PLEASE READ THIS FIRST

Many thanks for buying the BLUTO!

To ensure a great maiden flight, there are several things we really want to emphasize before you begin building the kit, and before your first launch.

(a) **NAIL THE CENTER OF GRAVITY!!!** Wings of this type are very CG sensitive. Please follow the recommended CG placement and "Fine Tuning" procedure carefully… you will be glad you did!

(b) **DO NOT EXCEED THE RECOMMENDED ELEVATOR THROWS.** One other aspect of planks, or pseudo plank-style plan forms, is that they need very little up / down elevator. Use the Dual Rates and/or End-Point Adjustments on your transmitter to dial-down your elevator to the recommended throws. If you exceed them, hyper-stalling, a feeling of sluggishness (meaning only the plane, but who knows?), and short flights are almost guaranteed.

(c) **TRY TO BUILD THE BLUTO TO MANUAL SPECIFICATIONS.** We did our best to cover all of the bases in the manual, and, especially, testing the materials and techniques being used to put it all together. If you have a specific goal in mind, and, experientially, know exactly what you are doing, by all means… modify. All we ask is this: If it doesn't work, or doesn't fly properly, or works beautifully, please disclose your mods if posting publicly, or to us, if calling/emailing.

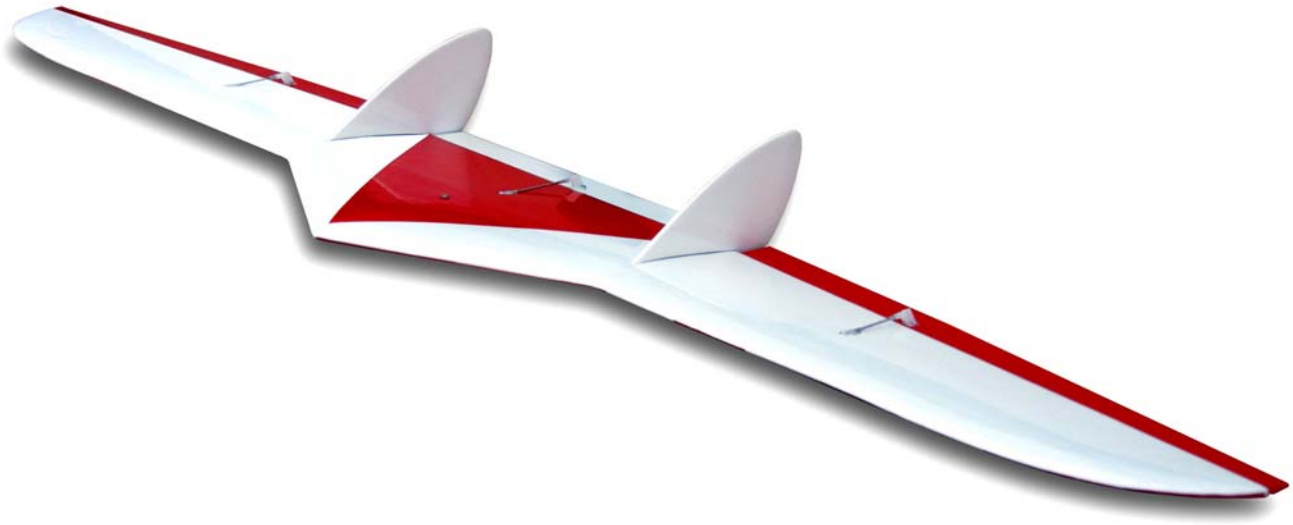
As you have probably read, the BLUTO is intended for medium to heavy air. It should *maintain* in lighter lift, depending on how clean the build is, but it is happiest in beefier conditions.

We are always learning, modifying, adjusting and improving our aircraft. Consequently, we continually update our website with the latest findings. The "Latest News" and FAQ sections can be checked for reference.

THANKS!!

☺

The BLUTO



High Performance Sloper

For when you want to beat up the competition!

Wing Span: 60" • 456 Area: Sq.In. • Typical Minimum Weight: 40 Oz.

Note: For the very latest info on any CG or building updates,
please check the "Latest News" section on our website.

