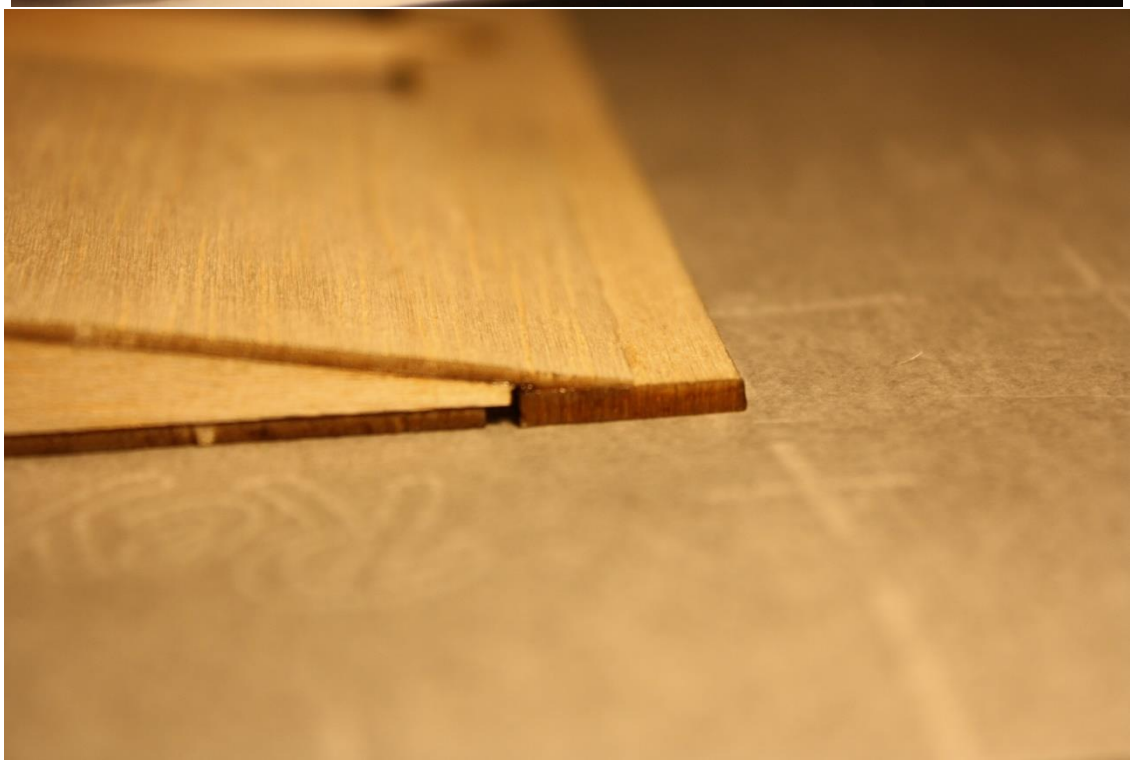


Grab the 1/16” sticks from the parts sheet, and glue them into the slots on the inner panel. Note that the 3 ribs on top of the sheeting have half depth slots, so the stick won’t sink all of the way into the rib. Do not force them into the rib.

Grab the rest of your 1/32” balsa sheet. Get the 4 small narrow bits of wood (S4-S7). These fill in the slots between each turbulator spar. They are sized to be an almost perfect fit, but you will need to sand them slightly to fit. Just take your time and sneak up on it. Once they are all in, sand the from pieces of wood back to the leading edges of the ribs. This will prep that area for gluing on the leading edges.

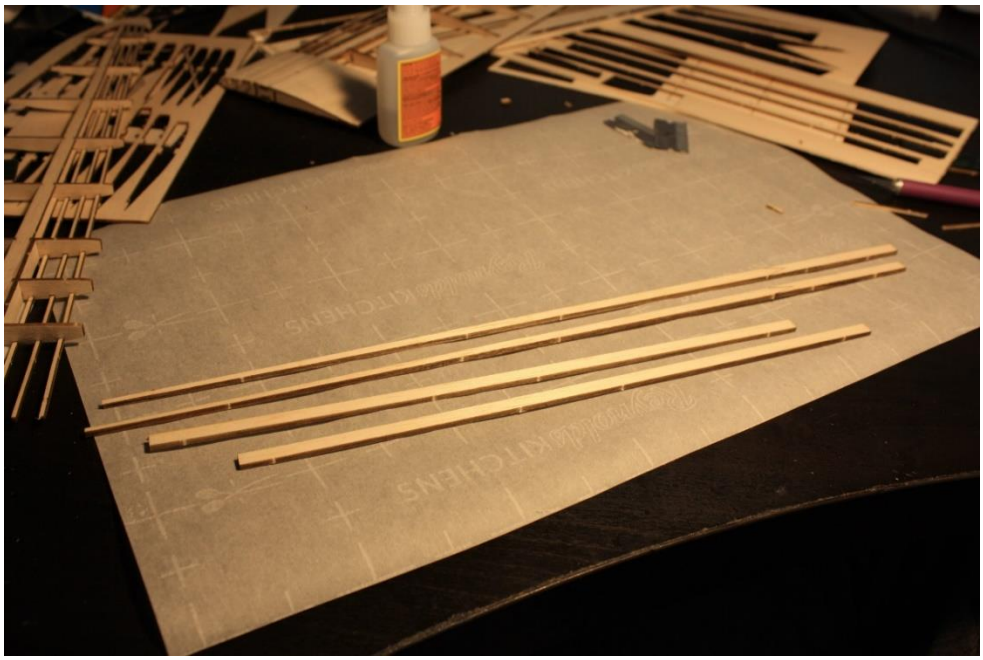


Take the longest piece of 1/32” sheeting (S3), sand a taper into the short edge as shown. Then, glue it onto the 3 ribs, main spar, and trailing edge. I find it easiest to apply glue in all locations, then butt it against the spar and roll the wood onto the ribs towards the trailing edge.

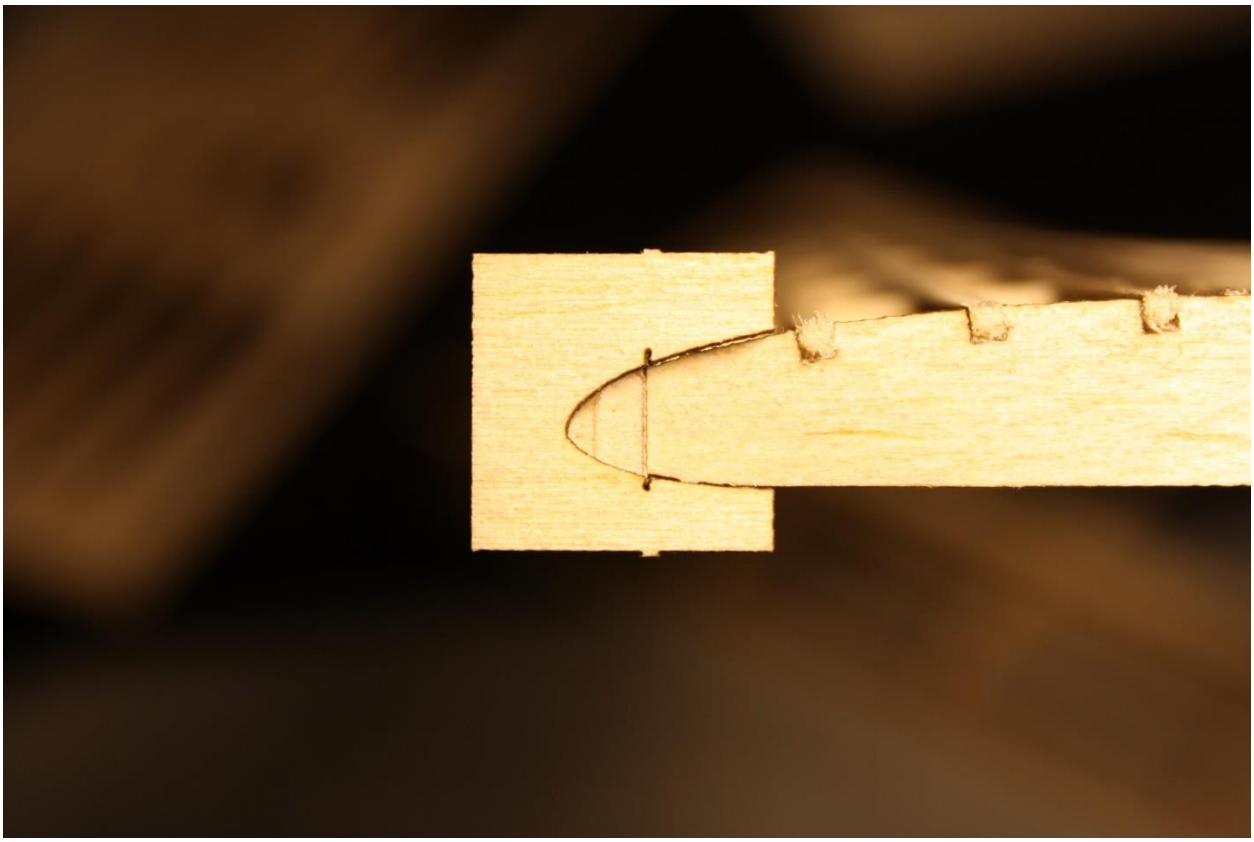


Go back to your sheet of 3/32” wood. You need to grab 2 of the plain rectangles, and 2 of the tapered pieces. These will become your leading edges.

The tapered ones go on the outer panel, and the rectangles go on the inner panel. Just laminate the two pieces together, and glue to the ribs. At the tip, line the edge of the leading edge to the wingtip. You’ll see where to stop, as the straight edge along the wingtip will stop and the tip will start sweeping back. Just glue the leading edge to that straight part of the tip and you’ll be good.



In the sheet of 1/16” balsa with the trailing edges and other things, there will be a little airfoil gauge. You use it as shown here. Just profile the leading edge as close as you can to the gauge. The two little vertical lines are where the leading edge should touch the rib. For the tip, sand the leading edges to a taper, so at the tip the cross section is about 3/32”x3/32”. Then just extend the airfoil all of the way to the tip. Try to be as exact as possible with shaping the leading edges. Dave Thornburg knew what he was doing when he designed this airfoil, and he really stressed the importance of a well shaped leading edge and the performance advantage.

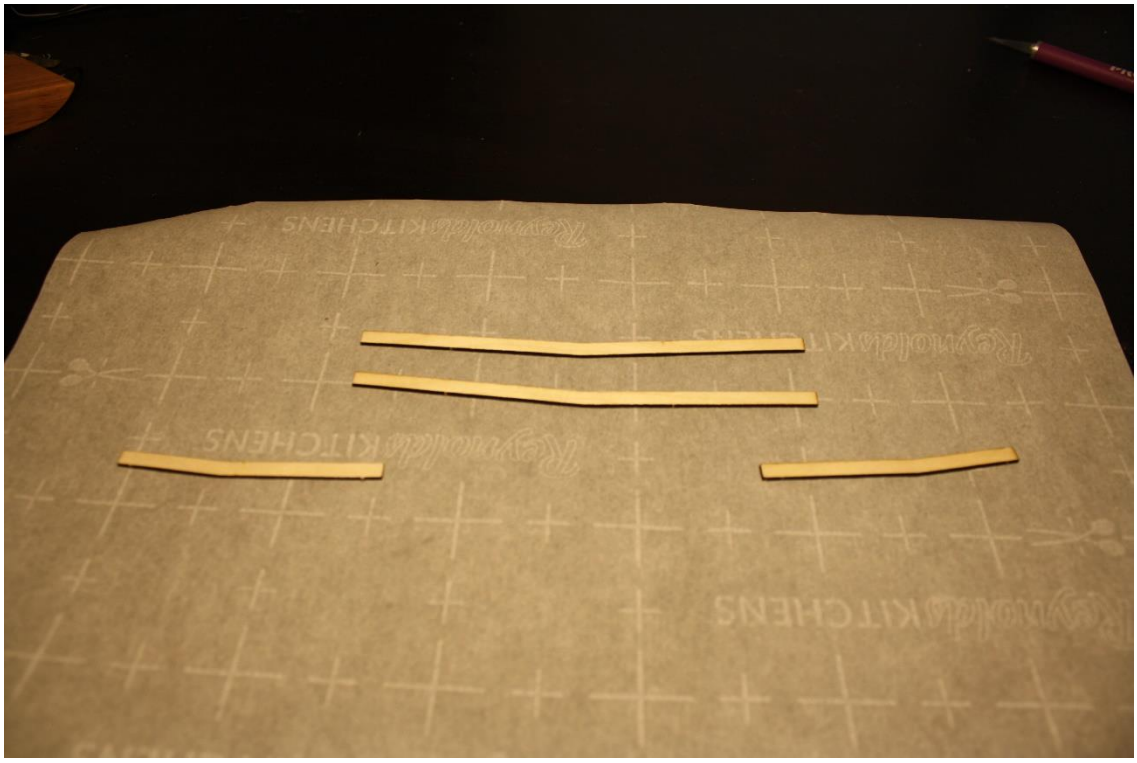


So now you have a beautiful half wing panel. Now you have to build another. Of course,

