GEO 78

A Balsakits R/C Sailplane Kit

Building Instructions

The manufacturer assumes no liability for damages or other loss in the use of this product, as we have no control over the construction or end use of this product.

The GEO 78 is the first in a line of laser cut balsa sailplane kits.
The GEO was designed to be light, strong and very easy to build. It also has excellent, gentle flying qualities.

About power choice;
The GEO is made for electric motor launching with a 2212 motor and 10x6 prop
Or
As a "pure" glider with no motor. Use a hi start or winch to launch.

The motor version will be about 2 ounces heavier than the pure version.
Even then, the wing loading is so low that the glide is unaffected.

Servos;
This model uses "9 gram" size servos. We like metal gear digital servos like the ones we sell.
2 servos are required for rudder and elevator.

Spoiler option;
If you decide to install the optional spoilers (and we highly recommend them), you will also need a pair of 3.7 gram digital servos, as well as 2 each 6 inch and 12 inch servo extensions.

Building Tips

Follow the plans and instructions. If this is your first build, follow them exactly. If you have built a few balsa kits before, this one will be a breeze.
The fuselage and tail are simple standard construction.
The wing is made in the conventional manner, with a few steps done to make it easier to build.
Be sure to only remove parts as you need them. Some are too small to mark and look very similar.

Also, build the assemblies in the order shown. If you don't, you may find that the next step is impossible…

When working with balsa, pins are the best tool you have.
Pins allow you to build a straight, flat airframe.

Pin everything when building the wing. Pin each rib at the front and back.
Pin all sheeting at the joints. Nothing worse than balsa sheeting that is not flush on the bottom. Use pins!

You can use a ceiling tile to build on. Just be sure it is flat and warp free.

Glue;
We used Titebond 2 for 100% of the build on the VEO 78. No other type of glue was used except for the hinges.
We used thin CA for that.
You can use CA glue for general assembly, but keep in mind that it sands like concrete, so all glue seams will be visible. Titebond sands very well.

This manual is available in full color online. Go to balsakits.com and look for Instruction Manuals.

Tools and supplies needed to build:

- **FLAT building board**
- **Sanding blocks with 80, 220 and 400 grit paper**
- **Titebond 1 or 2 glue or CA glue**
- **Fine blade razor saw**
- **X-Acto knife or similar**
- **Waxed paper**
- **Model pins**
- **10-24 Tap and #25 drill**
- **Long 1/8 drill bit**
- **3/16 drill bit**
- **Small clamps**
- **Tape**
- **Screwdrivers**
- **Allen wrenches**

Required for electric power:

- **2212/ 1000 kv motor**
- **30 Amp ESC**
- **3S 500-1000 mah battery**
- **10x6 folding prop**
- **2x 9 gram size servos (metal gear is best)**
- **4 or more channel radio**
- **Covering material (3 rolls)**

Required for Spoiler Option:

- **Spoiler kit**
- **2x 3.7 gram digital servos**
- **2x 12 inch servo extensions**
- **2x 6 inch servo extensions**

Why we recommend spoilers;
First, we make more money 😊
Honestly, it adds a whole new dimension to sport glider flying.
The VEO/GEO airfoil is a special 9% laminar flow airfoil designed by our own in-house crack engineering team.

It glides *really* good.
It glides so good that landings require extensive planning and some luck.
You have to really plan where you want to land and make sure that you meet all of your altitude markers on the approach.
Once in ground effect, it repels the earth.

But, if you have spoilers installed, none of that matters…
You can slide it in from 60 feet over the runway in a quick but easily controlled decent that is actually kind of fun in itself.

Launching as a Pure glider:

You can use a high start with up to 6 pounds of pull (we haven't tested any more than that)

Or you can use a winch.
Be sure to pulse the winch as this is a 2 meter wood wing.

The tow hook location that is pre-drilled worked well for both hi start and winch launches.

We talk more about launching later in the flying section.

Launching as an electric glider:

Full throttle- throw it!

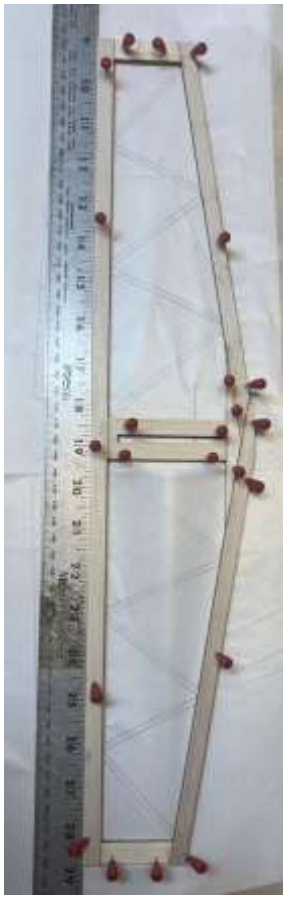
HORIZONTAL STAB

Remove the larger 3/16 balsa tail parts from their sheets.
These parts are marked STAB.

Leave the tiny sticks until the frame is built.

Lightly sand the little bumps left by the tabs.

See the plan for arrangement.



Put some waxed paper down over the plans so the glue doesn't stick to the plans.

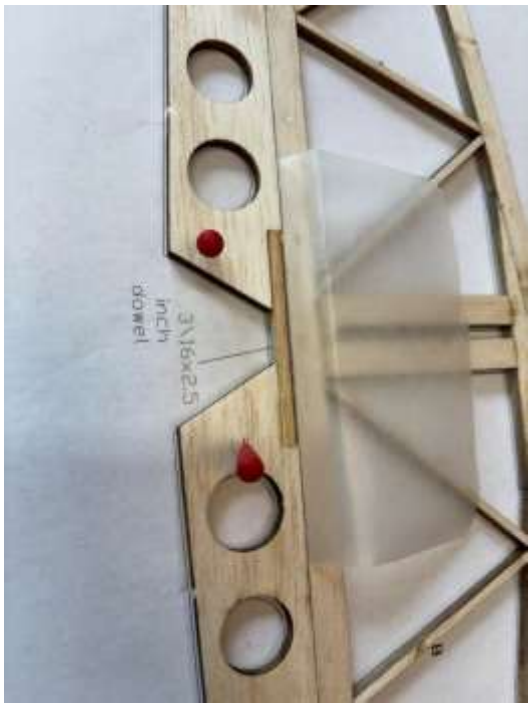
Use a straightedge on the back of the stab TE while you pin it in place.

Pin the parts to the board over the plans.

Use the inside lines as the plans will probably be a little bigger than the parts.

Test the fit of the stab outer frame parts.

When satisfied, glue and pin securely in place.



The stab diagonals are in two identical sets; left and right.

Remove only one set at a time.
They are marked A, B, C, D and E.

Place the diagonals in their respective location.
If the angles don't match, flip it over.

Sand the little bump left from the holding tab.

Test the fit of all diagonals.
It is important that they have a good fit on the front and back.
It is not an issue if they don't touch each other.

Don't worry if they don't align with the plans.
Just try for tight joints.
If needed, sand for a good fit.
You should not have to do this, but don't worry if you do.

Continue to glue until all diagonals are in place.
We don't generally pin diagonals.

Just be sure that they are flush with the top.

You can build the elevator right up against the stab.

Just be sure to put a small piece of waxed paper between the stab and elevator where the dowel joiner gets glued.

Pin one elevator half down against the back of the stab.

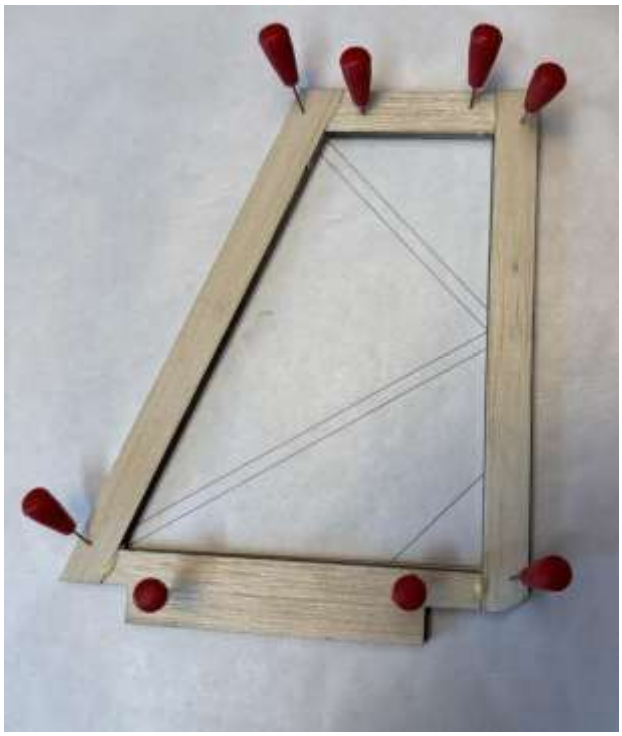
Put the 3/16 wood dowel in place and set the other elevator half in place so it is touching the end of the dowel.

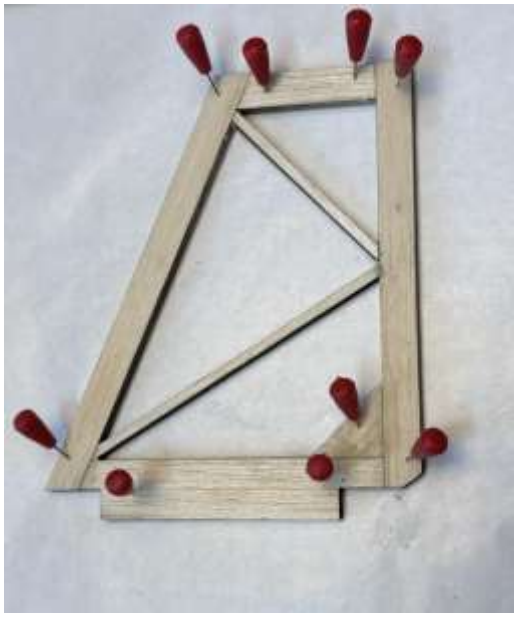
Check to be sure that the elevator is about the same length as the stab.
Within 1/8 inch or so.

If the stab is too long, you can sand the ends of the elevator later so it matches the stab.

Once happy with the fit of the dowel, glue it in place on the elevator halves.

Pin everything in place and leave it overnight.





FIN & RUDDER

Assemble the fin and rudder exactly the same way you did the horizontal stab.

Put some waxed paper down over the plans so the glue doesn't stick to the plans.

Test the fit of the fin outer frame parts.

When satisfied, glue and pin securely in place.

Pin everything to the plans and only cut free the parts that you are currently building.

The rudder diagonals are 3 pieces.

They are marked A, B, and C.

Place the diagonals in their respective location.

If the angles don't match, flip it over.