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~ N C F M ~

ASSEMBLY INSTRUCTIONS:

(Revision 4 –06 /10/2011)

Kit Includes:

4 Wing Cores (2 center and two outer panels, CNC machined, 1.9lb Density EPP)
(Note: The Top Beds are not included)

2 Wing Spars (27" carbon shafts)
3 Drag Spars (1/4"x1/8"x 24.5" basswood)
3 Elevons (24.5" Weight-matched balsa)
1 Spar Joiner (Aluminum tube)

2 Drag Spar Joiners (Diamond shaped basswood)
4 Tapered Gussets (1/8" x 4-1/2" Basswood)
4 Ribs (1/16" laser-cut plywood)
2 Fin Tangs (1/16" laser-cut plywood)
3 Elevon Control Horn Sets
6 Machine Screws
6 Black Steel Clevises
3 Control Rods (3" long threaded rods)
8 Lead Slugs (Balance Weight, 4 Per Side)
2 Spar Channel Tip inserts (3" long EPP strips)
6 Spar Weighting Caps (3"x3/8"x3/8" Balsa)
2 HardPoints (aluminum discs)

2 Fin Material (1/16"x 4"x 18" balsa sheets)
1 Instruction Manual DVD
1 Copy of Diagram "C"

Materials Needed:

"Gorilla" or Elmer's Ultimate Polyurethane Glue
Epoxy: 5 & 20 Minute+
J-B Weld Slow Epoxy Resin *
Goop, Shoe Goo, or Similar Clear Gel Glue (opt.)
Gap Filling Cyanoacrylate (Thick C.A.)
Strapping Tape (1" or 2" will work)
3M77 or Similar Spray Adhesive
Drywall Screen and/or Misc. Sandpaper
Lightweight Spackle (optional, but recommended)
Ultracote® Covering or Similar
2" Clear Poly Tape (we like Manco, with the duck)
Masking tape
(2) 6" Servo Lead Extensions (likely)
Max Ballast Tube: 9/16"dia x 12" for end-loading
Recommended Servos: (2) HS85-MG or better
Recommended Rx: Berg, Hitec 555 or similar **
Recommended Batt: 600mAh Nicad Flat or sim ***
Required Transmitter: One with Elevon mixing, end-point and/or dual rate adjustments.

**** Glues**: It is essential to use an extremely strong, aggressive glue to join the Carbon Spars with the Spar joiner. We recommend "J-B Weld" given its adhesive tenacity and rotational resistance on impact. We also recommend the original "J-B Weld" over its sibling, "J-B Qwik", as the latter does not allow much working time. Second best would be Gorilla Glue, but it is not really recommended for Dynamic Soaring, as high-speed impacts can compromise the bond.*

*****Receiver**: This is a thin wing, so you will need a thin receiver. It is also important to use the "end-plug" type since the "vertical-plug" type might not fit as easily. A Berg or similar low-profile 72 MHz Rx will fit nicely. The newer 2.4 GHz systems will work too but pay close attention to the antenna layout requirements and follow the manufacturers recommendations.*

******Battery**: The provided balance weight for the BLUTO is based on a typical build, using a standard 600mAh Nicad flat pack (KR600AE), which weighs approx. 95 grams. The 1000-1200mAh NiMH pack is also similar in weight and should work fine. Since access to the foam nose for additional balance weight is difficult once the plane is covered, be conscious of any major weight differences when using other battery packs.*

Before you start: *To see where all the parts go and to get oriented, take a look at Diagram "A" on page 20 and Diagram "B" on page 21.*
Two important things to remember:

1. *The Spar Channel is on top of the wing.*
2. *Servos and electronics are best installed from the bottom of the wing.*

Step 1 • Glue The Lead Balance Weight

The nose of the wing comes pre-cored for the provided Balance Weight (the round chambers in the root near the leading edge). The Balance Weight consists of eight lead slugs (4 per side). It is very important to mask off the wing above and below the balance chamber, so that if epoxy does oozes out it can't glue the cores to the beds.

Use 30 Minute Epoxy to glue 4 slugs in each wing, into the pre-cored balance chambers.

If you plan on installing a Ballast Tube proceed to Step 2.