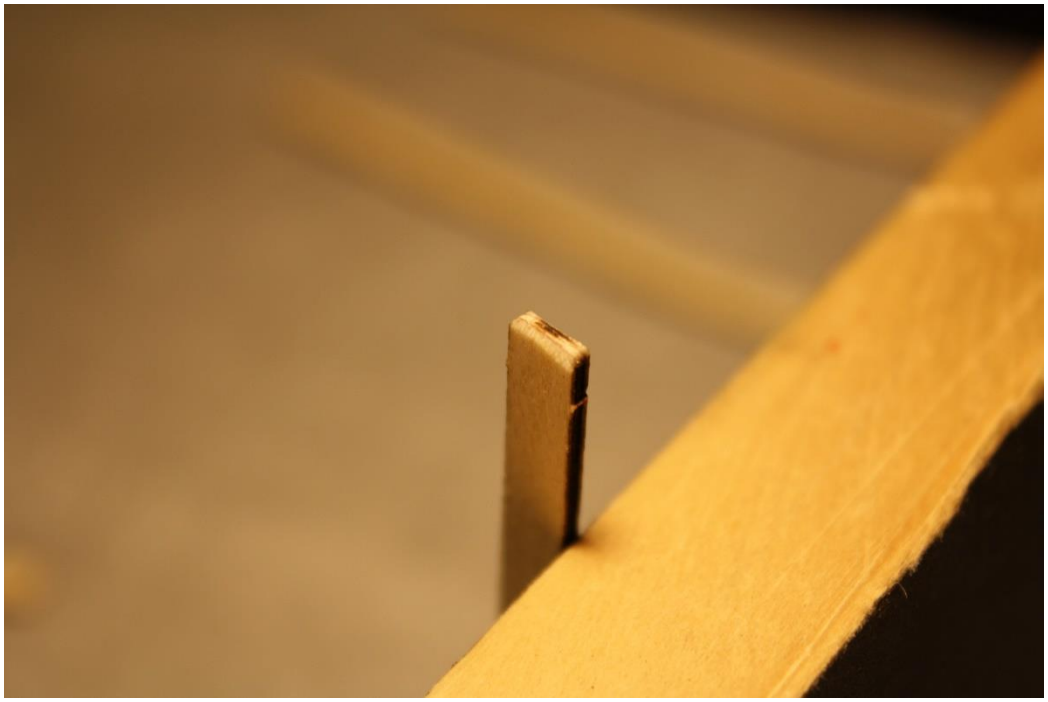
DO NOT BUILD TWO OF THE SAME WINGS. IF YOU BUILT A RIGHT HAND WING, MAKE SURE TO BUILD A LEFT AND WING AND VICE VERSA!!!!

We will get you another wing kit if you do make this mistake, but it's always good avoid all that down time!

Time to join the wing panels. Grab your sheet of 1/16” ply, and get all of the joiners. Lightly sand to remove the tabs. You can see the layout of how they will be going in the wing. You might find it helpful to mark the bend in the joiners with a pencil.



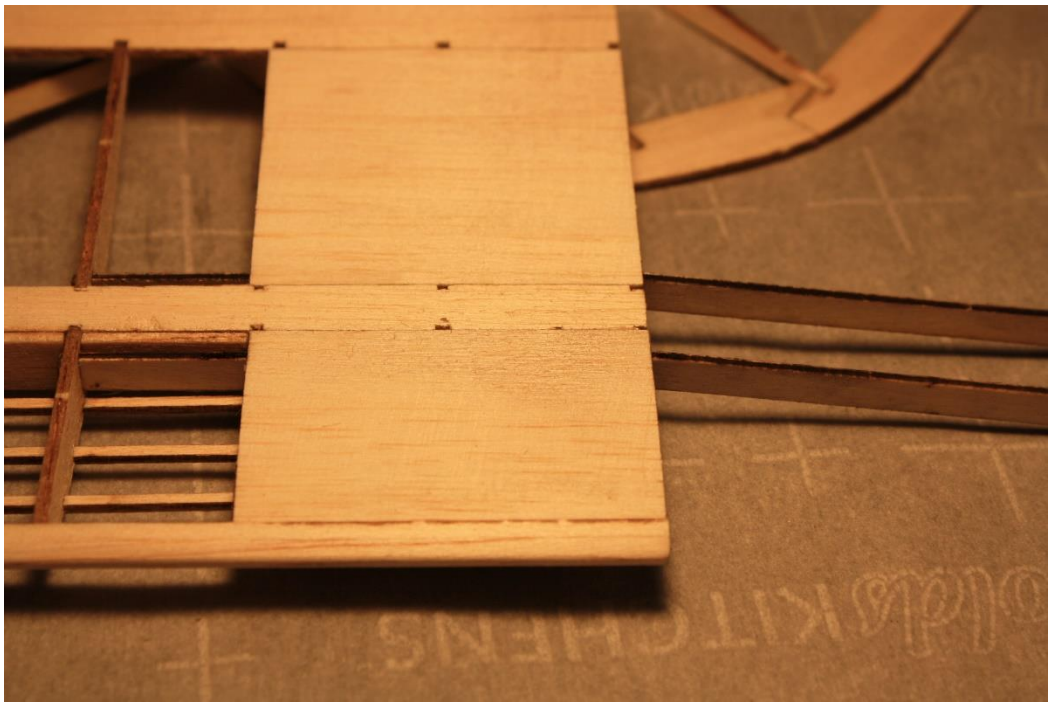
Slightly round off the ends of the joiners, this will make it easier to slide the wings together.



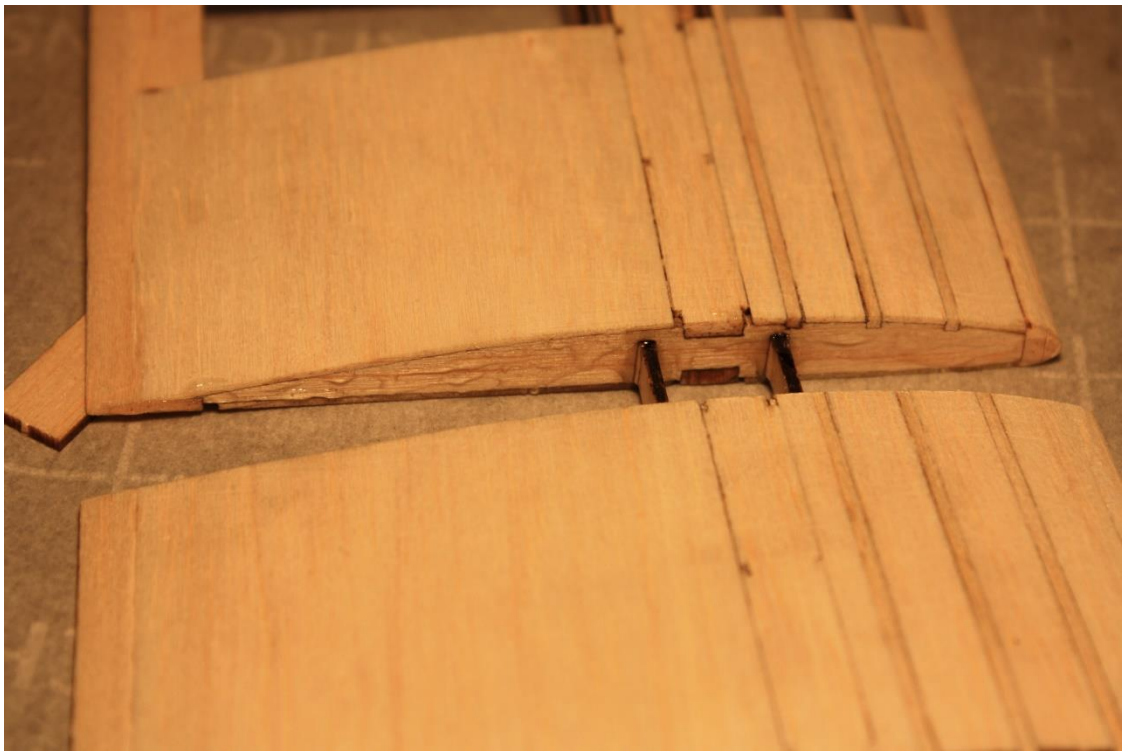
Slide a joiner into an outer wing panel. Glue in place with ca.

Slide the joiner into the other side of the wing, slather a rib in ca, and glue the outer panel to the center panel. Then apply ca to the joiner where it slides into the rib. I forgot to take pictures of this step, but continue on, the process is identical to gluing the two inner panels together.

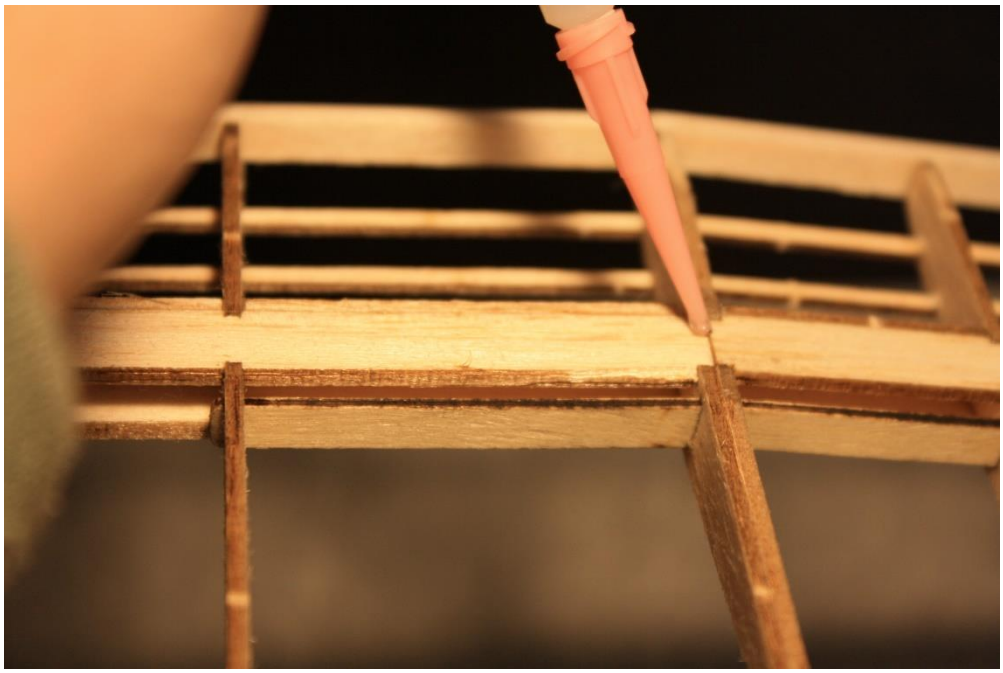
Slide the two center joiners into one side of the wing, and glue them to the ribs.



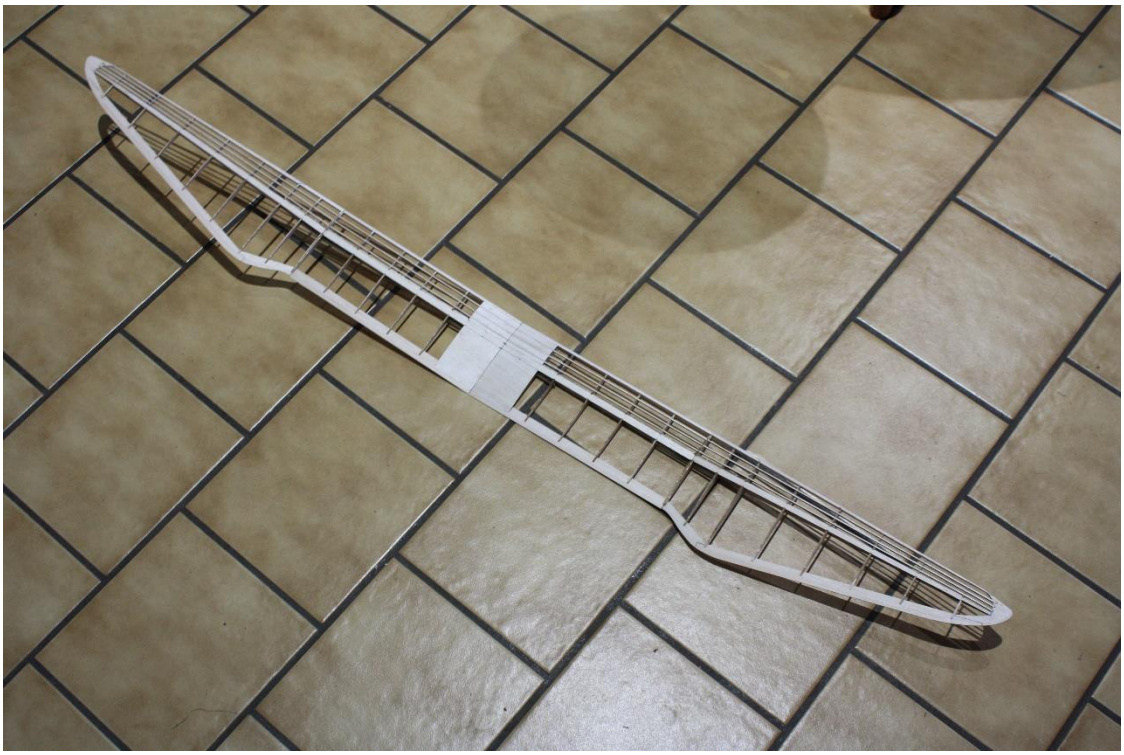
Now, slide the other wing half onto the joiners, and slide it almost all of the way together. Slather one rib in ca, and put some on the joiners close to where they enter the rib hole. Then, slide the wing together, and glue the joiners where they go through the other ribs.