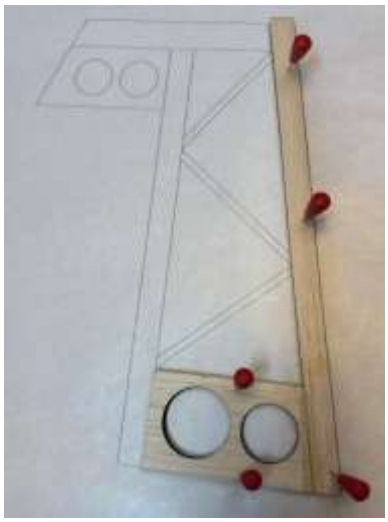
Sand the little bump left from the holding tab.

Test the fit of all diagonals.
It is important that they have a good fit on the front and back.

It is not an issue if they don't touch each other.

Don't worry if they don't align with the plans. Just try for tight joints.

If needed, sand for a good fit.

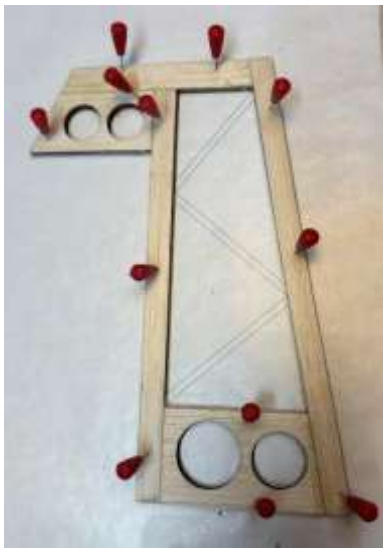


You should not have to do this, but don't worry if you do.

Continue to glue until all diagonals are in place.

We don't generally pin diagonals.

Just be sure that they are flush with the top.



Double check that everything looks good and leave overnight.

Don't glue the elevator or rudder to anything. Set these aside.

When cured, sand both sides of everything smooth with 220 on a block and set aside.

FUSELAGE

You will need to determine if your GEO will be powered or pure.

If powered, use the rear servo tray (marked R).

If pure, use the front (marked F).

Or, install both and have the option.

The model shown is being built for pure flight. We built both powered and pure, so some images will be the powered version.

Start by laying out one fuse side.

be sure to carefully remove any parts in the lightening holes.

Sand any bumps left be the holding tabs.

Glue formers F2 and F3 to one fuse side.

Glue the servo tray to the side.

Glue the other fuse side to F2, F3 and the servo tray.

Add F4, F5 and F6.

Use rubber bands and masking tape to hold everything tightly together.

Add F1, taping it tightly in place.

Allow to sit for 5-10 minutes.

Add the lite ply fwd bottom. Tape it down good.

Add the 1/16 balsa aft rear bottom sheet.

Be sure that the balsa is flush with the light ply sides.

Add F7 stab support.

Ideally, place the fuse on a flat surface with some weight so that it remains straight and square.

Allow to cure.

Glue HS into the slot in F2. Glue the square HS on top of that.

This gets drilled later for the hatch screw.

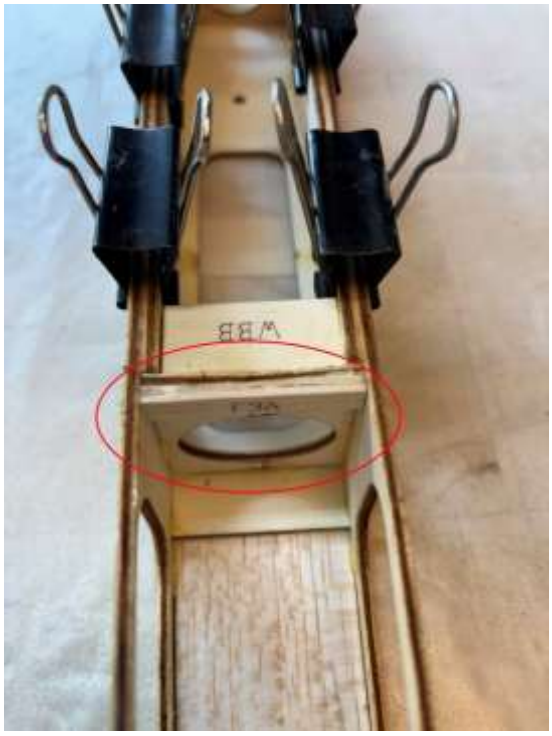
Test fit the F9 doublers before gluing. You may need to sand the front a tiny bit.

Glue in both F9 wing saddle doublers and WBA at the same time.
Glue the WBA into the slots in the rear of the F9's, then glue this assembly into the fuse.
Be sure that the "F9" is right side up.

F9 serves as a wing saddle doubler and a mount for the wing blocks (WBA and WBB)

Be sure that the F9 doublers are flush with the top of the fuse sides.

Glue in WBB on top of WBA. Clamp everything until cured.



Glue 1/8 balsa F3A to the back of F3.

This gets glued flush with the top of the fuse sides and supports the 1/16 cross grain top rear sheeting.

Allow to cure.

HATCH

Use the two (unmarked) 1/8x1/8 ply hatch supports to center the hatch tongue (HT).

Don't glue them, just use one on each side to center HT.

Glue HT to the hatch.

HT should overhang the front by about halfway.

This part is the "tongue" that retains the hatch at the front.

Using the hatch supports again, use them to mark a line 1/8 inch from the sides

Glue each hatch support on the inside of your lines. Try to be exact.

The supports should be centered, front to rear.

These supports stiffen the hatch and also help center it on the fuse.

Sand the top front of the fuse so that F1 is flush with the top.

Glue FF in place at the very front of the fuse.

Let it overhang a tiny bit on the front and sides.

Clamp everything and let cure.

Once cured, check the fit of the hatch.

Sand the top rear of the fuse with 220 on a block. Just make it flat.

Glue the 1/16 balsa cross grain sheeting in place on the aft fuse top.

Start at the wing trailing edge. Glue sheet A so that it fully covers F3A but does not extend forward of that.
If it does, you will have to trim it later so that the wing will fit.

Center sheet A on the fuse top.
Use pins to carefully keep it in place.

Repeat with the other cross grain sheets.

When you get to the last sheet, it will require trimming.

Allow the glue to cure completely before trimming the rear of sheet F.

Use a piece of 1/4x3/8 balsa wing leading edge to fill the rear of the fuselage.

This balsa plug serves as a block to hold the bottom rudder hinge.

Sand this for a nice fit into the rear of the fuselage.

Once the fuse is completely cured, sand everything.

Sand the excess cross grain sheeting flush with the sides.

Sand the hatch flush with the sides.
Sand the balsa tail plug flush with the sides.

Sand the fuse all over.

You can round the corners a little.
Don't round the corners at the wing saddle or the stab platform (F7).

Sand the front of F1 flat and smooth.

Install the pushrod tubes thru the holes in the bulkheads then thru the fuse sides at the rear.

We like to use a tiny drop of 5 minute epoxy at each bulkhead and a little on the inside of the fuse where they exit the rear.

Don't use any more than a tiny bit of epoxy, as it is very heavy and we don't want any extra tail weight.

When cured, cut the pushrod tubes flush on the outside and sand them flush.

Leave the tubes inside the fuse a little long, say to the front of the servo tray.

This completes the fuse for now.

NOSE BLOCK

If you are building the pure version, glue the included balsa nose block to F1.
Be sure to leave an overhang on all sides.

To shape the nose block, we used a band saw to cut both sides and the top and bottom to the approximate shape we wanted.

Then, sand the sides, top and bottom flush.

Using 80 grit paper on a block, rough sand the sides to the shape you want, checking from all sides to make sure they are the same.

Then do the same for the top and bottom.

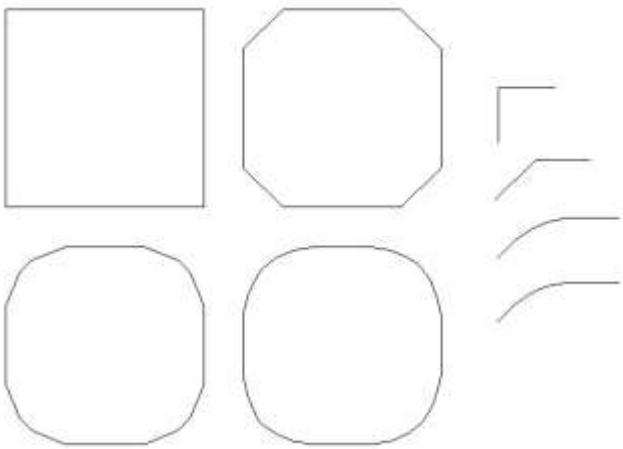
Take your time and try for a pleasing shape.

Once you are satisfied with the shape, start the rounding process.

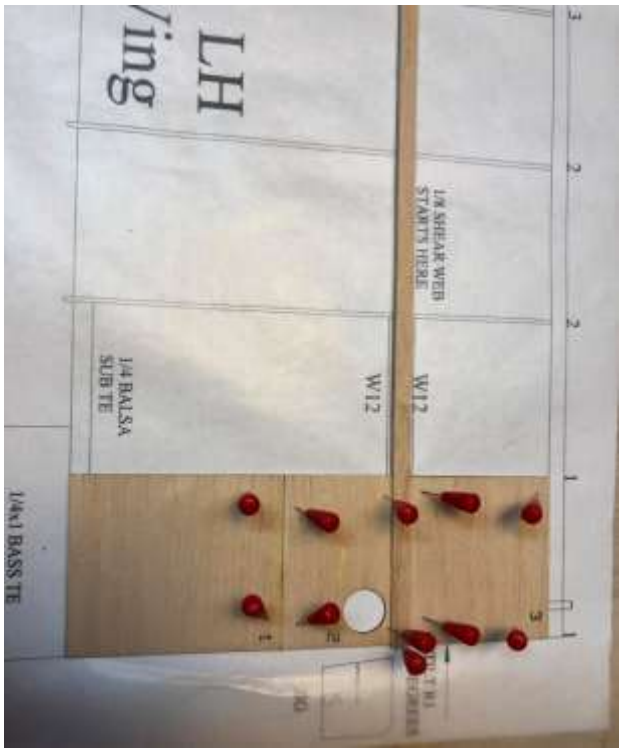
Bevel each corner. Sand this bevel into the fuse side to some extent.

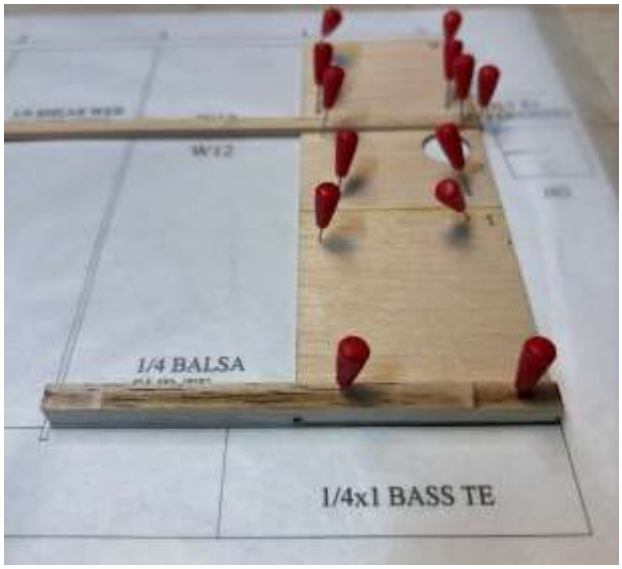
Once all 4 corners are knocked off, bevel the edges of those corners.