If you do not need a Ballast Tube installed, remove the cylindrical piece of foam from each Ballast Tube chamber and glue it back in using 30 minute epoxy glue. This is important because if left empty or unglued, the chamber will weaken the wing. Be careful as the chamber is very close to the bottom of the wing and glue will ooze out when you push the piece of foam in.

Step 2 • Install The Ballast Tube

If you plan on installing a ballast tube, now is the time.

A typical Bluto Ballast System consists of two 6" long brass tubes. Each tube is installed in one of the center wing panels centered on the Center of Gravity (1" behind the leading edge) with the open end of each about ¾" away from the centerline (3/4" inside the chamber). In this configuration the tubes can be loaded from the 1-1/2" breech (2 x ¾"=1-1/2") between the two tubes.(See Diagram "A")

Ballast Tube Prep:
Start the installation by gluing the plastic caps to one end of each tube with CA. Sand the rim off of the cap so it is flush with the body of the tube.

Apply three narrow strips of strapping tape over the cap and secure it to the body of the tube. Insert a 1/2" diameter wood dowel (about 9" long, not

included in the kit) inside the Ballast tube. Grip the part of the wood dowel that remains outside of the tube (about 3”) as a handle for inserting the tube.

Use a felt-tip pen to place a mark on the wood dowel exactly 3/4” away from the open end of the tube. Apply a small amount of Petroleum Jelly (KY brand works fine) to the wood dowel around the open end of the tube to seal the opening and prevent the epoxy from entering the tube. Do not allow the jelly to smear the outside of the tube.

Ballast Tube Insertion:

Apply 30 minute epoxy to the inside of the ballast chamber with a long stir-stick. Apply epoxy to the outside of the first 2” of the closed end of the tube (all around)

Start inserting it into the chamber and rotate the tube slowly as you slide it inside the chamber. Stop when the mark you placed on the wood dowel arrives at the root of the wing panel. In this position, when finished, the open end of the Ballast Tube will be 3/4” away from the centerline of the wing. Do not remove the wood dowel yet.

Quickly wipe off the epoxy that has squeezed out of the chamber and accumulated around the opening of the chamber and the wood dowel. Once clean, withdraw the wood dowel while rotating it and remove it from the tube. Inspect the open end of the Ballast Tube to ensure that no epoxy has oozed into the tube. Do not allow any epoxy ooze-out to cure. Remove it with a clean rag dipped in acetone (don’t worry, the acetone will not attack and eat away the EPP).

Remember to temporarily plug the open end of the tubes with a 1-1/2” long piece of foam before joining the center wing panels to prevent epoxy from seeping into the Ballast Tubes.

Step 3 • Join and prep the Wing Beds

The wing beds are used to support the wing cores in the correct position while they are being worked on. The first step is to join the beds together.

On a flat, straight surface, glue the wing beds together with 5 minute epoxy.

Just like the balance chamber, you need to prevent epoxy and/or polyurethane glue that can ooze out of the bottom of the spar groove from gluing the cores to the beds. Laying down strapping tape on the beds where the glue is likely to ooze will accomplish this. The back (non-sticky) side of strapping tape is resistant to glue especially if it rubbed with a little machine oil.

After the epoxy has cured, cover the joints with 2” wide strapping tape.

Using the outer wing panels. mark the location of the Spar Groove at the tips on the tips of the bottom beds. Draw a straight line between these two marks. Cover this line with a 2” wide strip of strapping tape from end to end.

Step 4 • Join the Wing Cores.

The Wing Cores are glued together with 5 min. epoxy. To ensure accuracy, perform this in two steps:

a) First epoxy the two Center Panels together and leave them in the beds to cure.

b) Next glue the two Outer Panels to the Center Panels and set the wing into the beds to cure.

It is important that the leading edge, trailing edge and spar groove of each panel lines up precisely with the adjacent panel. Verify that the top and bottom surfaces of each panel are also flush with the adjacent panel before you apply the glue.

Apply 5 minute epoxy to the root of each panel, bring the two panels together and place them in the beds to cure. Ensure that the wing is level, properly aligned and flush at the root. Use straight pins and judiciously placed weights in a few locations to hold the wing snuggly in the beds, and let cure.