To really tie it all together, rub ca into all of the spar joints. This will make the wing substantially stronger.

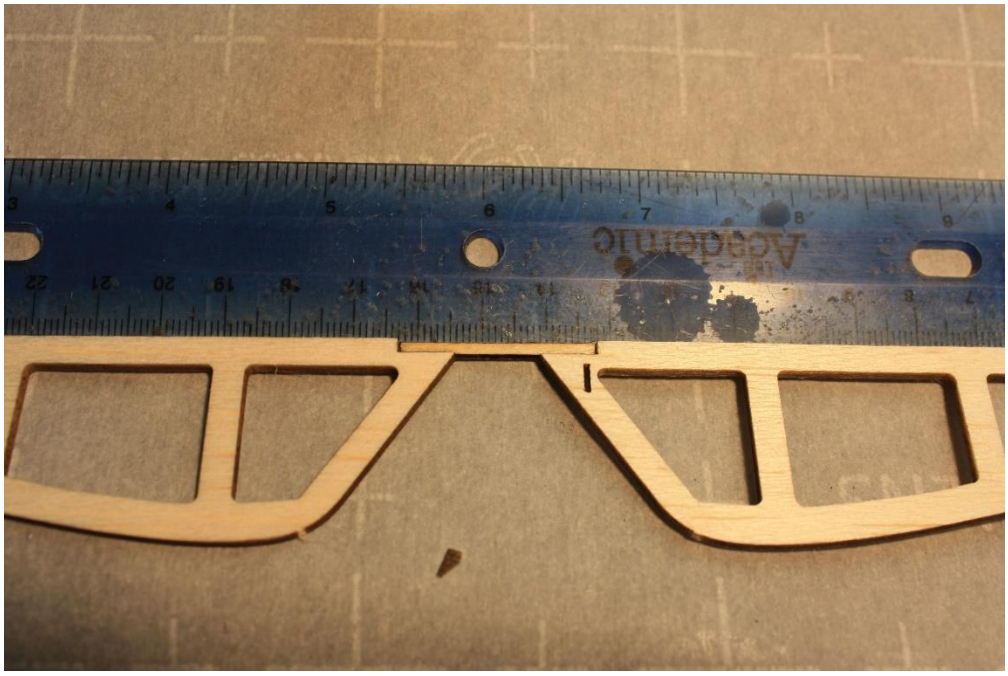


That is your wing done!



A quick note to mention **before** you start the tail surfaces. In this kit, we are including two rudders. The smaller one is the direct scale down, and the fatter one is one we drew up; to increase turning authority. If you use heavier covering (monokote, ultrakote, etc), you will find that the airplane doesn't enter a turn as well/as quickly, due to the extra mass out at the wingtips. The larger rudder will help with this. If you use light covering (solar film, parklite, doculam, etc), use the stock rudder (unless you want ultimate turning performance!).

Grab your 3/32 balsa tail parts, and that sheet of 1/16” ply. There is a small rectangle, which is your elevator joiner. Join the two halves, and pay attention to the control horn location. As shown, you are looking at the bottom of the elevator. The joiner should be flush with the top of the stab.



Bevel the bottom of the elevator. You will have to slightly sand a bevel into the joiner. On the rudder, you will have to bevel the left hand side of the rudder, as the control horn is on the right. Now things are beveled, round off all of the edges. Rudder, elevator, horizontal stabilizer, vertical stabilizer, the underpart of the vertical stabilizer, and the skid on the fuselage.

Now is a good time to do a final sand on the entire airplane, and get it nice and smooth. The next step is covering.

I'm just going to give a basic overview of how to cover. Included will also be some links of more in depth explanations.

The most important part of covering is having time and sharp blades. I'll normally use 3-4 cheap single edged razorblades when covering a wing. If it doesn't cut by sliding through the plastic, it needs to be changed out for a sharper blade.

The hardest part about covering a wing with polyhedral is the breaks. If you look at your wing, you'll notice that since the wing ribs are not 90 degrees to the wingspars. This means that to get a consistent depth seam, you must cut a curve into the film. If you haven't done this before, it's a good idea to dry run it. I cover each wing panel in two pieces. One on the top, one on the bottom. If you're feeling brave, you can cover the bottom of a wing half in one piece. However you do it, cover from the outside in.

I cover the bottom of the outer wing panel first, and the top second. Start at the bottom outer panel, tack the film down along the edges up the double ribs, then trim the film a half inch outside of the wing. Start wrapping the film up around the edges. To do this for the tip, cut the film on the corners, and then just push the film up and around the tip. High heat is useful. Once everything is tacked, trim the film from the leading and trailing edges, and the tip.

Take a piece of film oversize from the wingtip. Lay the film on top, over the dihedral break. Then, trim the film so it follows the curve of the dihedral break. Once it follows closely, tack the film on top of the ribs. Then tack the other 3 sides/edges, and wrap it around the edges. Then trim. That's a wingtip covered, the same process is used on the inner panels too.

Covering the tail surfaces is even easier. Lay down a sheet of film on top of the surface, stick on, wrap around the edges trimming where necessary, and then do the same for the other side. Some overlap is required, but not a massive amount. I can normally get away with a 1/16" of overlap.

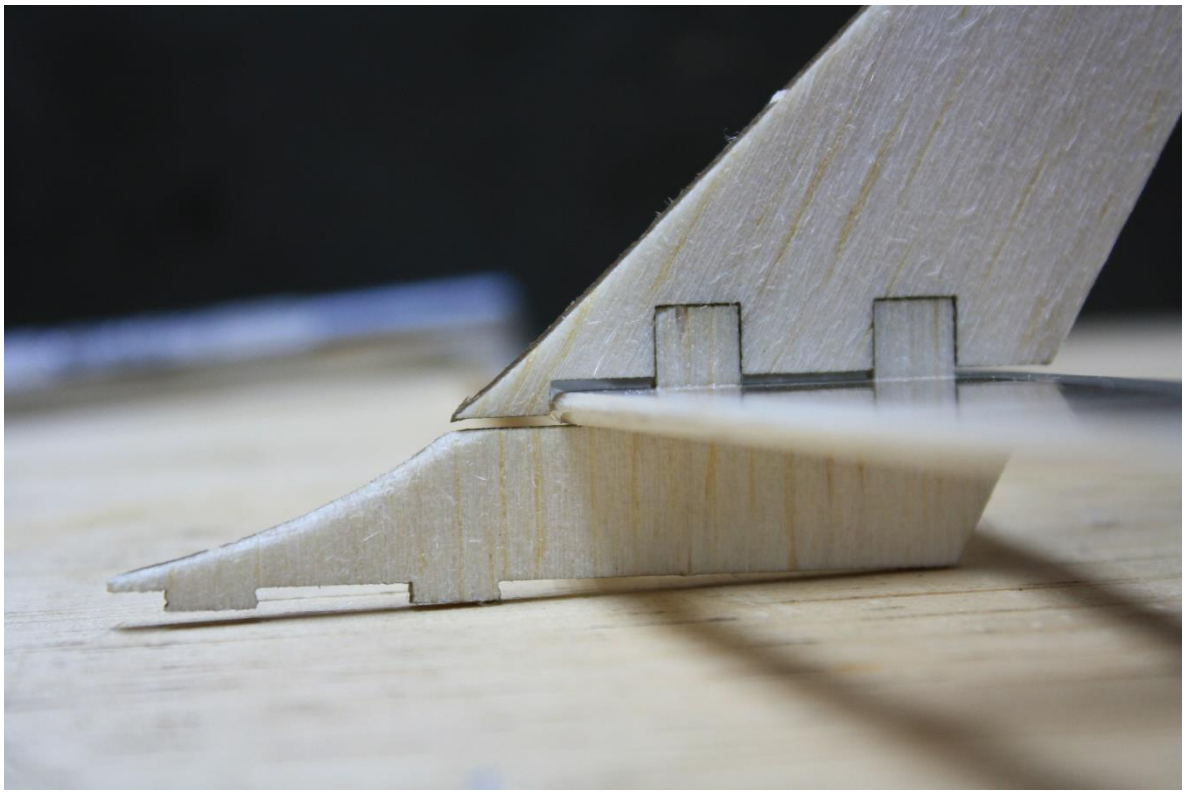
The main thing is to take your time! It takes me at least 1-2 hours to cover things nicely enough to be willing to show other people my work. Here are some useful links that show some other techniques. There are a million different ways to cover, and its up to you to find a method you like!

http://www.rc-airplane-advisor.com/heat-shrink-covering.html

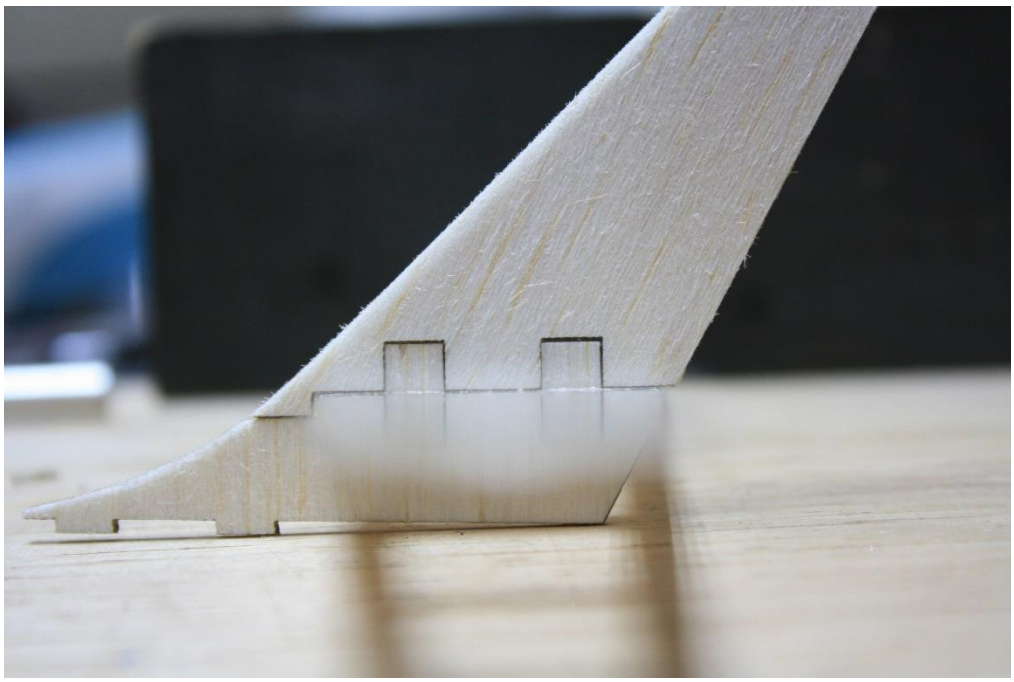
http://amaflightschool.org/diy/covering-techniques

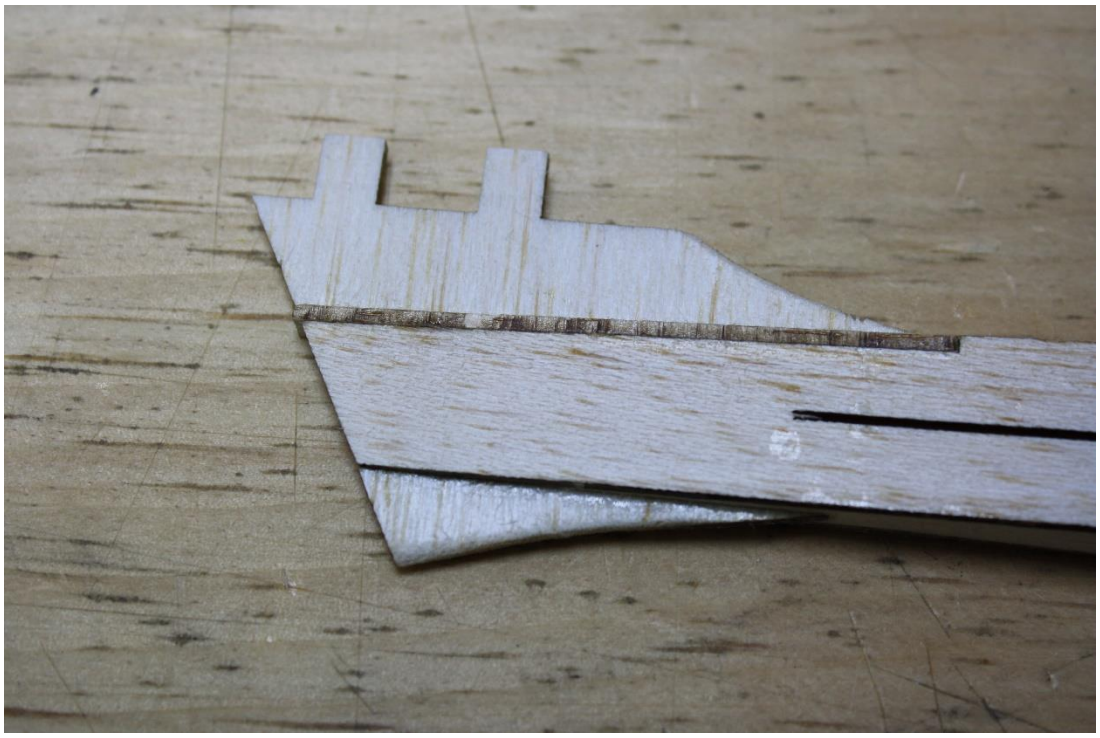
https://amaflightschool.org/getstarted/how-cover-model-airplane

One last thing, you might find your airplane will fly better if you add a few degrees of washout in the tip panel. Some I've built have needed it, some haven't. If your model drops it's wing in tight turns when your are pulling hard, you'll find that some washout may make life easier.