You will end up with a nearly perfectly rounded surface.



Sand with 220 paper and make the nose a little blunt as shown.





WING

Build the wing directly over the plans.
Put a layer of waxed paper over the plans before you build.

The following instructions are for the optional spoiler wing panels.
If you are NOT using spoilers, refer to the non-spoiler canter panel plans and substitute R2 ribs as needed.

Start the Left inner wing panel by pinning the 1/8x1/4 basswood spar in place.
Don't pin thru the spar, just pin at the ends so it doesn't move side to side.

Pin and edge glue the 1/16 balsa bottom sheeting in place. These are marked 1, 2, and 3.

Be sure to pin so that the numbers are INSIDE the wing.
They may show thru the covering if on the outside.

The bottom sheeting is pre-cut and should not require any fitting.
Start with sheet 2. Glue the front edge and pin in place against the spar.
Line up the sheeting perfectly with the plans.
Glue sheet 1 to sheet 2.

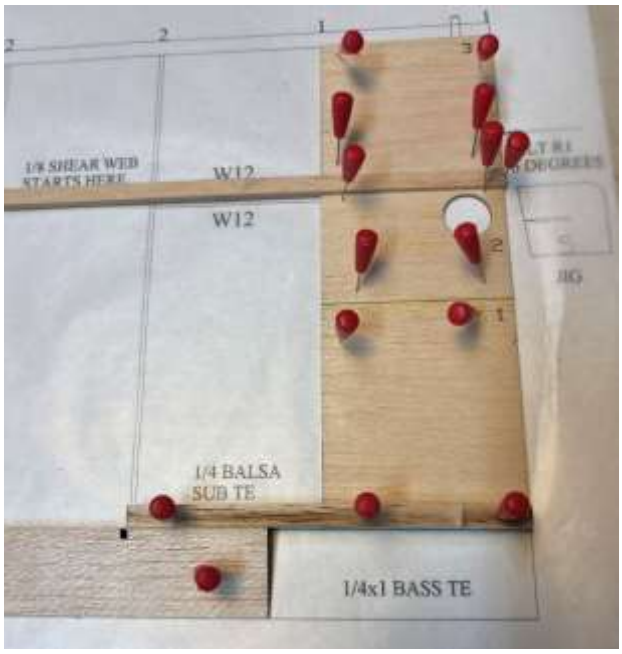
Be sure to pin at each seam so that the sheeting seams are flat.

Glue sheet 3 to the front of the spar.

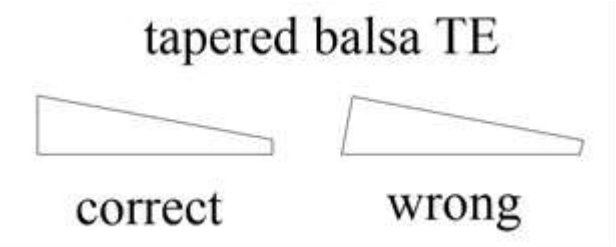
Glue the balsa sub trailing edge to sheet 1.

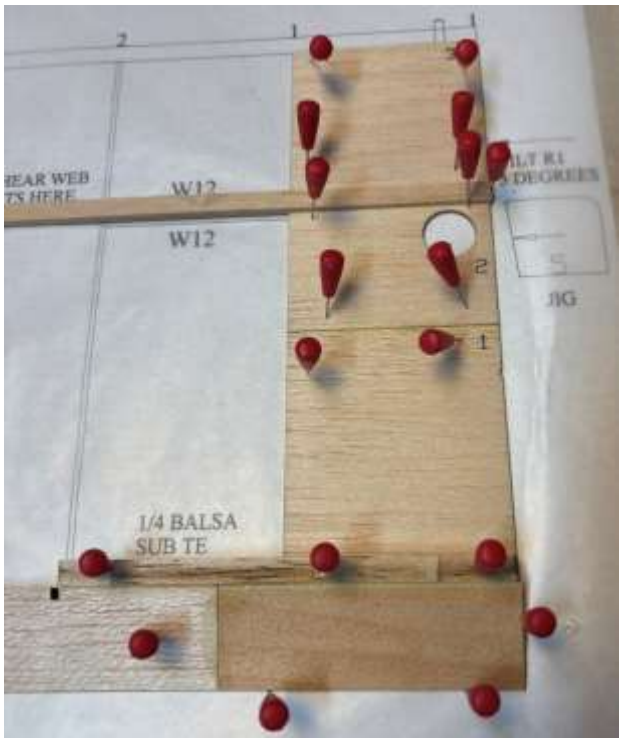
Use something at the back to make the TE and sheet 1 flush.

Pin everything in place.



Pin the 1/4x1 notched balsa trailing edge to the plans. Note that it only goes one way. There is a right and a left and they are not the same.





When placed on the bench correctly, the balsa TE will have the leading edge straight up and the end notch should be at the tip as shown on the plans.

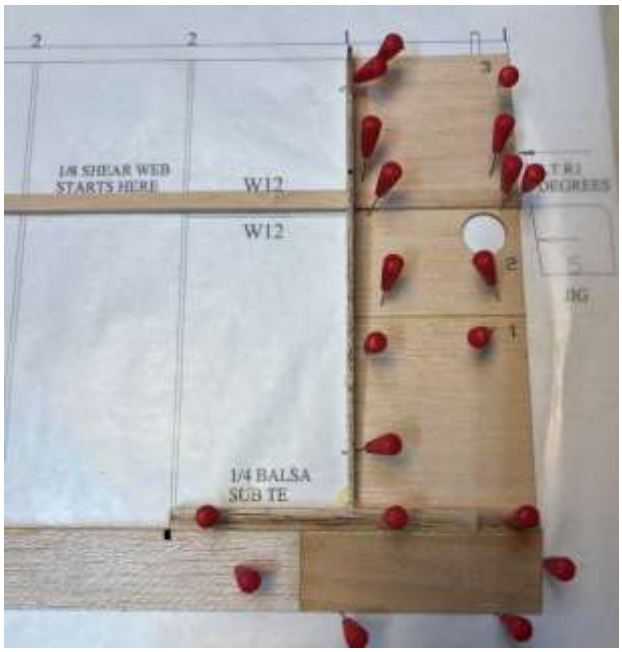
Be sure to glue the balsa TE to the balsa sub TE where they contact.

Make sure that the balsa TE is straight when you pin it down.

Use a straightedge at the back and hold the TE against it while you pin.

Glue the 1/4x1 bass inner TE to the sub TE and balsa TE. Sand so that it butts well against the notched balsa TE

Make sure it is not upside down.



Start gluing ribs, beginning with the second number 1 rib.

Don't glue in the first (root) rib just yet.

Glue the second rib 1 in place over the plan.

It should be at the left edge of the bottom sheeting.

Glue to the spar, sub TE and bottom sheeting.

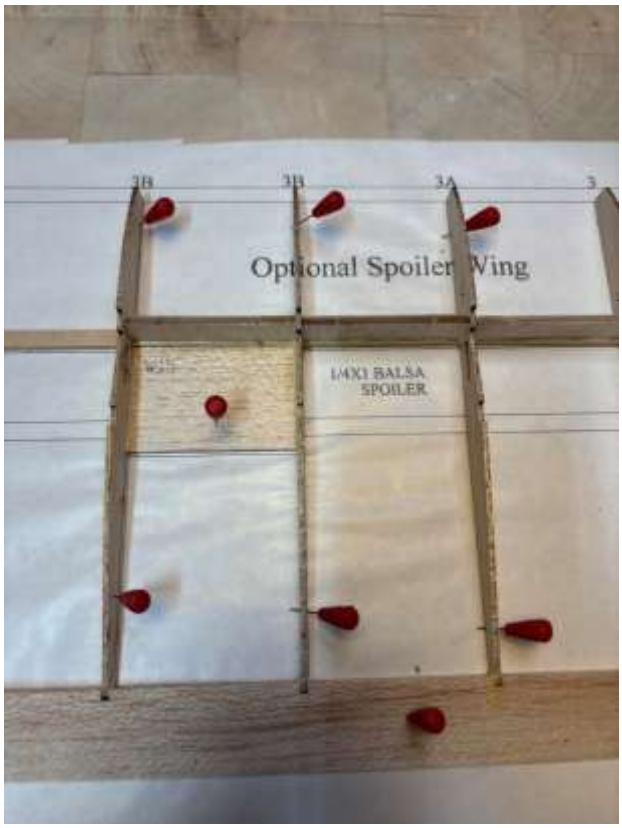
Make sure the rib is straight up, and pin front and rear.

Grab one of the 1/16 ply W12 braces and use it as a spacer to place the next rib, number 2.

Don't glue this ply brace in yet, just use it as a spacer.

Glue the 2 rib to the TE, sub TE and spar.

Again, make sure it is straight up and pin in place.



Glue the next rib the same way, only this time, glue a 1/8 balsa shear web to the bottom spar and both ribs.

This web also acts as a spacer, so from here on, glue rib, web, rib, web and let the webs determine the rib location.

It's okay if the ribs don't match the plans exactly.

It's more important to have a strong wing and tight joints.

Glue W15 to the back of the spar as indicated on the plans.

This serves as the servo bay floor for the spoiler servo.

Glue ribs 3B to this.

Note that the last bay doesn't get a balsa web. We will add braces here later.

When you get to the end (outside) of the panel, use the 5 degree jig to set the last 4 rib inward at a 5 degree angle.

This is important.

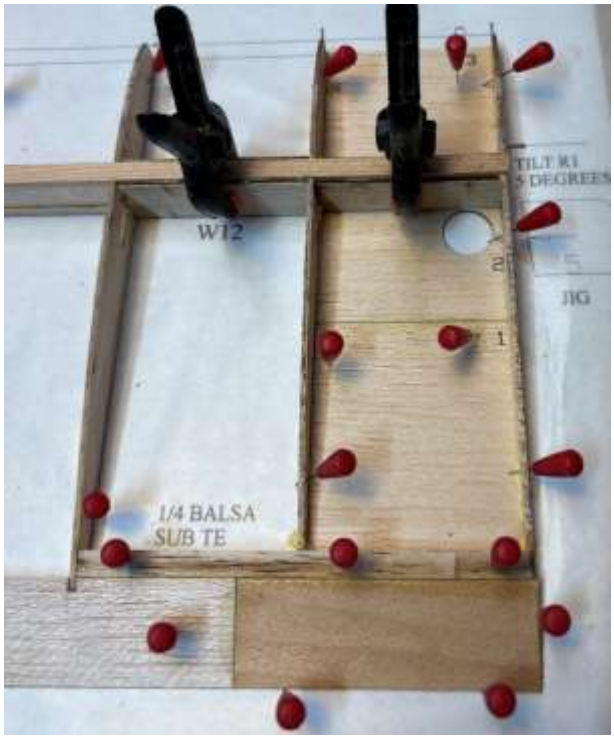
Be sure the R4 rib matches the plan. It should be 90 degrees to the trailing edge.