Step 5 • Glue in the Spar System.

We strongly recommend that you use polyurethane glue to install the spar system. This is due to the fact that, as you can see, there is very little foam connecting the front and rear parts of the wing core. As such, it is vitally important that the glue that binds these parts together (which is the same glue that holds the Spar in place) be strong and not shatter upon impact. It is our considered opinion that most epoxy glues are too brittle for such an application.

NOTE: Unless you are very familiar with "Gorilla" and/or other polyurethane glues, do a test run first on a scrap of foam or cardboard... it is important to know the working time and expansion volume of the glue in your environment. We recommend the "Gorilla Glue" brand, given its specific expansive properties; Other brands can also work, provided they have the expansion potential of the former. Other than the usual items used to build any kit, i.e. masking tape, epoxy, sand paper, etc., you will need:

(a) Polyurethane Glue (Gorilla or Elmer's Ultimate)
(b) JB-Weld Epoxy Resin (slow version)
(c) A small tub of "Lightweight Spackle", (used to fill nail holes in drywall)
(d) A total of 12lbs (6 kg) of weights: (six weights, 2lb or 1kg each).
(e) A healthy supply of paper towels & a few small paper or plastic disposable cups

Spar System Prep: For a good glue bond, rough-sand the entire exterior of the aluminum Spar Joiner with 150 grit sandpaper.

Gently sand the first 7" of the inside of each Carbon Spar (wide end), or as far as you can reach, and wipe clean.

Mark the center of the Spar Joiner with a felt-tip pen.

Pre-fit the Carbon Spars onto the Spar Joiner—they should slide smoothly up to the center mark of the Spar Joiner, without forcing them.

When satisfied, spread "JB-Weld" epoxy evenly on the Spar Joiner and insert it into one Carbon Spar. *Have paper towels ready!* Since the tight fit will certainly squeeze out the majority of the glue, ensure that the parts there are adequately covered with epoxy; pre-applying some JB to the inside of the Carbon Spar and then turning the Spar onto the Joiner very slowly works well. Make sure the Spar Joiner is inserted only up to the center line you marked earlier. Set this assembly (now called the Spar System) aside and let the epoxy cure. *We tried many other glues, including PU, regular epoxy, CA, etc., on the Spar System and none were able to maintain the rotational lock on impact as well as JB-Weld.*

After the *JB-Weld* has cured, place the Spar Assembly into the Wing Spar Groove and center it by lining up its middle joint with the center joint of the Center Panel.

Next accurately mark the location of the joints between the Center and Outer Panels on the Spar Assembly.

Remove the Spar Assembly from the Spar Groove and wrap a 3/16" wide strip of masking tape around the Carbon Spar centered on the marks you made in the previous step. *These strips of masking tape will keep the PU glue from adhering to the Carbon Spar where the Fin will be installed later on.*

A Few Words About Polyurethane Glue and The Gluing Process:

When PU glue is used for gluing in the Spar System, after foaming, the cured glue will form a domed spar cap above it. The domed spar cap is sanded flush with the wing core and filled with spackle. This contributes to making the wing incredibly strong, stiff and torsionally rigid. Instead of using a continuous balsa spar cap, use the six 3/8" x 3/8" x 3" balsa strips (three per side), and weigh each down with 2lbs weight placed on top of small, elevated cross-bridges. The gaps between these balsa pieces allow the PU glue in the spar channel to bubble to the top of the spars and between the balsa pieces, without gluing the weights to the wing. If the spars were to be fully covered with a continuous cap, the pressure excreted by the foaming glue would push the Spar AND the Spar Cap out of the groove. Do not worry about not having a continuous balsa Spar Cap; In this case, the cured PU will act as the spar cap. The balsa pieces merely act pressure points to hold the spar system down in its groove. Both the balsa and the cured PU will be shaped to conform to the shape of the airfoil.

Prep: With the spar channel masked off on both sides, and the Carbon Spars epoxied onto the Spar Joiner and protected at the panel joints, you are ready to install the Spar System.

Lightly rough up the outside of the Carbon Spars with sandpaper and test fit everything, including the balsa Cap Strips, and the bridge weighting system.