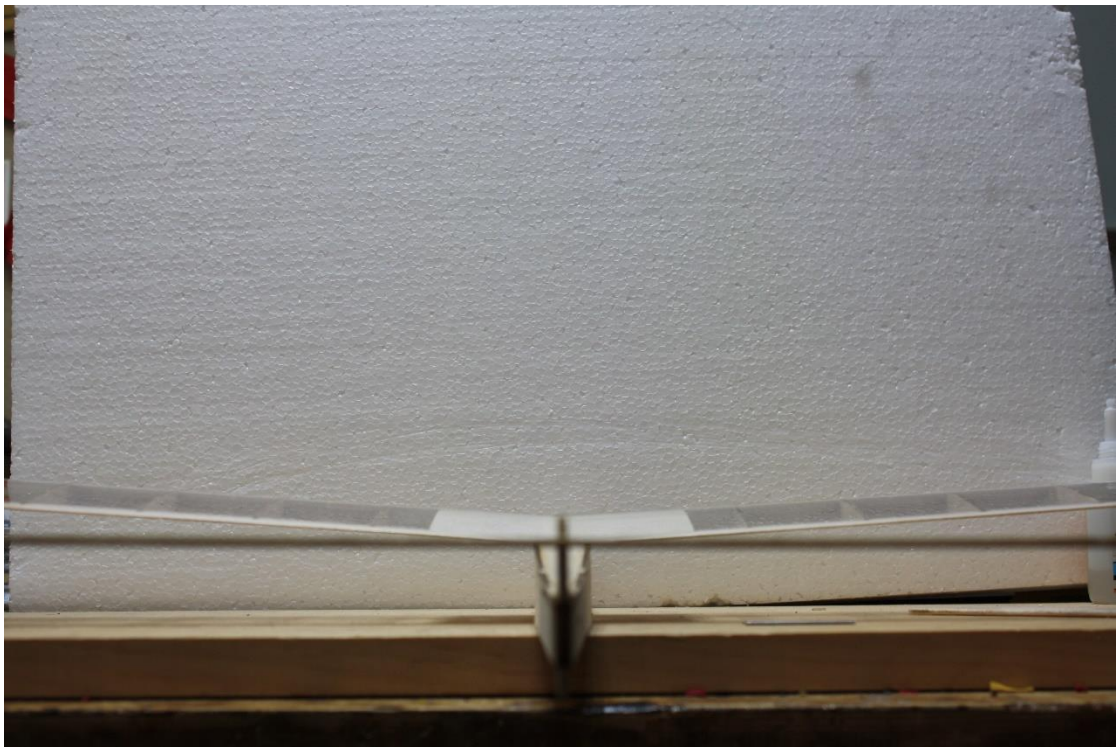
Once things are covered, cut out the film from the two slots in the horizontal stab, and dry fit it onto the sub fin. You will see a gap, which may or may not be the same as shown. Sand the posts until the gap has disappeared. This is due to the fact that the 0.093” balsa we buy isn’t always 0.093”. It is often 0.105” or more, and can be as little as 0.090”. This would change the height of the posts, so we supply them slightly too tall so you can sand them down to a perfect fit for your balsa thickness.



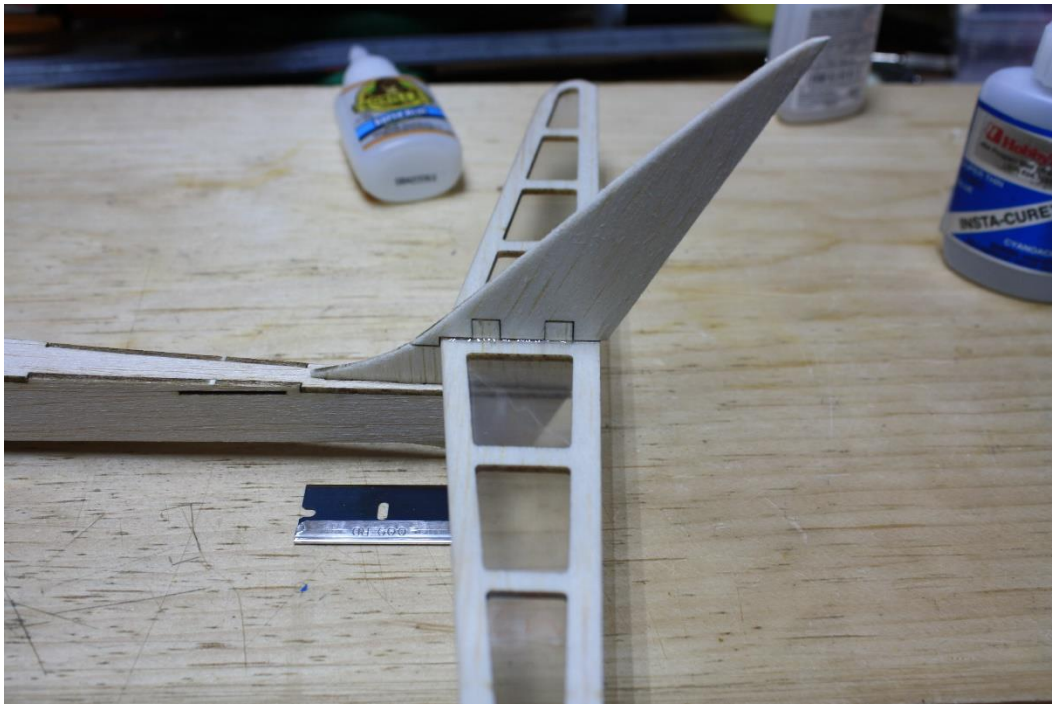


Take the sub fin, and glue it into the fuselage, taking care to keep it vertical. Do the same for the skid, keeping it flush with the rear of the fuse and vertical too.

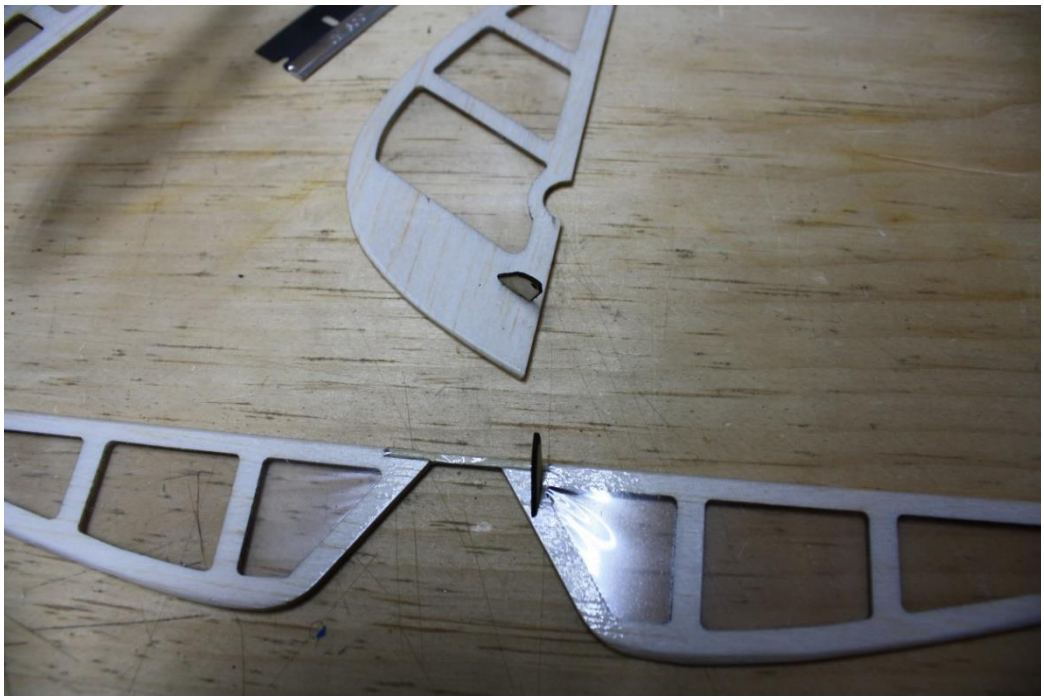
Get the horizontal stab, dry fit it onto the sub fin. I find it useful to set the wing on the fuse, and use the wing to get the horizontal stab glued on straight. Once it's on, glue it in place with thin ca, and then apply a fillet of glue on the bottom.



Put the rudder on the sub fin, get it 90 degrees to the horizontal stab, and glue it in place too.

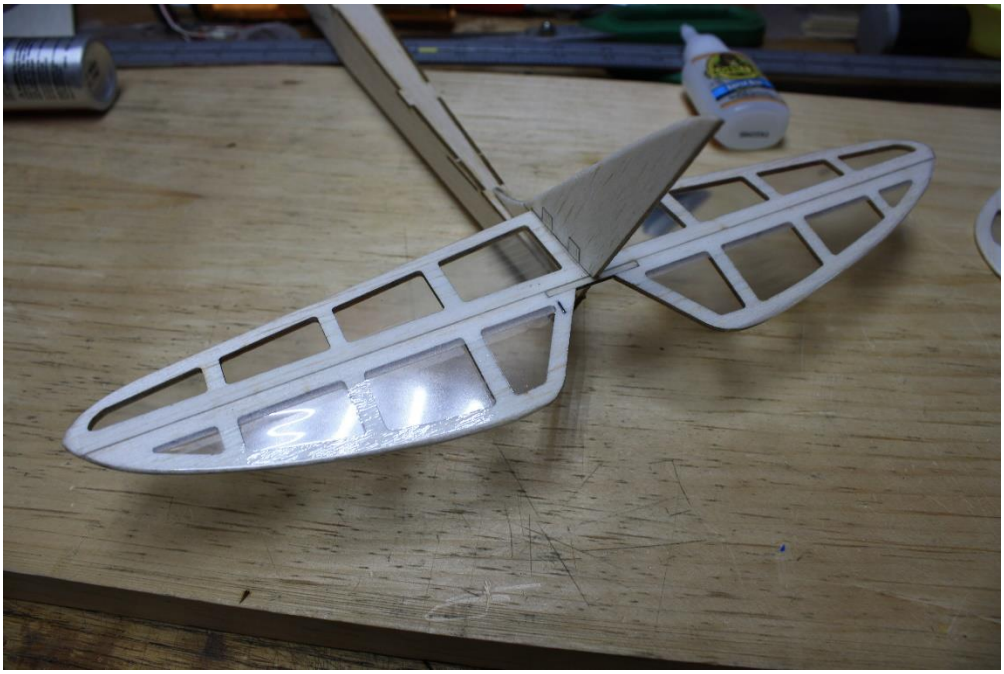


Glue the control horns into the surfaces. Pay attention to what side they are on, keeping in mind what side each slot is on. Here, you are looking at the bottom of the elevator, and the right hand side of the rudder.



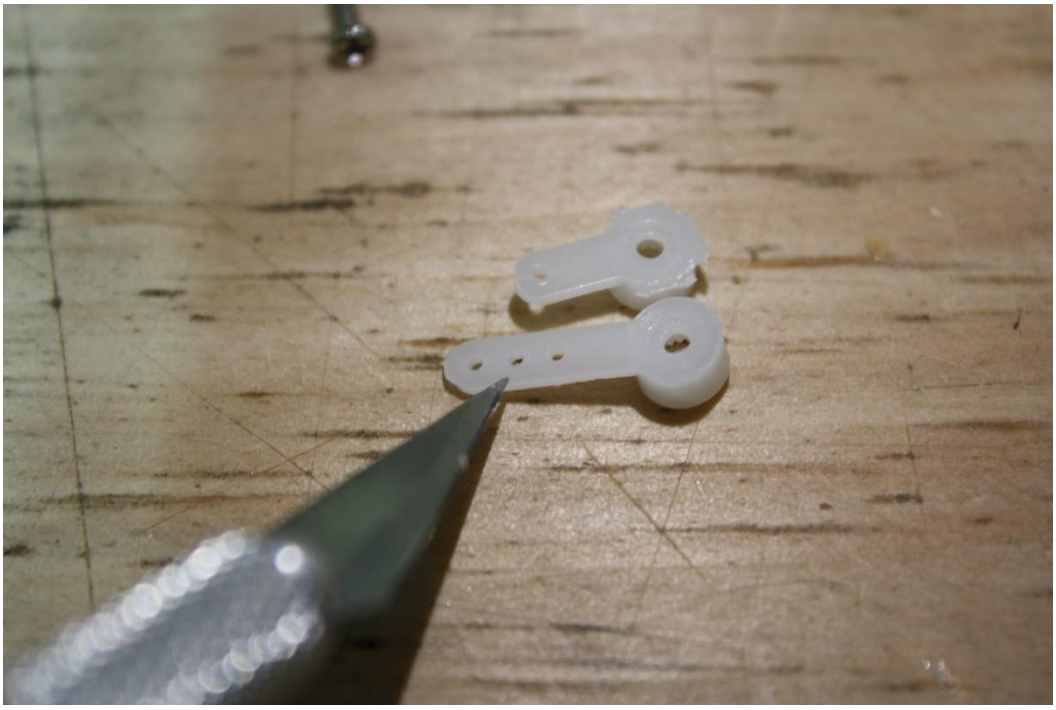
Get some hinge tape, and put it on the elevator. Cut the tape to size, and trim off the excess that's around the joiner and such. Also, cut a slot to clear the vertical stab.