You can use a square if you have one.

The rib must be tilted inward 5 degrees for its entire length.

Use pins to hold it securely in place.
Do the same with the first 1 rib. 5 degrees inward and 90 degrees to the TE.

Pin securely.



Add the top 1/8x1/4 bass spar.

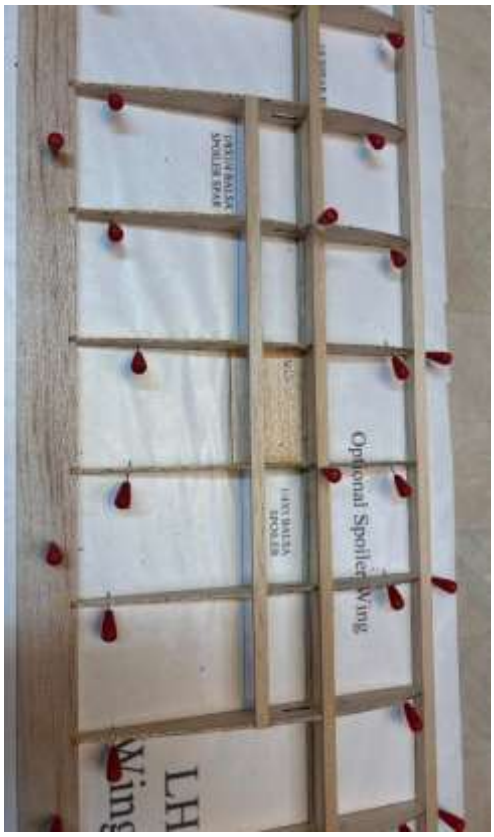
Glue in W11 and W12 1/16 ply braces between the 1 ribs.

Note that W11 is angled 5 degrees to match the root rib.

Be sure these braces are sitting even with or below the tops of the ribs.

Otherwise they will interfere with the top sheeting.

Double and triple check your 5 degrees at root rib 1.



Glue in the 1/16 balsa W13 braces at the outer end of the panel.

These are angled to match the 5 degrees of the 4 rib.

Sand to fit if needed.

Double check the 5 degrees at both ends of the panel.

Add the 1/4x3/8 balsa leading edge.

Add the 1/8x1/4 balsa spoiler spar as shown.

Allow everything to cure.
If you have room, build the Right inner panel.

Glue in both 1/8 balsa G1 gussets to the outer end of the panel.

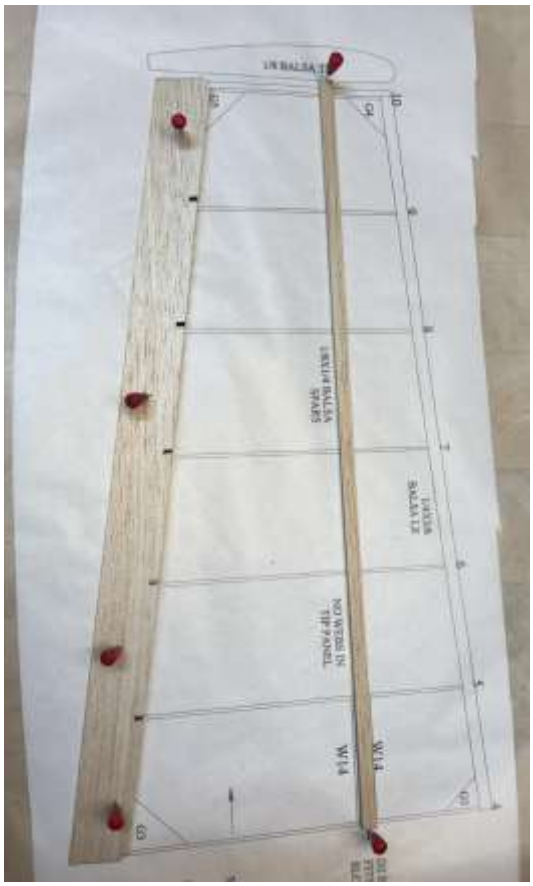
Lightly sand the tops of the first ribs.
Test fit the 4 and 5 1/16 balsa top sheeting.

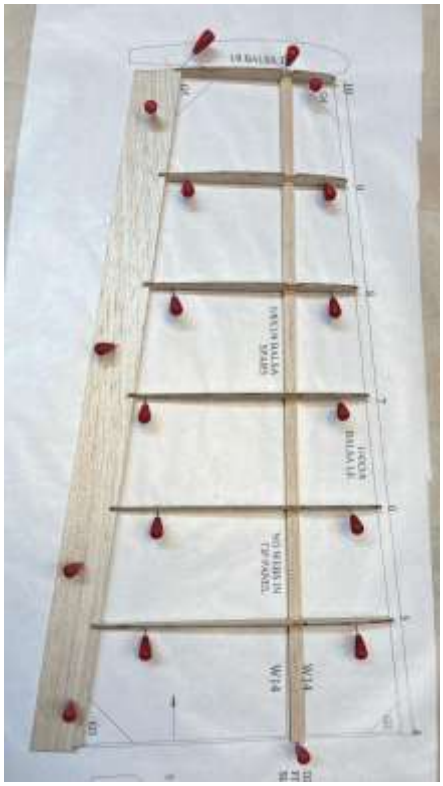
Glue in the 4 and 5 top inner panel sheeting.

These get glued to the ribs, spar and sub TE.
They should fit well. If not, carefully sand to fit.

Pin in place and allow to cure.
<u>Do not glue in sheet number 6 at this time.</u>

Repeat on the other inner panel if you have not done so.





TIP PANELS

Pin the 1/4x1 notched balsa in place over the plan.

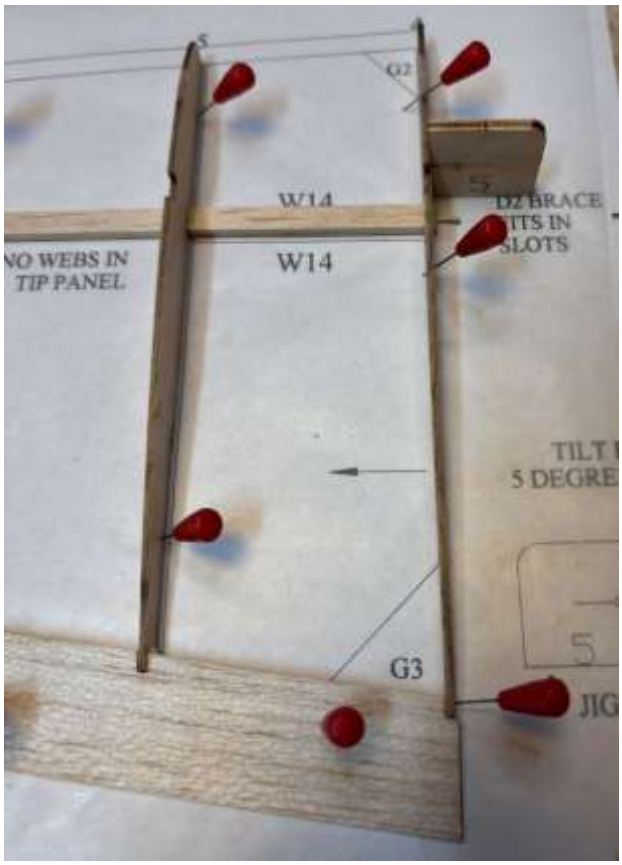
Note again the there is a right and left, and they only go one way.

Be sure the leading edge is straight up and you will be good to go.

Set the 1/8x1/4 balsa spar in place. Test fit with a couple of ribs to determine the exact spar location.
Be sure the front of the ribs all meet the leading edge line on the plans.

You can pin the spar on the overhang outside of the panel.

Glue ribs 5-10 to the spar and TE, pinning the ribs as you go.
Be sure that they all line up at the LE.



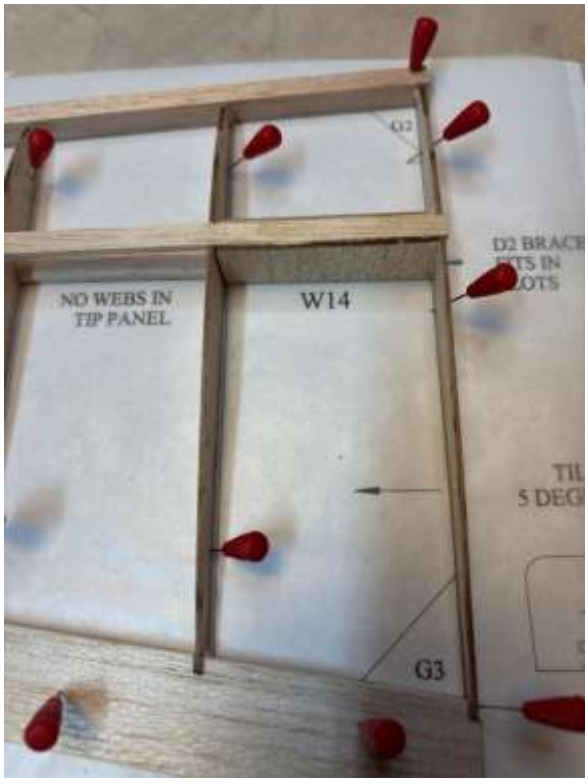
If the notches in the TE don't match the plans, that's okay.

Just keep the ribs parallel to the rib plan and straight up.

Glue in the first 4 rib at 5 degrees inward tilt.

Use your jig and be sure it matches the plan.

If not on the line, at least parallel with the rib line.



Add the top 1/8x1/4 balsa spar.