When satisfied with the fit, remove the parts and set them within reach, arranged exactly as they will drop in. You will be "on the clock" once the glue goes in. So be prepared!

Glue The Spar System:

Water is the activating agent for polyurethane glue. Instead of relying on the moisture in the air or the wing cores to start the foaming/curing process, you need to introduce a controlled amount of water to the PU glue in the Spar Channel.
You will do this in two steps:

1. *Infusing the foam walls of the Spar Channel with water.*
2. *Introducing water to the PU with a wet brush.*

Lightly wet out the channel with water, using a small brush or dampened paper towel to do so. After making sure the entire Spar Channel is wet (including the walls), wipe off any standing beads of water with a dry paper towel.

Squeeze in a bead of glue about 3/16" in diameter, all along the channel, stopping about 1" from the tip. Use the small brush to mix the glue with water, spreading it around the channel bottom and up on the channel walls. (*We use an aluminum plumbing solder flux brush, costing about 25 cents at Home Depot)*. Dip the brush in a small cup of water after every 10 seconds or so of mixing; Don't make the mix sopping wet by adding too much water. Add just enough water to turn the glue opaque and get it to flow a little--this system makes for good glue expansion, yet has excellent strength to weight ratio.

Quickly place the Spar System in the Spar Groove, insert the 2 small foam plugs into the spar channel, at the end of the Spar System, and apply another bead of glue over the top of the entire spar. Mix this last bead of glue with the dipping water brush, lightly filling in any areas that look like they may need more glue *(the 1st layer of glue should already be foaming a little by now)*. Position the 3 balsa Cap Strips per wing half on top of the Spar System (at the root, middle & tip), and weigh them down each with a 2 lbs weight.

Keep in mind that, over the next 30 to 60 minutes, the glue will expand to many times its volume; what might not look like much can become huge. If any areas look drastically thin in relation, mix a little glue with water in a Dixie cup and add a touch more in that area. Ideally, when fully expanded, you want the glue to create a 1/2"+ high dome all above and along the spar channel in between the six weighted balsa Cap Strips. You can now put the PU glue bottle aside! Make sure you squeeze the glue to the top of the bottle before capping it, to preserve the glue shelf life.

Once the PU glue has cured, remove the weights and the bridges and use a serrated kitchen knife, or similar, to cut the glue dome down close to the airfoil. Next use a small hobby plane, if available, and after that graduating sandpaper grits, to finally bring the glue dome flush with the airfoil, and then remove the masking tape. Apply 1 coat of lightweight spackle to fill the air bubbles, let cure and sand flush with the airfoil*.

IMPORTANT: *When sanding the glue dome, use a long sanding block and keep its side parallel to the leading edge of the wing. Always sand airfoils with the block moving at 45 degrees to the leading edge, (i.e. SE to NW) and use a gentle touch, letting the abrasiveness of the sandpaper (not pressure) do the work. This will help to prevent flat spots and maintain the proper airfoil shape.*

*Later on, just prior to beginning the taping/covering process, later on, and after all of the wires, servos, Rx, battery, etc. have been installed, apply a 2nd coat of spackle over these areas and over the spar channel, if desired—sand smooth.

Now is a good time to cut out the balsa parts you will need in the next few steps. You are provided with a copy of Diagram “C” in the kit. This is a full size copy of the Fin balsa parts. You will need to make two full size copies of each part and use them to cut the parts. This way you can save the original Diagram “C” for later, when you might need to make additional or replacement part for the Bluto.
Cut out the image of each part from the copies you made and place them on each piece of 1/16” x 4” x 18” balsa just as they appear on Diagram “C”. This will ensure that you won’t run out of wood and that each part has the wood grain oriented in the correct direction (See Image 1).