Stick the elevator on.

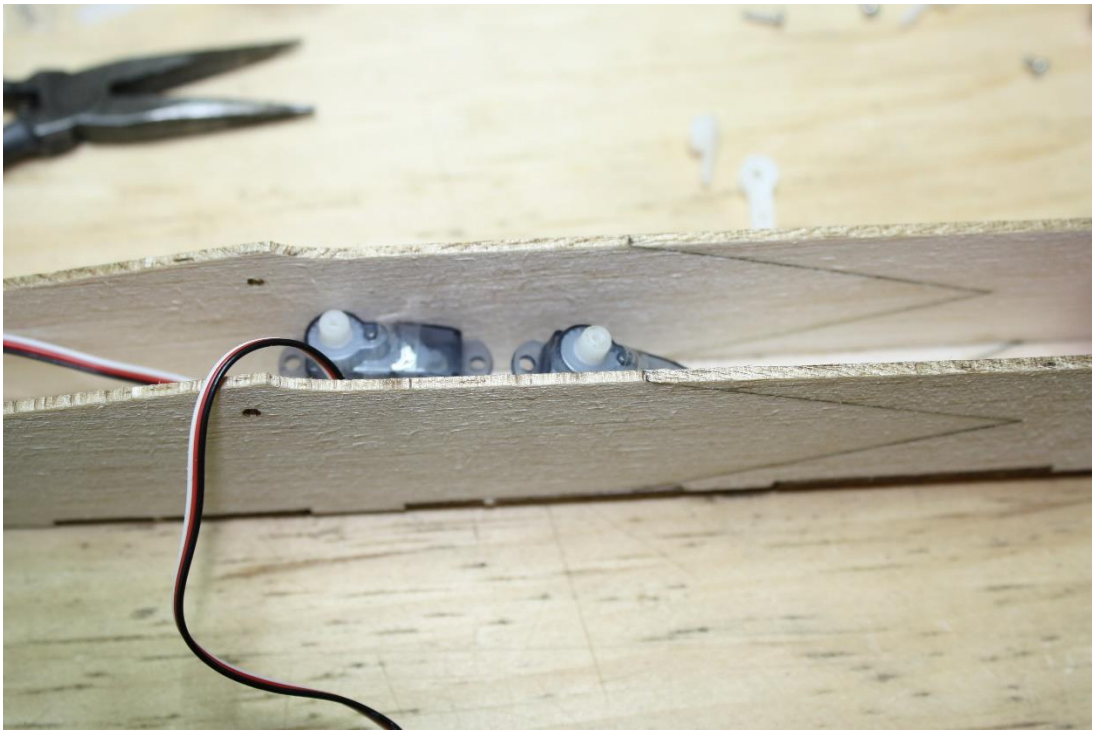


Do the same on the rudder. Once it's on, put hinge tape on the skid, as well as the sub fin, not just the top vertical stab portion.

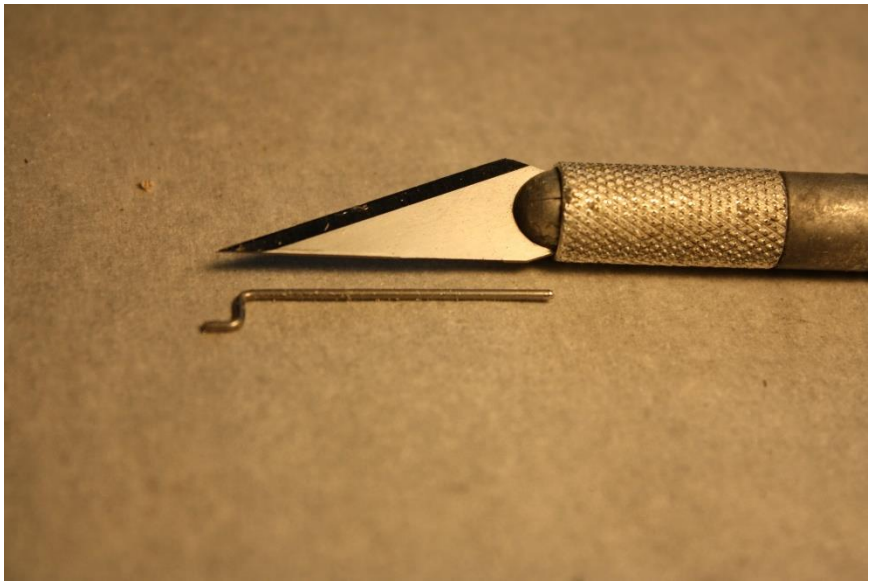
Time to install servos. First, grab the servo horns. One needs to be cut down to use the inner hole, and one needs to be cut down to the 2nd hole in from the end. The x-acto knife is pointing at the hole you want to use, so just cut off the one outer hole.



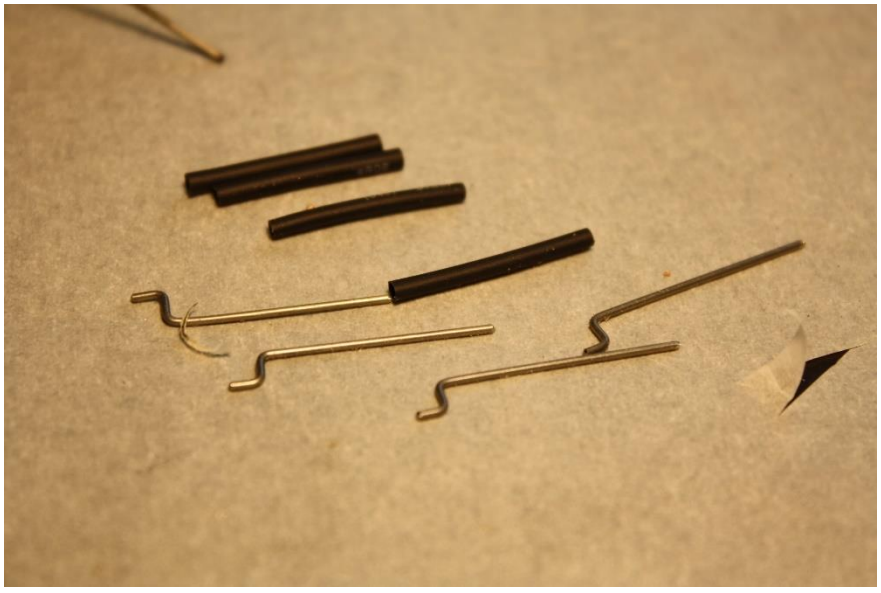
Then, glue the servos in roughly where shown. The one up front gets glues to the right hand side of the fuse, and the one in the back gets glued on the left hand side.



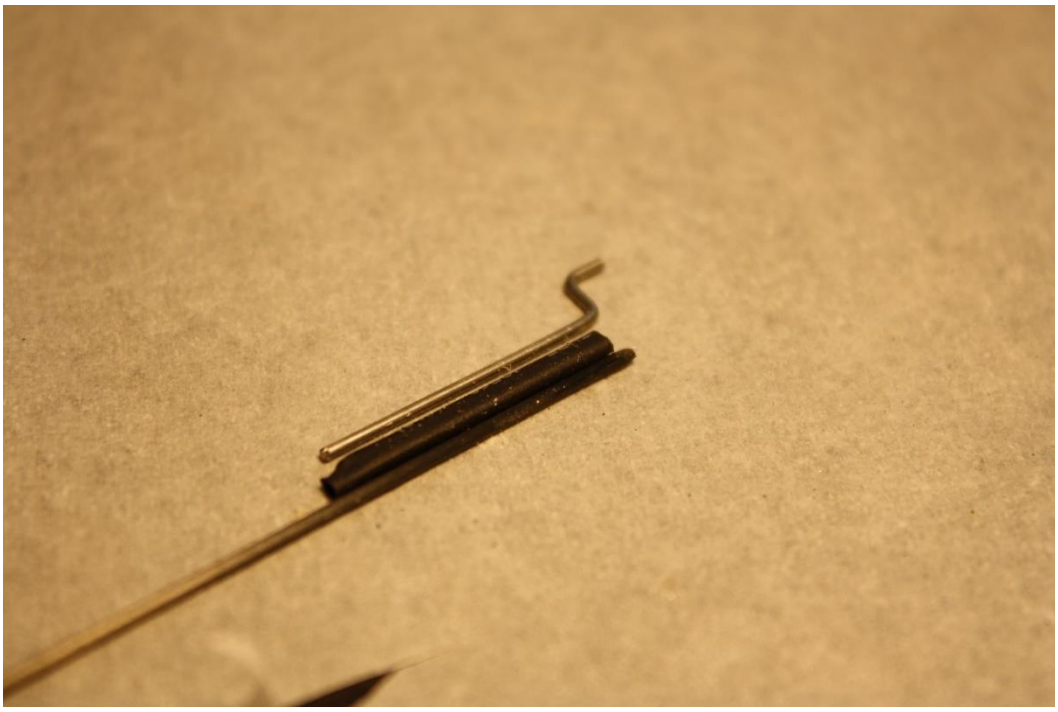
Now it’s time to make the tail surfaces move. Find your included musicwire, carbon fiber rod, and heatshrink. Grab some needle nose pliers, and bend 4 Z bends, as small as you can. Cut them so the total length is about 1”.



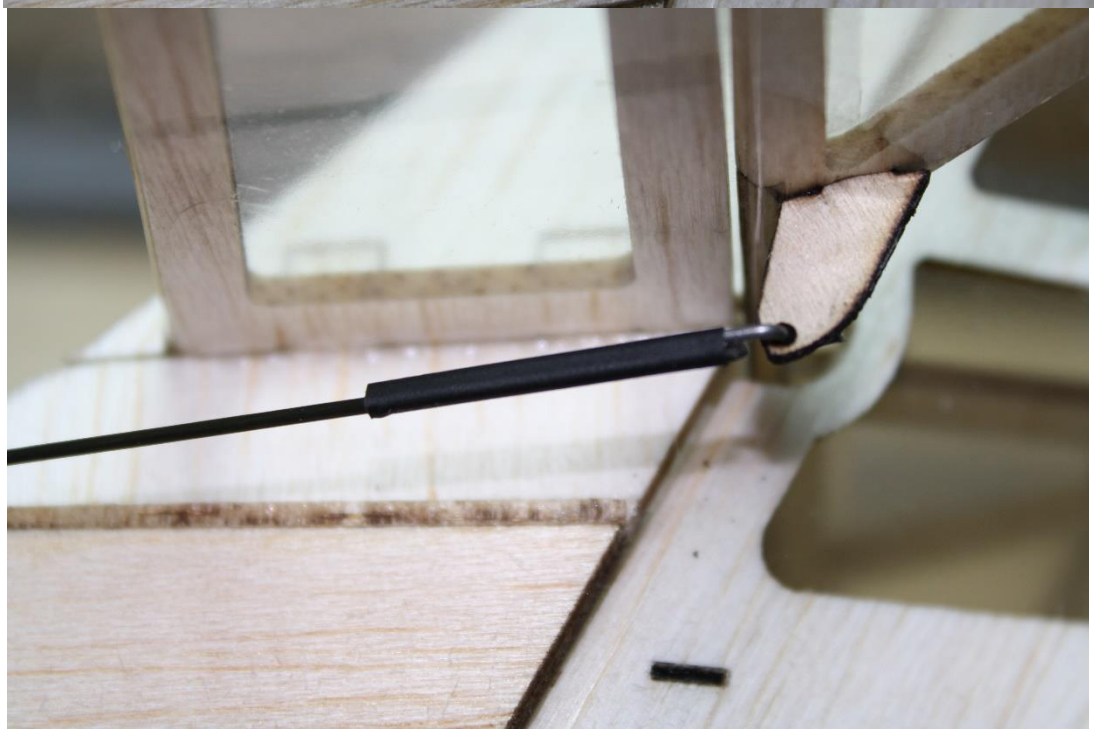
Next, grab the heatshrink, and cut 4 lengths of around 0.75” long.



Grab the carbon rod and a lighter/soldering iron/ heatgun, and slide a piece of heatshrink over the carbon, then, insert a Z bend, and shrink the heatshrink. Once it's cooled off, grab and twist the z bend out, and slide the piece of newly molded heatshrink off. Repeat this another 3 times.