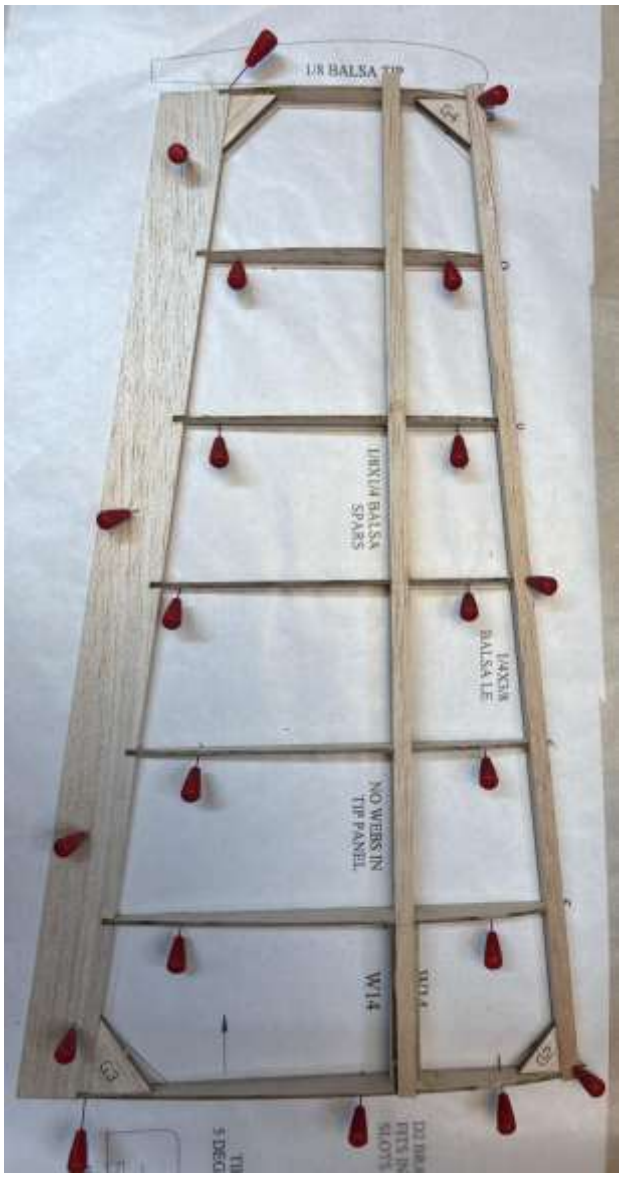
Glue in the 1/16 balsa W14 braces.

Note that they are angled to match the 5 degree tilt of R4.

Glue the 1/4x3/8 balsa leading edge to the front of all ribs.

Double check the angle of R4 and be sure it is 5 degrees all along, front to back.

Allow to cure.



Add G2, G3, G4 and G5 gussets as shown.

Allow to cure.

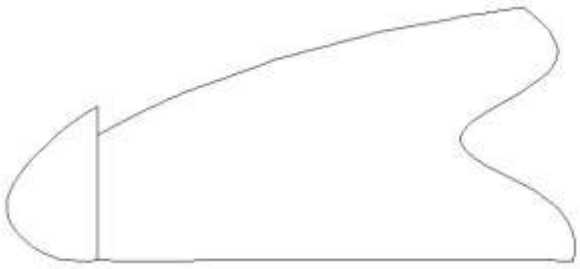
Repeat on the other tip panel if you have not done so.

ASSEMBLY

Sand all panels so that the 1 and 4 ribs are flush. Sand the tip panels so that rib 10 is flush.

Plane the balsa leading edge so it looks like the shape shown.

<u>Be sure to leave some thickness at the wing root, as the #6 sheets will be glued against the balsa LE.</u>



We use a small razor plane and 80 grit sandpaper on a 12 inch block.

You can do it with just a sanding block but the plane makes it easier and more accurate.

Repeat on other wing panels.

Glue the 1/8 balsa tip plate in place.

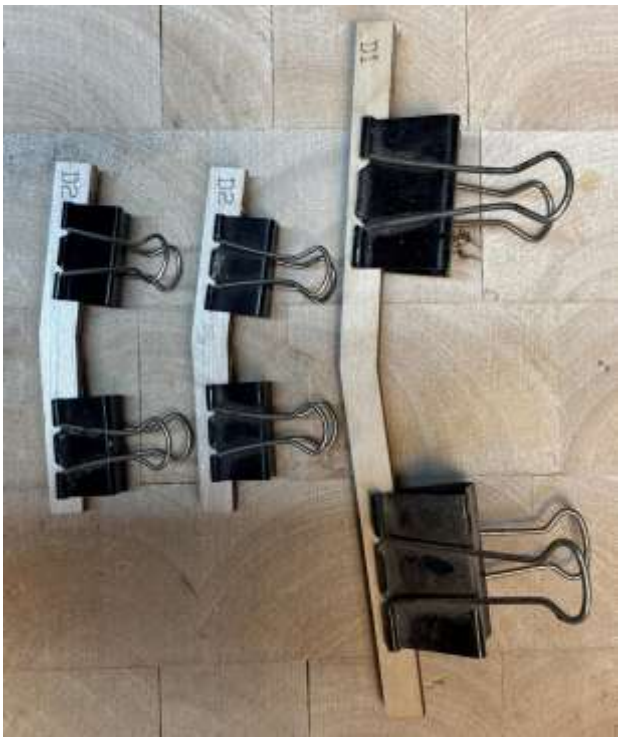
Sand all wing panels with 220 paper. Remove any tabs bumps and glue drops.

Sand the wing tip so that it is flat and flush. You can round the tip to a pleasing shape.

Lets get the center panels joined.

Laminate the two D1 braces. One 1/8 ply and one 1/8 balsa. Also laminate both D2 into a pair of balsa tip braces.

Double check alignment and allow to cure.



Use a sharp knife to cut away the spar box in the first rib only (different wing shown).

The first two ribs are slotted between the spars for a cutting guide.

Cut the balsa away from the first rib.

You can carefully use a flat screwdriver to knock the balsa away from the second rib.

Use a small file to carefully clean the slot.

Remove all balsa debris.

Be very careful not to damage the third rib.
It is an innocent bystander.

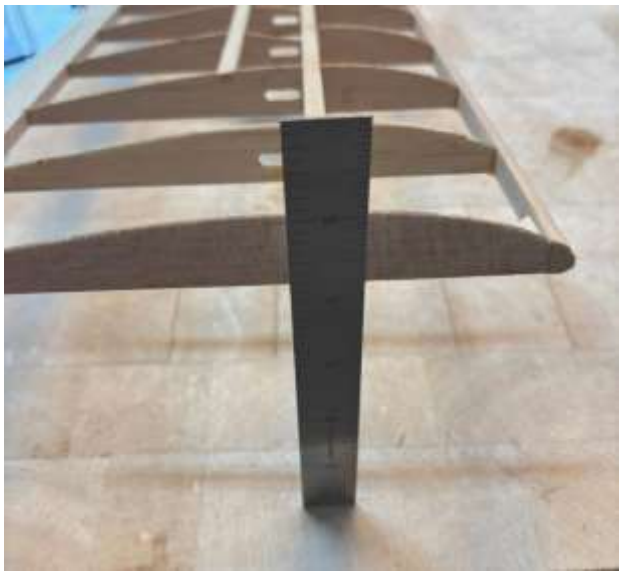
Test the fit of the D1 brace in each wing half. It should be a slightly snug fit but not at all tight.

Sand the balsa side of the brace slightly if needed for a smooth fit.

Place the wing on the bench over some waxed paper.

Test fit the wing panels together with the D1 brace.

Set one panel on the bench with some weight and block up the other so that it measures about 4-1/4 inches from the bench (at the wing bottom spar tip).



The dihedral angle is not critical. Prop the tip up as high as you can without pulling up the other panel or putting upward pressure on it.

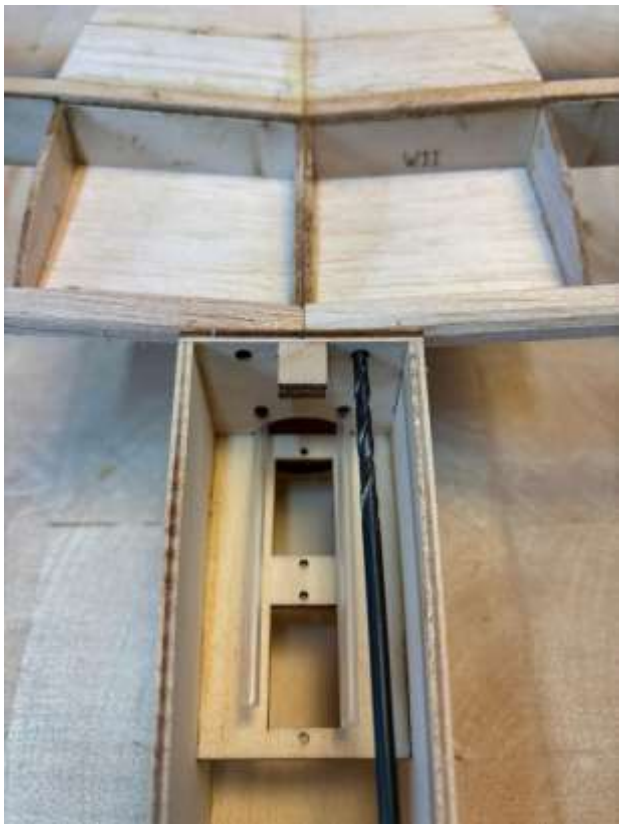
If you are happy with the fit at the wing center joint, apply glue all over D1 and the wing roots where they join.

Put the wings together and wipe away excess glue.
Weight and block up the wing as before.

Pin and tape the wings tightly together.

Allow to cure.

Time to get the wing mounted.



WING MOUNTING

Make small marks at the center of F2 and F3 for alignment.

Set the wing in place in the wing saddle.

Make sure the wing is all the way forward in the saddle and centered.

Center the wing on your marks and tape in place.

Use a 1/8 drill bit (a long bit works best) to drill a straight hole thru F2 and thru the balsa LE.

Go slowly and try to keep the bit straight and square.

Repeat for the other hole, making sure nothing moved.

Slightly round both ends of the two 1/8x3/4 Beech dowels.

Test fit the dowels in place. They should be tight in the wing LE and not tight in F2.

Glue both 1/16 ply DD parts in place.

These are dowel braces glued to the back of the balsa LE.

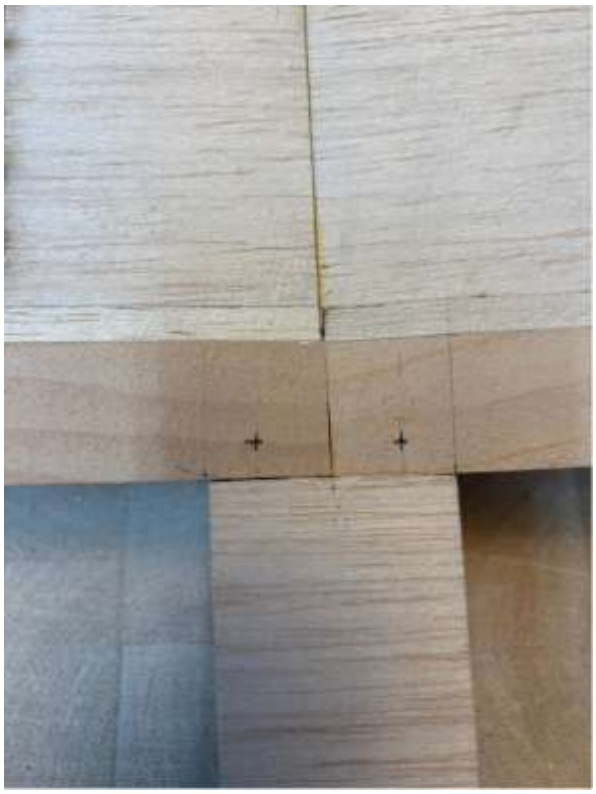
Use only a tiny bit of glue.