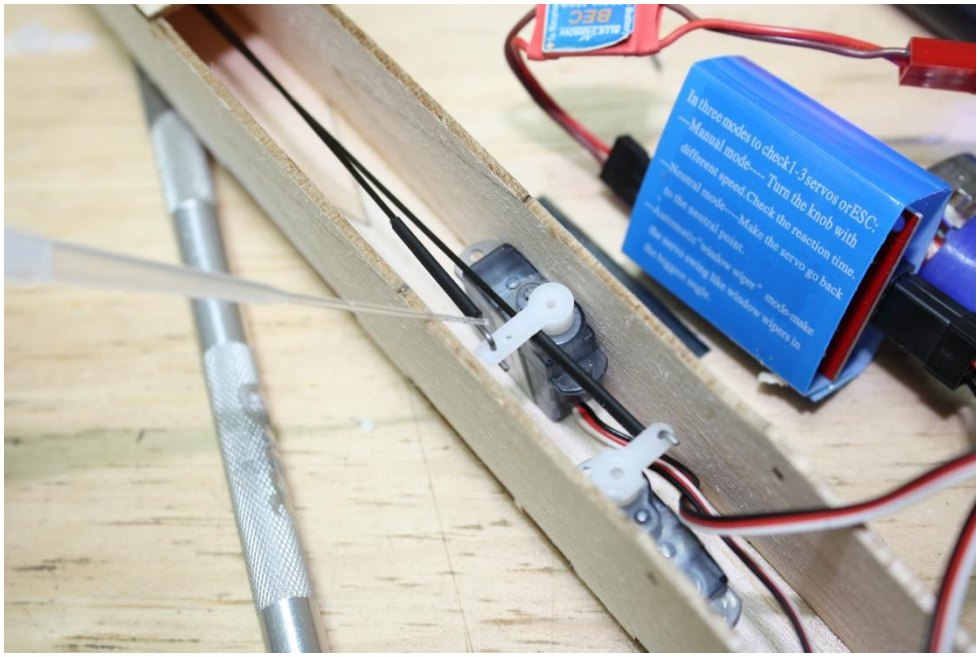
Slide a piece of carbon rod into the elevator slot, stopping it just short of the elevator servo horn. Now, cut it just short of the control horn. If you took the carbon rod out of the fuse, re-insert it. Slide the heatshrink tube over the carbon, insert the Z Bend into the elevator horn, and then slide the heatshrink over the z bend. Hopefully the pictures demonstrate this, it's not the easiest thing to explain!



This rod will go to the front servo, so cut the carbon rod about 1/8” short of hitting the servo center.

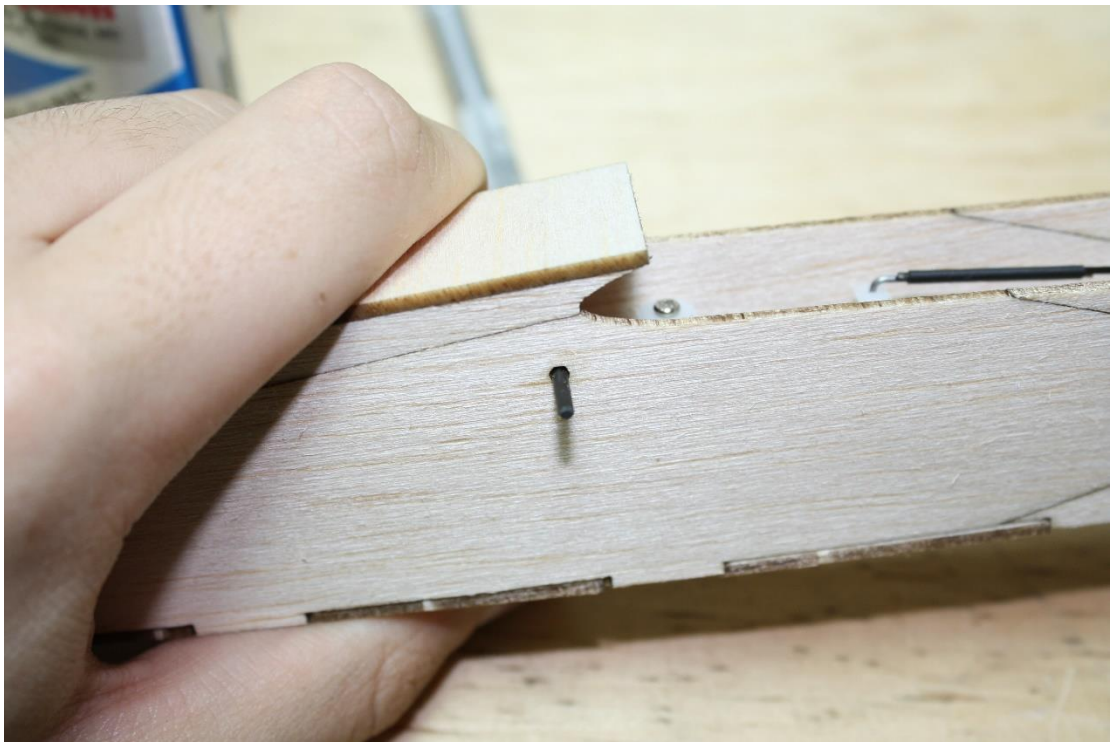
Slide the heatshrink and z bend on the carbon rod, making sure the z bend points up. This is important, so follow the picture. Once on, put the horn on the servo. This can be tricky, so don’t be afraid to use pliers here.

Do the same process as above on the rudder. When it’s done, it should look something like this.



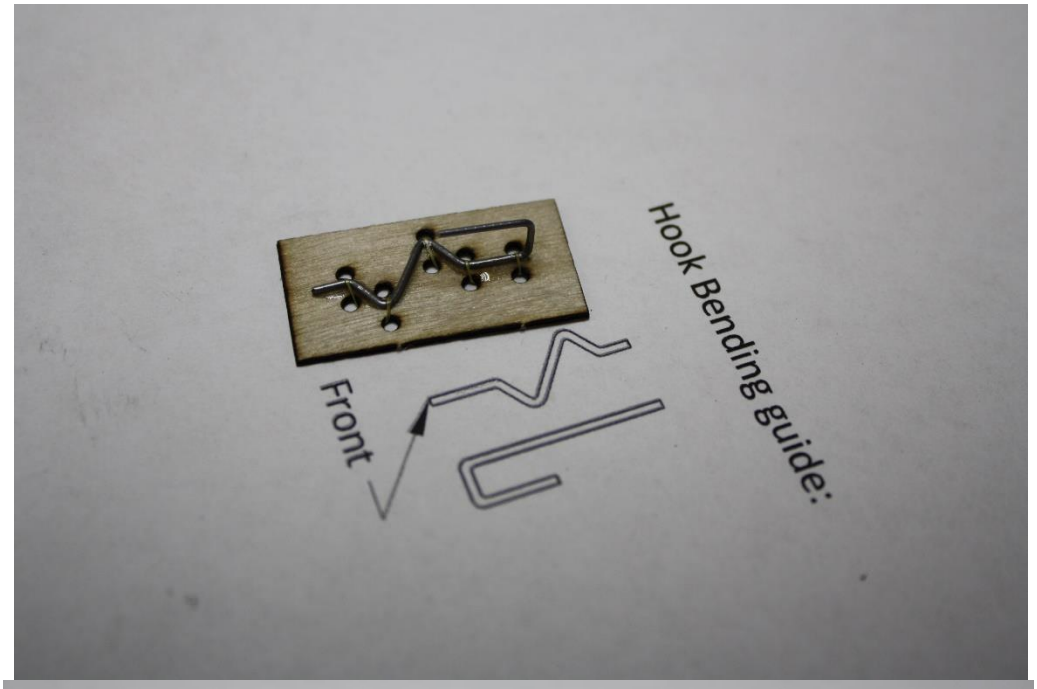
Power on the servos, and center them. Slide the carbon underneath the heatshrink at either end to center the surfaces. Once centered, apply a drop of thin CA to wick into the heatshrink on the servo end as well as the control horn end.

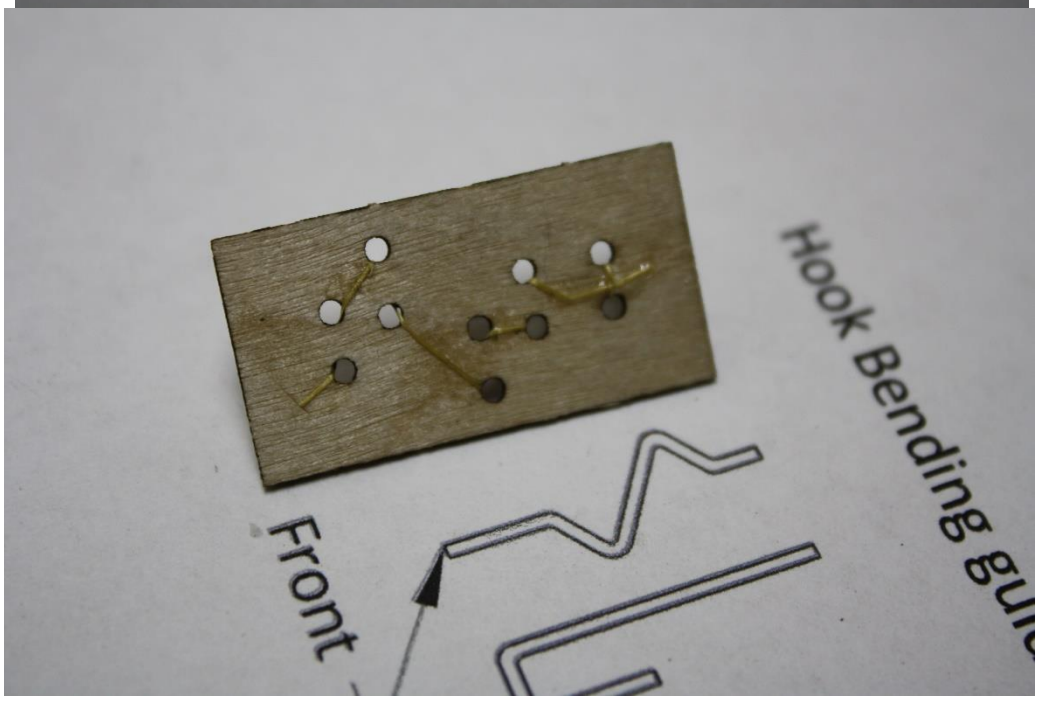
Now is a good time to glue in the carbon wing rods. Up until now, the fuselage doesn't have formers, making it kind of floppy. To get the right width, put the canopy on the glider, and lightly pinch the sides of the fuselage together. Then slide the wing rods into place, and glue. This gets the fuselage to the right with, ensuring a good clean fit with the canopy.



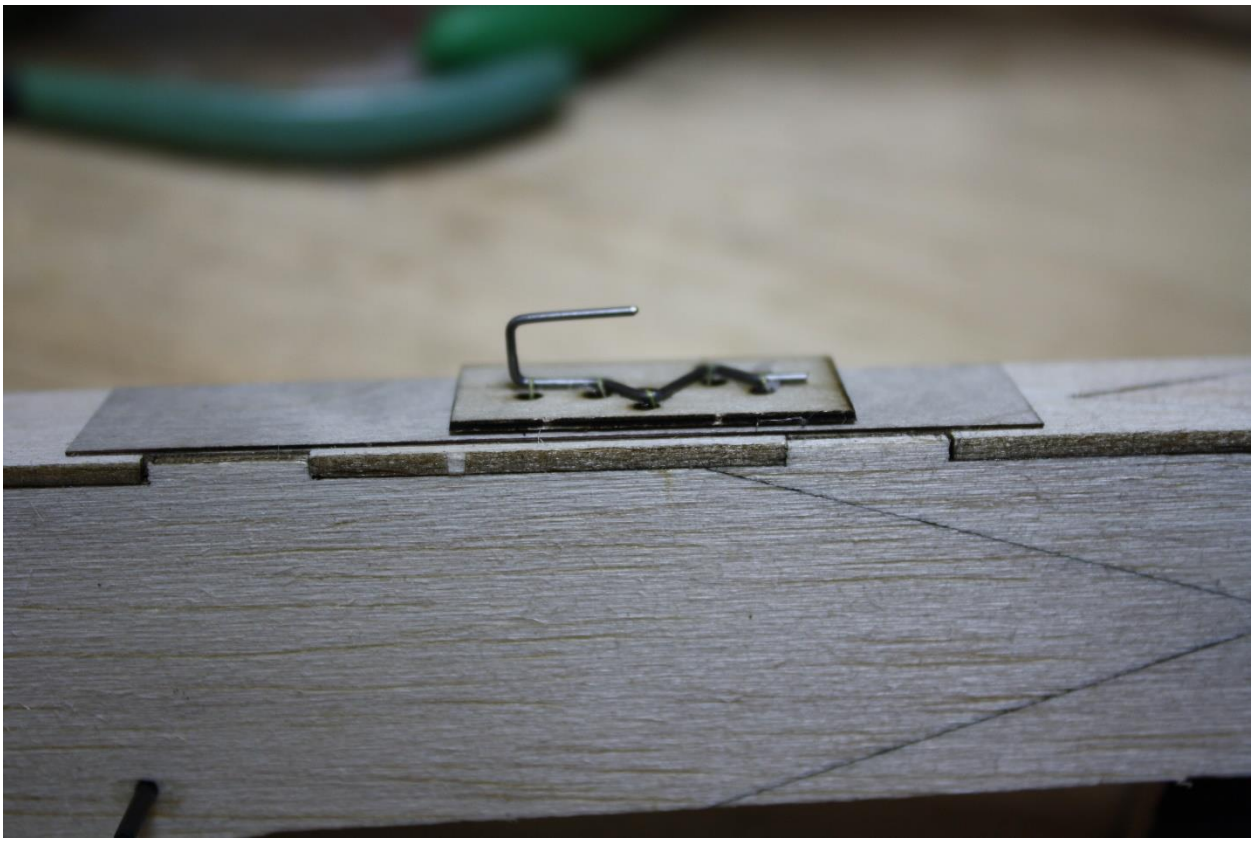
Now bend up the highstart hook, and tack glue it to the 1/32” plywood plate (it only goes in in one direction). The drawing for the hook will be on the last page of the pages of paper included with your kit.

Take the thread, and loop it over the rear side of the hook, and slide it through both rear holes, and tie the loop closed on the backside. Then, pull the thread through each hole, making sure it loops over the top of the music wire, this anchors it in place over the surprisingly high forces that the hook deals with during a launch. Instead of tying off the end, I just lay the thread down on the ply and apply glue, and cut it off. Once it’s all done, smear in CA along the thread and along the wire to properly anchor things.



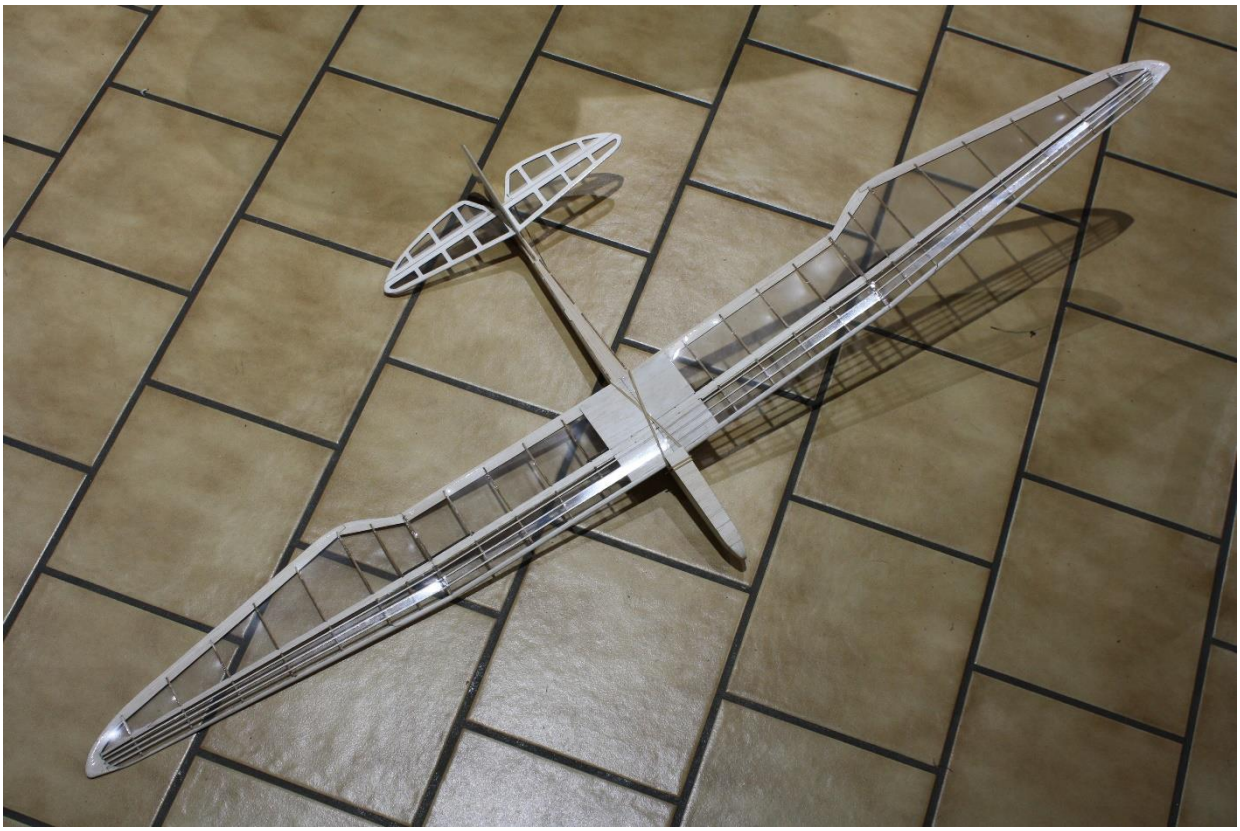


Take the 1/64” plywood plate onto the fuselage, lining up the front of it about 3/16” in front of the joint in the fuselage. See picture below. Once you’ve done that, hotglue the highstart hook to the bottom of the fuselage. Put the front of the hook about centered on the brown rectangle as shown. This is about perfect for a highstart, but move it forwards 1/8” or so if you will be flying in wind and such. If you ever want to change the location of the hook, just soak the area with denatured or rubbing alcohol, it will pop right off.



You have a few options to hold the canopy on. If you covered the fuselage, tape is a good option, as it won't loose its stickiness. I prefer to use a rubber band for simplicity. You can hook it over the wing mounting pegs, or just slide the rubber band over the fuselage.

With that being said, your build is complete!



Well, almost. Read on for some useful flight info.

The CG should be at the middle of the wingspar. That is a great starting point, but you can move it aft as you get more time on it. Mine required a tiny bit of noseweight, but yours may or may not. I'm using a 180 2s, full-size 6 chanel rx, and a tiny BEC all in the nose. The throws should be as much as you can get for the rudder, and about 25 degrees of elevator. You also might find some washout to be useful if you aren't liking how it's turning. If it's dropping a wing when you pull hard, put a couple of degrees in the tip panel. Just warp the wing a bit, and re-shrink the film. Naturally, make sure your washout is even on both panels!

If you want to highstart launch this, a good starting point is 15-20 feet of 1/16"-3-32" rubber (we sell 1/16" and 3-32" strip rubber in 16 feet packs, just tie two together), and 4-5x as much string.

If you go longer, be sure to use 1/16" rubber. The long lengths of the bigger rubber have a lot of pull, and 1/16" rubber will give a ballistic climb when you really stretch it out, so it's all you need for the long highstarts.

On the airplane end, you need a metal ring to attach to the airplanes hook. I used a small metal keyring, but you could use music wire, or any kind of metal wire under 1/16" in diameter. The wire is important, as it will ensure a clean release at apogee. Plastic isn't slick enough, and will often catch on the wire hook.

Tie a streamer that is around 10" long, around 4" ahead of the loop. I used flagging tape, but even a strip cut from a grocery bag would work. This will slow the end of the highstart down on its descent, to stop it from knotting up, and also make it easy to locate the end of the highstart.

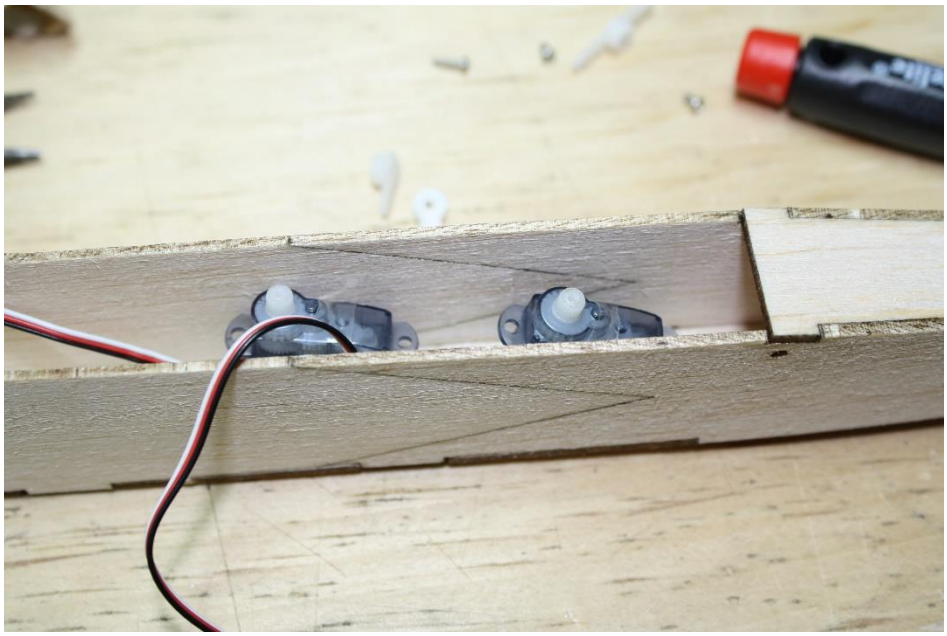
Start with low strength pulls, around 15 feet of stretch. This will be enough to get it into the air, and get a little bit of height. The airplane will naturally pitch up, and you use the rudder to keep it going straight. Keep stretching it back until you are getting the launches you want.

We really hope you enjoy this fantastic airplane as much as we do!

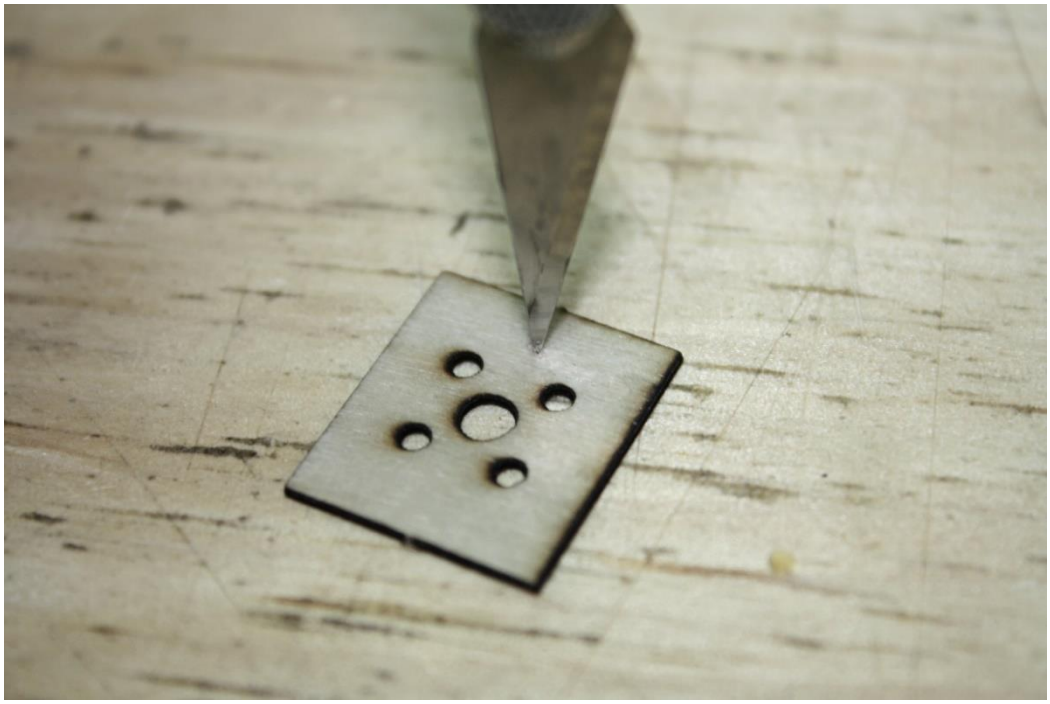
If you have any questions or comments, please contact us through our contact form:
http://jhaerospace.com/contact/

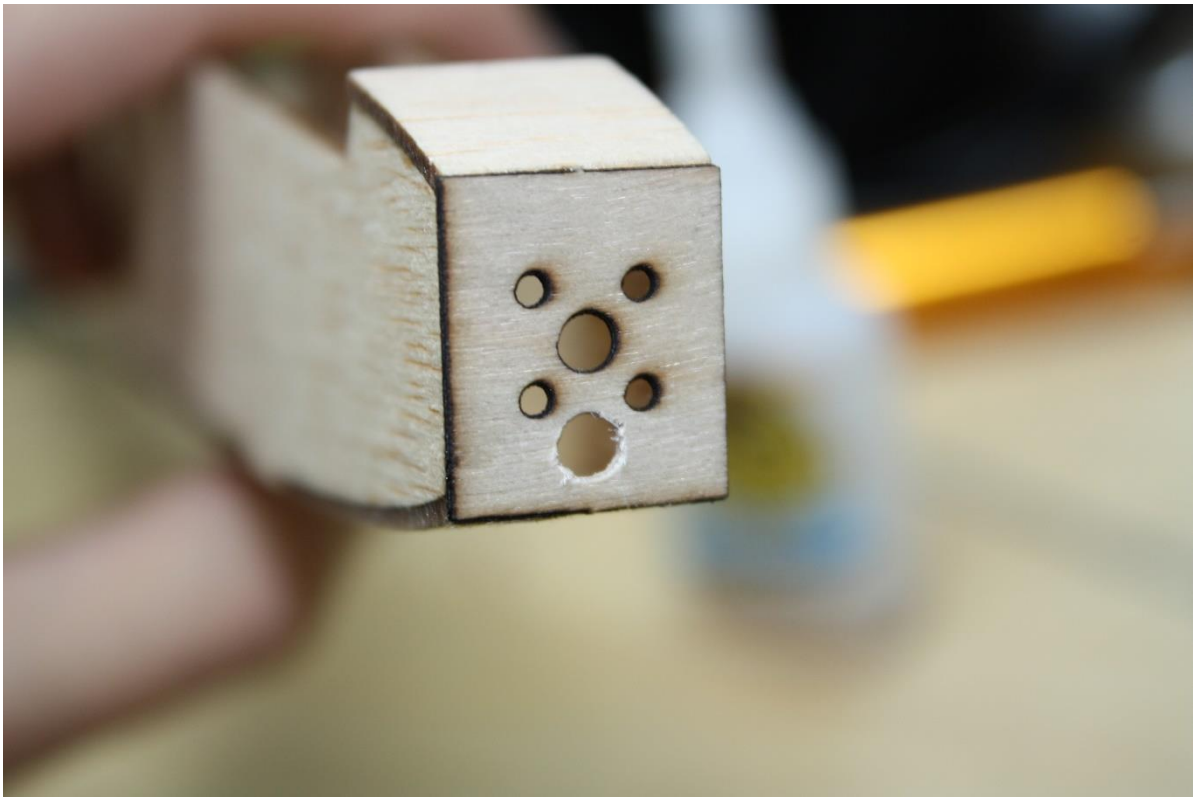
Powered version notes/differences.