Don't get any glue near the dowels.

They may need to be sanded slightly to fit well.

Carefully clamp both DD braces in place

Dowels are not glued in until after wing is covered.

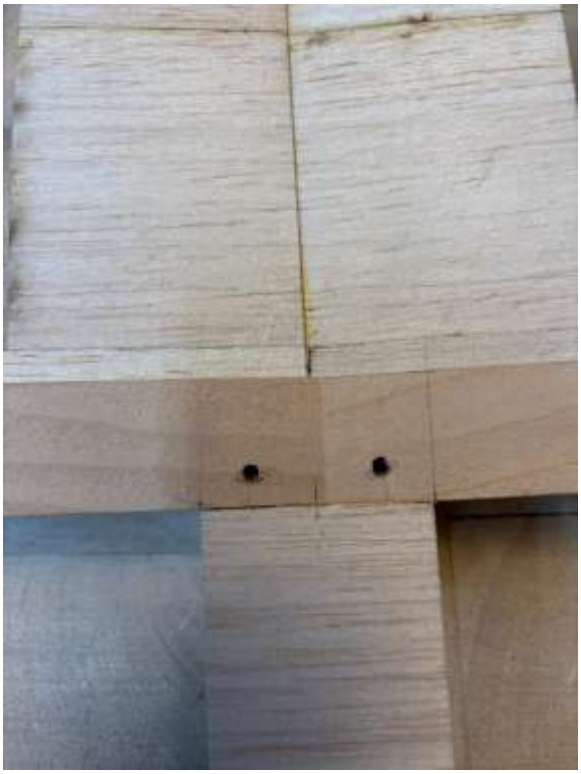


Mark the basswood TE for the wing bolts. Mark 3/8 to 7/16 inch from the <u>outside</u> of the fuse.

Make another cross mark at ¼ to 5/16 inch forward of the wing TE.

Drill at the cross marks with a #25 bit. Drill thru the wing and the wing bolt plates.

Try to angle the drill so that it is 90 degrees to the top of the TE (angled back). This will ensure that the wing bolts sit flat.



Remove the wing being careful not to disturb the ply DD supports.

Carefully remove the 1/8 wing dowels. You can turn and pull them out.

We will glue the dowels in place after we cover the wing.

Tap the holes in the wing bolt plates only with a 10-24 tap.
Go slow and try to make good deep threads.

Flood the tapped holes with thin CA or Titebond.
Use a Q-tip to remove excess Titebond. Allow to cure.

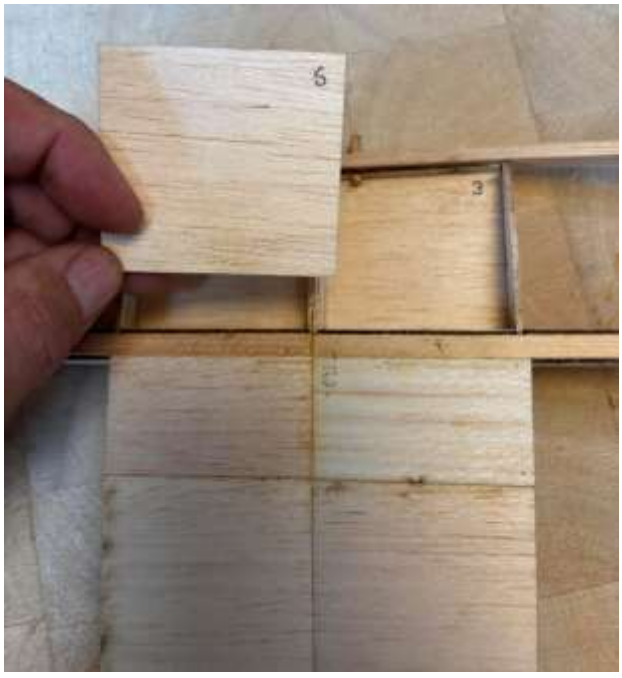
Once cured, run the 10-24 tap thru the holes a few times to clean out the threads.

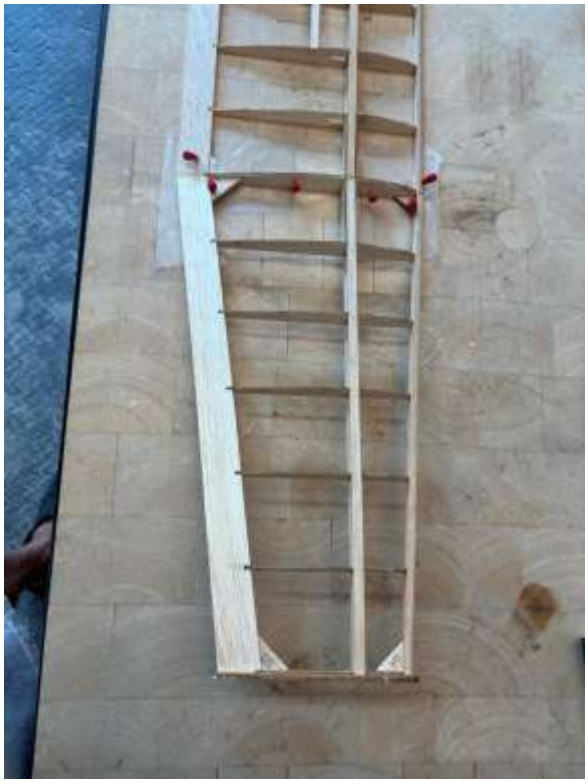
Drill out the holes in the bass wing TE to 3/16.

Back to the wing, check the fit of both number 6 balsa wing center sheets.

Sand slightly if they need fitting.

Glue both number 6 pieces in place and allow to cure.





TIP PANELS

Glue the tip panels onto the center panels just like you did before.

Fit the tip dihedral braces just like the center braces. Sand for a loose fit. Wood glue tends to grab instantly in balsa to balsa joints.
Make the braces a loose fit in the spar boxes.

Test fit the tip panel. If all is okay, glue, pin and brace just like before.

The actual dihedral angle is not critical. Just try to get both tips the same. We propped ours to 2-3/8 inch for reference.

Be sure to put waxed paper under the joint so that the wing and bench don't become one.

Allow to cure fully.

Carve and sand the 1/8 balsa wingtips to a pleasing shape.

The shape of the tip is not critical.

We like to round it nicely so it's easier to cover.

CONTROL SURFACE PREP

Mark the center of the elevator leading edge.

We used a pencil laid flat on the bench to mark the centerline.

You can also use the Balsakits hinge centering tool.
You can use paper as shims under the elevator to get the pencil lead (or pen) in the exact center.

Make this line for the full length.

Repeat for the rudder.

Bevel the leading edge of the elevator and rudder.

The best way to bevel the surfaces is with a plane. It makes for quick accurate work.

You can use a sanding block with 80 grit.

Make a 30 degree bevel on one side.

Bevel to the center line.

Flip the part over and do the same.

You should end up with a nice bevel on the leading edge of the control surface.

Note that you will have to sand a slight bevel in the wood dowel.

Go easy, and try not to sand the balsa along with it. Easy to oversand the balsa without realizing it.

Repeat for the rudder LE.

TAIL FITTING

Fit the horizontal stabilizer to the fuselage. You may have to sand the front of the stab.

Fit the fin in place in the slot on the stab, as well as the slot on the fuse.

You may need to adjust the tab on the fin slightly to get a good fit in the stab and fuse slot.

Check the *fin* trailing edge to see if it is flush with the back of the fuse.

The back of the fuse should just be a straight line with the fin TE.

If it is not, sand the fuse until it is.

The rudder attaches to the fin and fuse bottom, so this needs to be a continuous line.

Sand the front of the horizontal stab if needed for joiner dowel clearance. It must not touch the rudder.

MOCK-UP

Electric version is shown for mock up.

Cut 5 inches from each pushrod.

Slip the .047 steel rudder pushrods thru the pushrod tubes

Z bends to the tail.

Screw the rudder and elevator servos to the servo tray as shown.

Bolt the motor in place with the four screws we provide (#4 Phillips screws).

Route the motor wires thru the side cooling hole.

Add the 10x6 folding prop.

Don't plug anything in.

Put your ESC in the nose. Just set it in place for now.

Put your battery in the nose and pop the hatch in place.

If building pure, put your receiver and flight battery with switch in the nose.

Mark and drill a 1/16 hole thru the hatch into HS.

Measure carefully and try to drill in the center of HS.

Attach with the supplied brass wood screw.

Tape the rudder and elevator to the fin and stab.

We are gonna try to get an idea where this thing balances

We want the plane to balance on the front of the wing spar.

If you need more nose weight, try a bigger battery.

Better to add usable energy than dead weight.

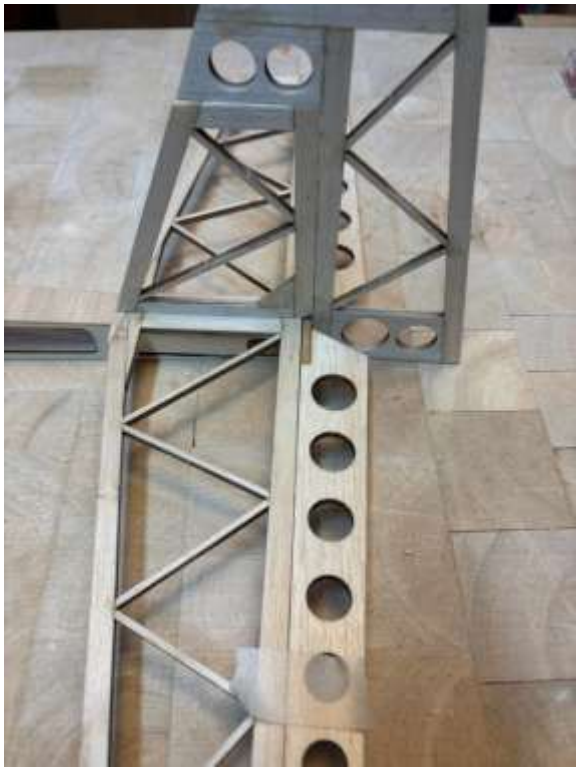
Either way, add whatever weight necessary for the plane to balance somewhere on the spar.

The plane should be level when held on your fingertips at this point.

Take the time to get this done. If you don't, you will quickly "re-kit" your investment.

Once you have a handle on the balance, take a step back and admire your fine work!

It is a law that at this point, you must keep the tail in place and stand back for a good look.



Depending on where you live, you may also be required to bring somebody else into the workshop for a look.

Enjoy the progress you have made thus far!

Remove everything in preparation for covering.

PREP FOR COVERING

Sand everything with 220. Get rid of any bumps or blobs.
Go easy on the balsa. 220 still cuts it pretty fast.