Servos should go farther aft if you want to put the motor in the nose. See the photo for the rough location. Just make sure you can get to the aft servo to hook up the pushrods.



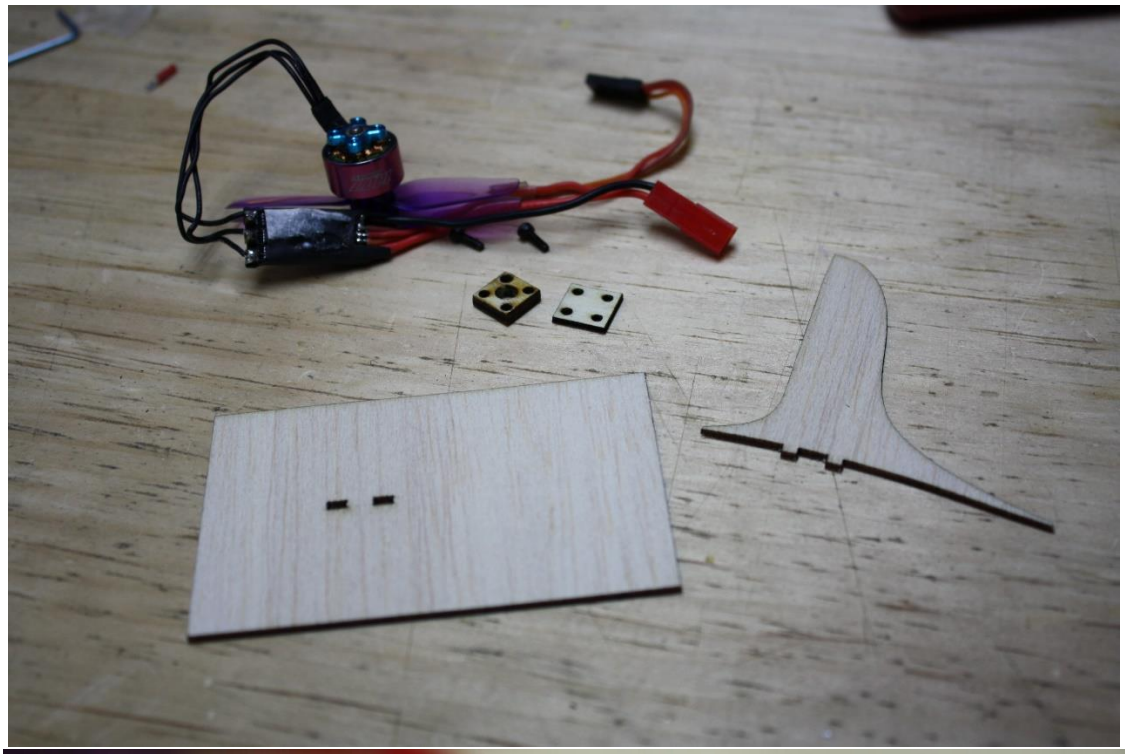
For the motor mount, just sand the front of the fuselage flat, and glue. There aren't any holes in the mount for wires due to differences in the motor designs out there, so we leave it up to you to figure out where to make the hole. If you don't have a drill, see the photos. Just use the xacto and twist. There is also a blank motor mount supplied if your motor uses something other than 9mm spacing.

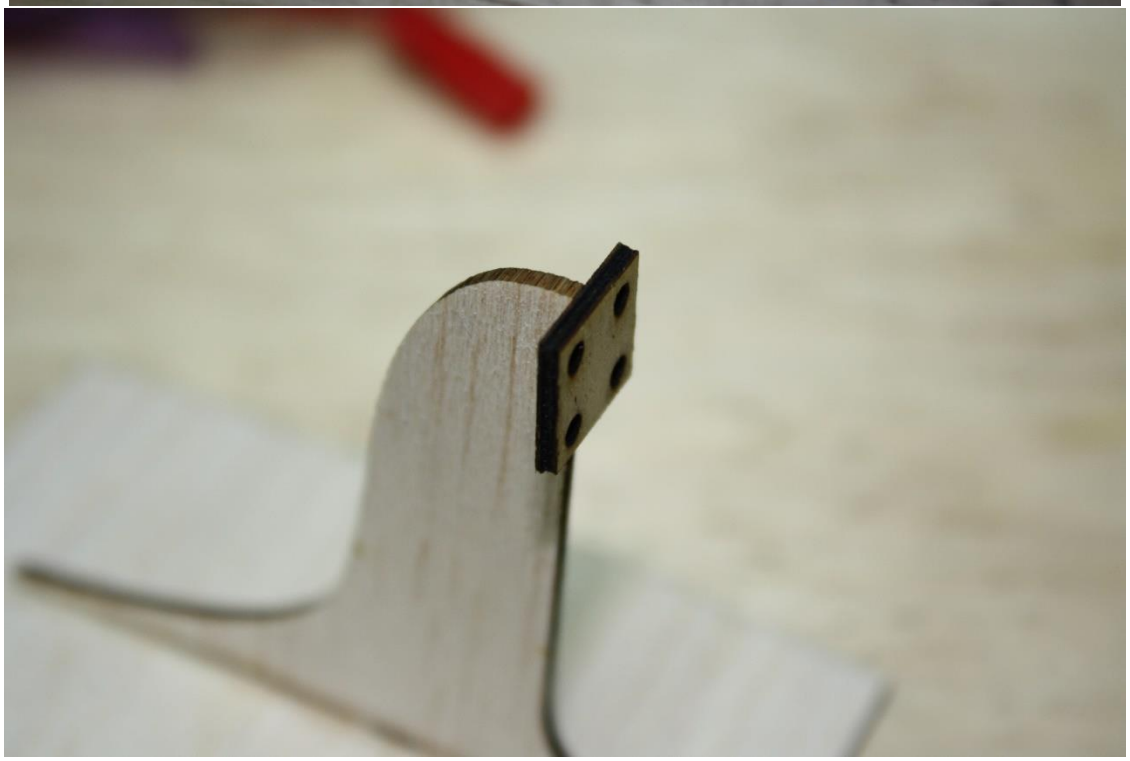


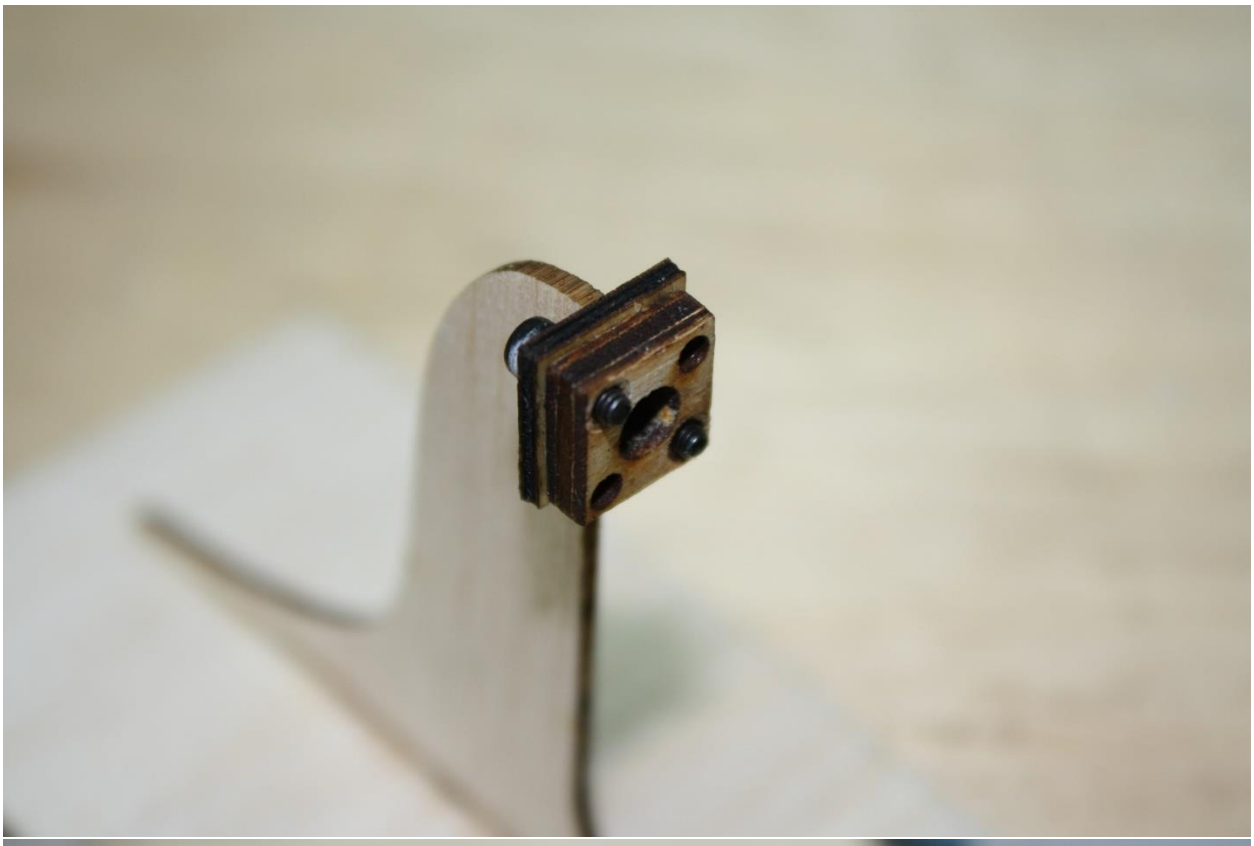


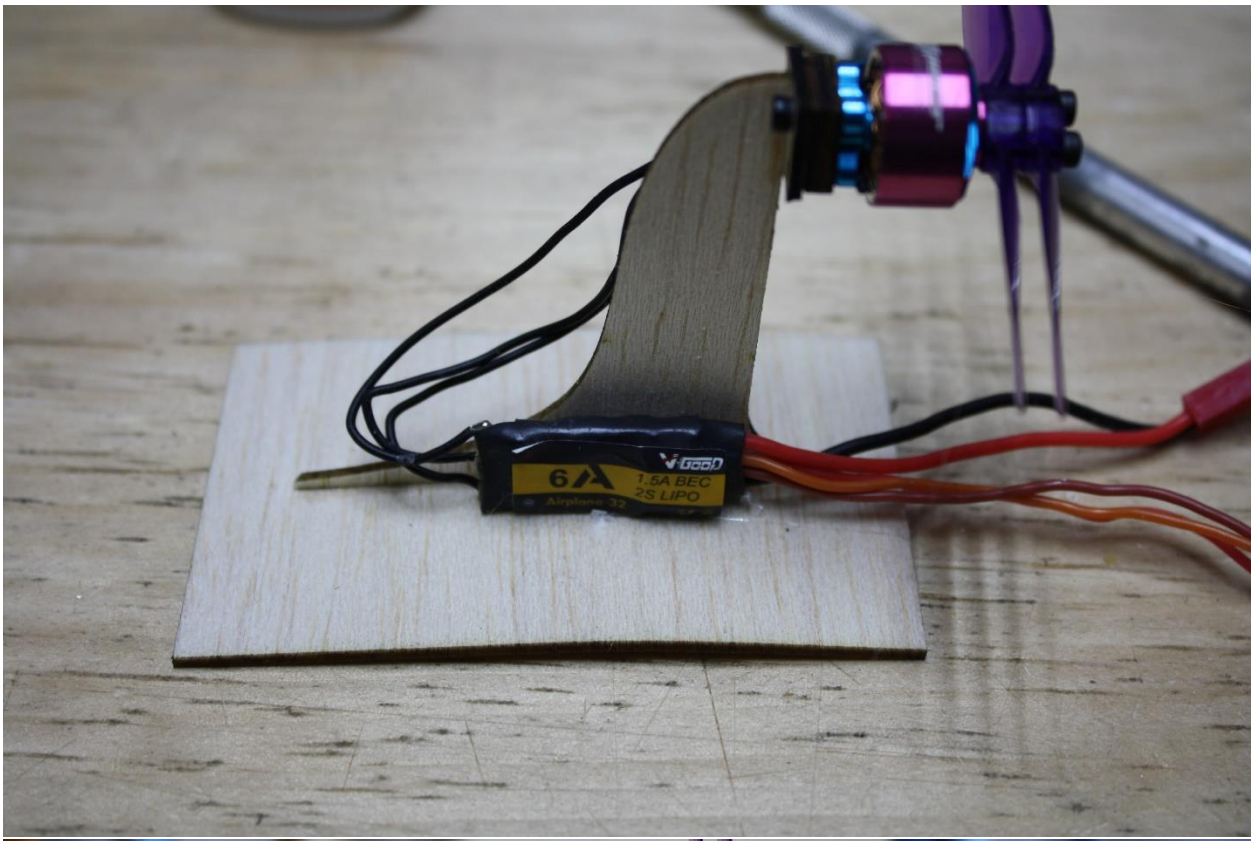
For the powerpod, just follow the photos.

And yes, that stacked prop works. Increases thrust by about 35%, and doesn't add to the frontal drag of the prop. Keeps the glide efficient. Once it's all installed, tape the wires to the balsa to keep it all pretty. I used blenderm. The powerpod just sits on the wing, and is held in place by the mounting rubber bands.








6A
1.5A BEC
2S LIPO