Sand the entire fuse.
Slightly round all edges on the fuse, except the wing and stab saddles.

Vacuum or blow off all parts completely.

Cover the plane with your favorite covering material.
We won't go into detail as there are hundreds of videos on YouTube about covering an RC airplane.

If this is your first covering job, it will probably be horrible.
It's not, but it may seem that way, as you know of every little mistake.

We assure you, it won't make any difference to the plane…

Just make sure that you don't induce any warps when covering. Check the wing by setting each panel on the flat bench.

If any part is not touching the bench, you can twist in the opposite direction and apply a little heat from a heat gun.
Allow to cool for 30 seconds and re-check.

Do the same for the tail. If it doesn't sit flat on the bench, fix it or crash.

SURFACE HINGES

Cover completely before hinging.

We like Tyvek type hinges. Normally called CA hinges.

Use thin CA. Just be aware that thin CA will go everywhere. Only use a drop on each side of each hinge.

Mark the hinge locations as shown on the plans.

One hinge should be in the tail block of the fuse. Glue this in when joining the tail to the fuse.

Use a sharp knife to cut a slot about 3/4 inch long at each mark Be sure it is centered on the surface edge.
Be sure to keep the slit on the centerline and straight into the part.

Run the blade back and forth in the slot so the knife is a loose fit.

Test the fit of the hinges in each component. You should be able to push the surface tight so that it touches the component (wing, stab or fin).

Once you have all hinges in place make sure that the surface is centered and not overhanging on the ends.

Keep the hinge gap as close to zero as you can.

If all checks out, put a drop or two of thin CA glue into the hinge with your fine tip glue bottle.

Allow to cure for a few minutes.

Be sure the gap between the surface and component is minimal (1/32 inch).

Allow to cure for a few minutes then flex the surface to its full deflection point at least 24 times. Do both the elevator and rudder like this.

ASSEMBLY

We need to mark the covering where the fin contacts the stab, and the stab contacts the fuse.
The covering must be carefully removed from this area for a strong, wood to wood joint.

Prepare the tail for gluing by marking the stab bottom where the fuse is. Put the stab in place on the fuse.
Cut the covering out of the slot in the stab.
Slip the fin and rudder in place.

Be sure that the stab is centered and not skewed. Mark the covering on the stab with a fine tip marker. Mark around the fin on top and along the fuse on bottom.

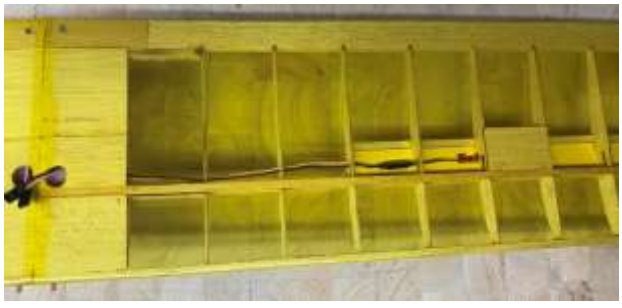
Carefully trim the covering well inside your lines. Try not to cut into the wood.

Wipe away marker lines with alcohol or acetone.

Glue the stab to the fuse, and glue the fin to the stab.
Make sure that the bottom hinge is in place on the rudder, and that the stab joiner dowel is free to move.

You can use a pin or 2 to secure everything until it cures. Try to get the stab as level as you can.

ELECTRONICS



Cut the covering in the wing servo wire holes if using spoilers.
Don't cut them out if no spoilers.

Bring the spoiler servo wires out thru the round holes at the wing root.
Attach a 6 inch servo extension to each servo port on the receiver.

Open up the holes in the plastic elevator and rudder servo arms with a 1/16 drill bit.
We used the second hole out.
Press on the metal retainer as shown.
Install the impossibly small slotted screw a turn or so.

Mount the motor to the firewall and run the wires thru one of the cooling holes like before.

Leave the prop OFF for now.

Plug the motor into to the ESC. Any order. There is no polarity. If the motor runs backwards, swap any two motor wires.

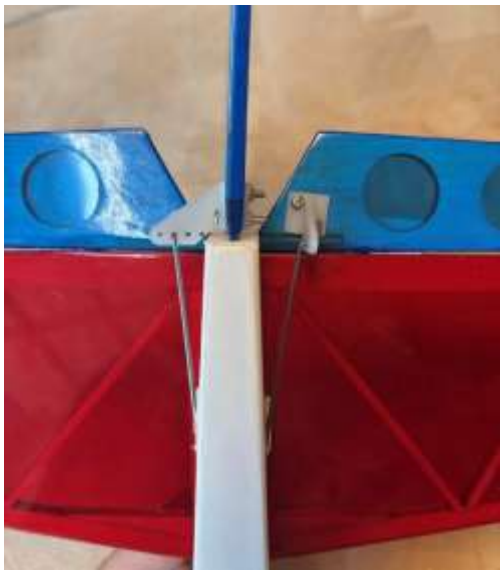
Plug the ESC into the throttle channel on your receiver.

Follow the instructions to bind your transmitter to your receiver.

Once bound, be sure to do throttle calibration on the ESC.

Once all that is done, plug in the rudder and elevator servos.

Make sure that all of your trims on the transmitter are centered. Turn on the transmitter and receiver.
Slip the pushrod thru the tube into the EZ connector at the servo.



Slip the Z bend pushrods into the plastic control horns. You may need to open the holes with a piece of .047 pushrod.

Place and drill the holes for the control arms. Be sure they are approximately lined up with the pushrod. Attach the horns with the screws and backplate provided.

Put the arms on the servos so that they are 90 degrees to the servo and pointed at the pushrods.

Center the control surface and lightly tighten the screw on the EZ connector.

Cut off the excess pushrod so that there is about ¼ inch extra.

Trim the corner of the rudder control horn so that it clears the fuse at the bottom.

SETUP

You should do all setup without a prop. Blood gets into the strangest places on the airframe.

First make sure that all surfaces move in the correct direction:
Elevator stick back is up, forward is down.

Rudder stick left and right are the same for the rudder.

Mount the receiver with two sided tape or velcro.
Mount the ESC (with two sided tape) to the side of the fuse down low.

Glue a strip of Velcro to the battery tray, with the other part of the Velcro on your battery.

Use your radio to set the control throws as shown. If you don't have dual rates, adjust so that the values are between low and high rate.

Remember that aircraft sensitivity is directly related to CG. A forward CG with low rates will require full stick movements normally.

Low Rates:
Elevator-3/16
Rudder-1/2

High Rates:
Elevator-3/8
Rudder-Full

Note that the controls will be more sensitive as you move the CG back.

Put the folding prop on and tighten securely.

Slip the silicone band over the blades until it is behind the spinner. Check that it folds on it's own (by hand, without power).

TIPS FOR COVERING

The various versions of "Chinakote" are all about the same. They may even be the same.
They all have the same traits.
First, they are not Monokote and will never be. Monokote is gone, but this is a good replacement. It is different, so there will be some differences if you are used to MK.

The heat ranges are as follows:

For tacking, we use about 240 degrees.
Tacking is the hottest temp that will not shrink the film.
Great for color over color.

For ironing on, we like about 280-300.
Sticks very well and will shrink the film around corners, etc.

The biggest thing you will discover is that the glue is low temp and the shrink is high temp.
This will manifest its ugly self as seams pulling away when you start shrinking.
Use generous overlaps (1/4 inch) when you can.
If you use a heat gun (and you should), mask any seams with a ruler or cardstock.
Keep the high heat away from the seams and they will hold.

This stuff will shrink quite a bit. We have never melted thru, but we have had it so hot that it changed color. Permanently. Try to get the film as tight as you can while sticking it to the perimeter, to minimize the amount of shrinking required.

All opaque colors have white glue. Not a big deal but it will melt and leave white residue and visible white edges.
This is easily removed with a little acetone on a rag.
Don't use lacquer thinner as it will dull the finish.

The film stays tight with extreme weather changes. This is a good thing.

The brighter colors will fade in sunlight after prolonged exposure.
Not a big deal unless you have to repair something.

The transparent colors have a clear backing that is difficult to remove.

We use two pieces of good quality masking tape at one corner.

Press them together and quickly rip them apart. It may take two or three tries, but the backing will separate.

Be very careful and don't let the film touch itself, glue to glue. It will permanently ruin the color.

You will find that this is the best and worst film you can find…

FLYING

Be sure that the plane balances at the front of the wing spar in the ready to fly condition. Balance there for first flights.

Double check that all servos have their servo arm screw in place and tight.

Attach the wing with the two 10-24 nylon screws provided.

Both electric powered and "Pure" planes:

Test fly your GEO in a grass field by gently pushing it forward towards a spot 50-75 feet away on the ground.
That's right- aim for the ground about 50-75 feet away.
You never want to throw an airplane up, especially a glider.

Make sure your radio is on, plane is balanced in the front of the spar, all control surfaces are neutral, spoilers are closed and wings are level.

Toss it and see what happens.
In a perfect world, it will sail gracefully, straight and smooth to that point.

If it does not, find out why and fix it now.
The number one most common reason that a plane wont glide straight is a warp in the wing or tail. Don't let this be you. Fix that stuff before you get to the field.

Once you have thrown your plane a few times, and are confident that all controls work as desired, it's time to get some altitude!

Electric powered planes:

Make sure that your 3S battery is fully charged.

The GEO 78 has a good 45 degree climb with the recommended power.

We generally launch to 400 feet and an 800 mah 3S pack will provide at least 2 launches.

We have run from 450 mah to 1500 mah.

We strongly recommend setting up an arming switch on your transmitter. This will prevent the prop from turning no matter the throttle position.

Full throttle and launch the plane exactly as you did in the test glides.
It will start to go up rapidly. Use some down stick to keep the nose at 45 degrees or so.

Once at altitude, slowly reduce power to zero.
That folding prop will snap into the stowed position, and you are ready to hunt!

Pure Glider:

Setup your high start or winch directly into the wind.
Make sure that the tow hook is tight and cannot rotate.

For the high start, pull until you get about 6 pounds on the line. This is about standard for a "2 meter" high start.
The wing can probably handle more, but you are on your own for that.

Throw the plane hard at about 45 degrees up (I know, I know).
Use the rudder to steer into the line. Very easy to do.

Watch the plane. If it starts to wiggle the tail or weave right to left, it is stalling or nearly so.
Hold a bit of down elevator until it stops.
For a winch, you should be tapping the pedal after the initial 2-3 seconds of launch.

On subsequent flights, trim some down elevator for launch, or use a launch mix on your radio.

The easiest way to release is to just continue to fly over the anchor or turn-around.
The plane will simply fly off the line, and the parachute will pull it away.

You can do a mild "zoom" launch but be careful. There can be a lot of broken dreams at the end of a zoom launch.

Once off the line, trim for a moderate (speed) glide. The plane will fly with quite a bit of down trim, but the GEO shines in the slower speed range.
About 20 mph by eye, although it really depends on conditions.

Get the plane trimmed for that speed and wings level.

The GEO is very responsive to lift, especially in slow flight.
Look for a wing tip to rise, then turn into that.

With practice you can learn to "feel" the thermals and get a sense of their size and movement.

Get comfortable with the plane. Experiment with different CG positions.
Once you know how your plane responds to the elements, you will be able to soar for a long time with relative ease.

Some tips:
Conditions matter. Gusty or turbulent winds are no fun, especially near the ground.
Although it is important to be able to fly in any reasonable conditions, don't push it.

Every time you turn into the wind, especially if you have some airspeed, the plane will "ballon" up.
This is not a thermal. This is you.

Terrain can help. Anything can give you an updraft, called "ridge lift". A row of trees, buildings, etc.
If the wind is blowing toward them, it will curl up and you can ride that.
Find the strong part of the wave, and travel parallel with it, or 90 degrees to the wind.
Try to always turn upwind. Turn, run along the wave, turn the other way, run along, etc.

This works for as long as the wind is blowing. It's fun, and you can learn a lot about invisible wind.

The best time for thermals is late morning in most parts.
What you are looking for is the ground heating up. That air gets warm and eventually forms a bubble that breaks free from the ground.

Thermals are all around, all the time. While you can certainly choose ideal conditions to launch, the only way to find a thermal is to fly into it.

Birds love thermals, but not mainly for the reason we do.
Thermals carry bugs aloft and birds eat bugs. The rising air is just a bug cafe to them.

When its time to land, try to come in low and slow, but not too low or to slow…
Use your spoilers to put the plane anywhere you want.

The bottom line is to fly as much as you can, in as many types of weather as you can.
The more in tune with your ship, the longer and more rewarding you flights!

The GEO will glide quite well, even in "bad" air.
Plan your landings well and try to avoid turns close to the ground.

Enjoy yourself and practice approaches from BOTH directions.

Once you have some flight time, try moving your battery around or use a lighter/ heavier pack.

You may have to adjust control throws after moving the CG. Just do what is comfortable to you.

Thank you *so much* for allowing us to help bring you a little happiness.

Please let us know if you have any comments, suggestions, complaints, etc. We listen.

support@balsakits.com

SPOILER INSTALLATION

The optional spoilers really add a new dimension to glider flying by allowing you to control your decent from a flat glide to a cinder block approach while remaining in complete control.

When building the center wing panels, replace some of the number 2 ribs with the spoiler ribs in the order shown on the plans.

The ribs marked 3 are on the outsides of the spoiler.
The ribs marked 3A are next and the ribs marked 3B are the two ribs at the center of the spoiler opening.

3B ribs are cut for the W15 balsa servo base.

Double check that you have the ribs in place as the plan shows in the "optional Spoiler Installation" Drawing shown on the plans.

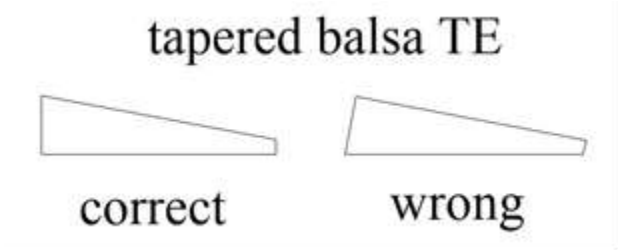
Glue in the 1/16 balsa W15 servo base. This gets glued to the bottom of both 3B ribs.

Seal W15 on top (inside wing) with a coat of CA or 5 minute epoxy. Just a thin layer. This provides a good base for the double sided servo tape.

Glue the 1/8x1/4 balsa spoiler spar in place behind the spoiler opening.

Test fit the spoiler blade (1/4x1 balsa tapered stock) in place. Sand the ends so that you have about a 1/32 to 1/16 gap at one end.

The spoiler should be upright as shown (just like the wing TE).



Clean the side of the servo case with lacquer thinner or other solvent and dry thoroughly.
Check the orientation of the servo and put a piece of double sided servo tape on the servo.
Leave the other side release paper in place. We cut off the mounting ears on the servo.

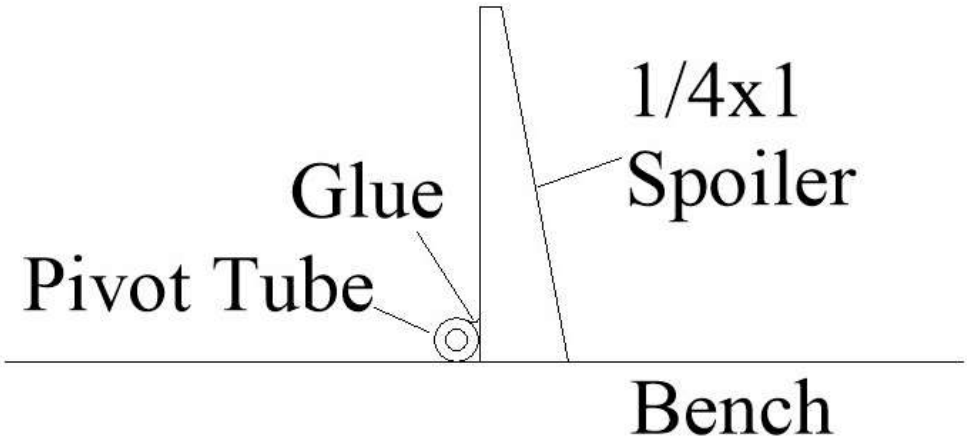
Use the long servo arm and drill out the last hole in the servo arm with a 1/16 bit.

Plug the servo into an unused channel and assign a switch to that channel.
Set the end points to +100 and -60.

Set the servo arm so that it is pointing slightly forward at the top of its travel (+100%) as shown.

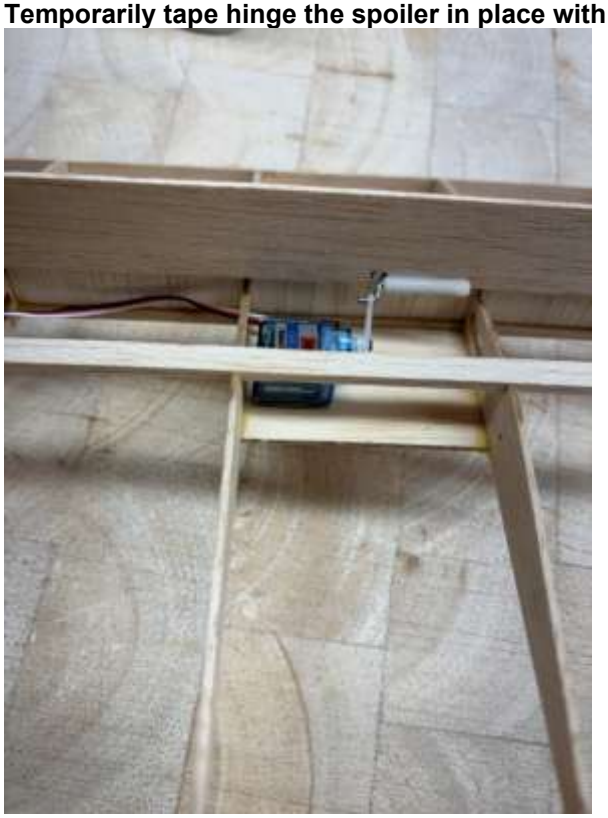
Mark the location of the servo arm on the bottom of the spoiler blade.
Remove the spoiler blade and glue the pivot tube so that it is about 1/8 inch outboard from your mark as shown.

The tube should be flush against the leading edge as shown.
You can use a piece waxed paper on the bench when gluing the pivot tube.



Put the .055 Z bend pushrod in the servo arm and feed it into the pivot tube on the spoiler.

Temporarily tape hinge the spoiler in place with masking tape. Be sure it is centered.

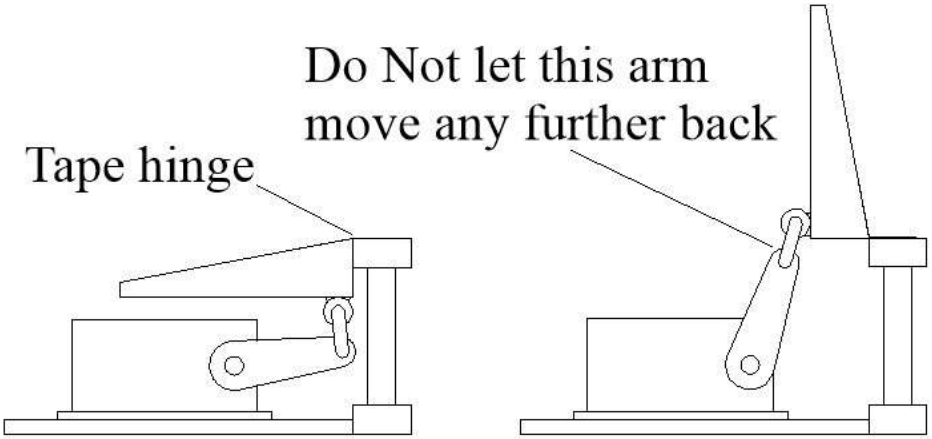


Flip the switch and see what you get.
Don't worry if the spoiler doesn't open or close fully at this point.

It must open at least 60 degrees. No need to open much past 60 degrees or so.

It makes no difference to the plane.

Take the time to get this just right.
You can always peel the tape off to repair or maintain the spoiler.



Adjust your end points so that the servo just closes with no strain on the servo when closed.

Be sure that the servo arm NEVER goes behind the plastic tube (over centers).
This will allow the spoiler to partially close but jam the linkage.

Not a good configuration to fly.
Test this by pushing the spoiler towards the closed position while it is open.

If the spoiler pushes back and flips the link, the servo arm needs to go forward slightly (decrease end point).

Put a 12 inch servo extension on the servo lead and feed it thru the holes in the ribs until it is at the hole in the wing center.

We will connect these to 6 inch extensions from the receiver once the plane is covered and ready.

Once the plane is covered, use a good quality clear tape, ¾ to 1 inch wide as a tape hinge on the spoiler. Using good tape makes it removable if needed.

Repeat on the other spoiler if you have not done so.

Be sure to put each spoiler on its own channel so that you can adjust end points individually.

It is important that both spoilers open and close the same amount.

It's up to you if you want to put the spoilers on a switch or use the throttle channel.

We tried the throttle channel first, but it turned out that we slightly deployed the spoilers a few times by accident while flying.

Not the end of the world but losing precious altitude is not optimal.

We also tried a 3-position switch. We found that we eventually went straight to the full position all the time.
Finally, we just mixed both spoiler channels to one switch. Works awesome.

Having both spoilers on separate channels works very well. It may be a little more setup in the beginning, but having both spoilers deploy exactly the same amount is desired.
If they don't, the plane will veer in one direction at deployment.

Hold your phone camera over the QR code to the left, and it will bring up the direct link to the GEO instruction manual in full color.