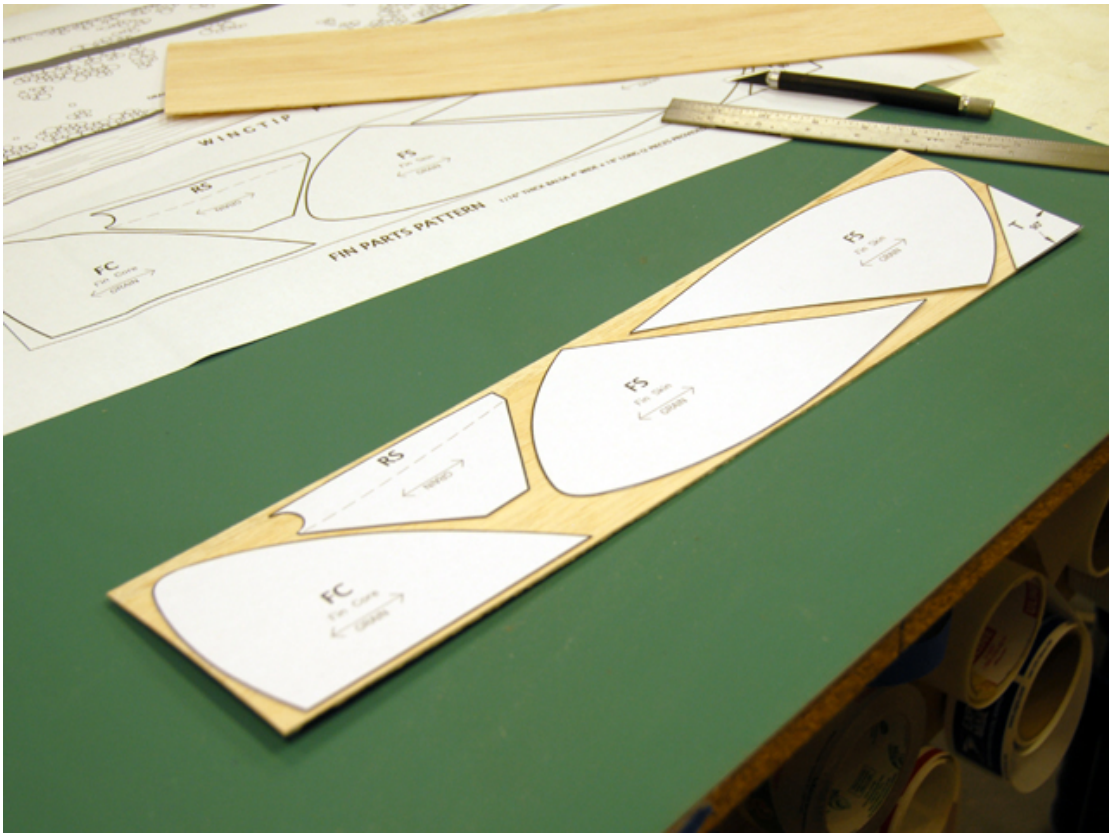


Image 1

To hold the templates in place lightly spray the back of each image with 3M77 adhesive. Now using a sharp hobby knife, cut around each image. Before removing the paper image from the balsa, sand the edges to ensure they conform to the image outline.

Step 6 • Installing the Drag Spars, Drag Spar Joiners, Ribs and Gussets.

The drag spars are the three 1/8” x 1/4” x 24.5” stiff basswood sticks that need to be glued to the Trailing Edge (TE) of the wing; part of their purpose is to allow the covering material to be shrunk very tightly without deforming the foam and crushing or warping at the TE… tight covering means better performance! The Drag Spars are secured together with the Drag Spar Joiners and further supported by the tapered gussets. There is a particular sequence which must be followed if a straight and true wing is desired. That sequence is as follows:

1. *Install the Drag Spars.*
2. *Install the Drag Spar Joiners.*
3. *Install the Ribs.*
4. *Install the Tapered Gussets.*

Step 7 • Install the Drag Spars:

Cut the center Drag Spar to exact length (16”) and using slow epoxy (no less than 30 minutes), glue it to the center sections trailing edge.

Apply the epoxy only to the middle 10” of the Drag Spar and leave about 3” of each end dry and free of epoxy.

Glue the other Drag Spars to the outboard wing panels. Like before, leave 3” of one end of each Drag Spars dry. This dry end will be the one butting into the center Drag Spar.

Make sure you apply a dab of epoxy to the very tip of the Drag Spars so they are glued to each other even though they are not glued to the foam wing cores in the area of the panel joint.

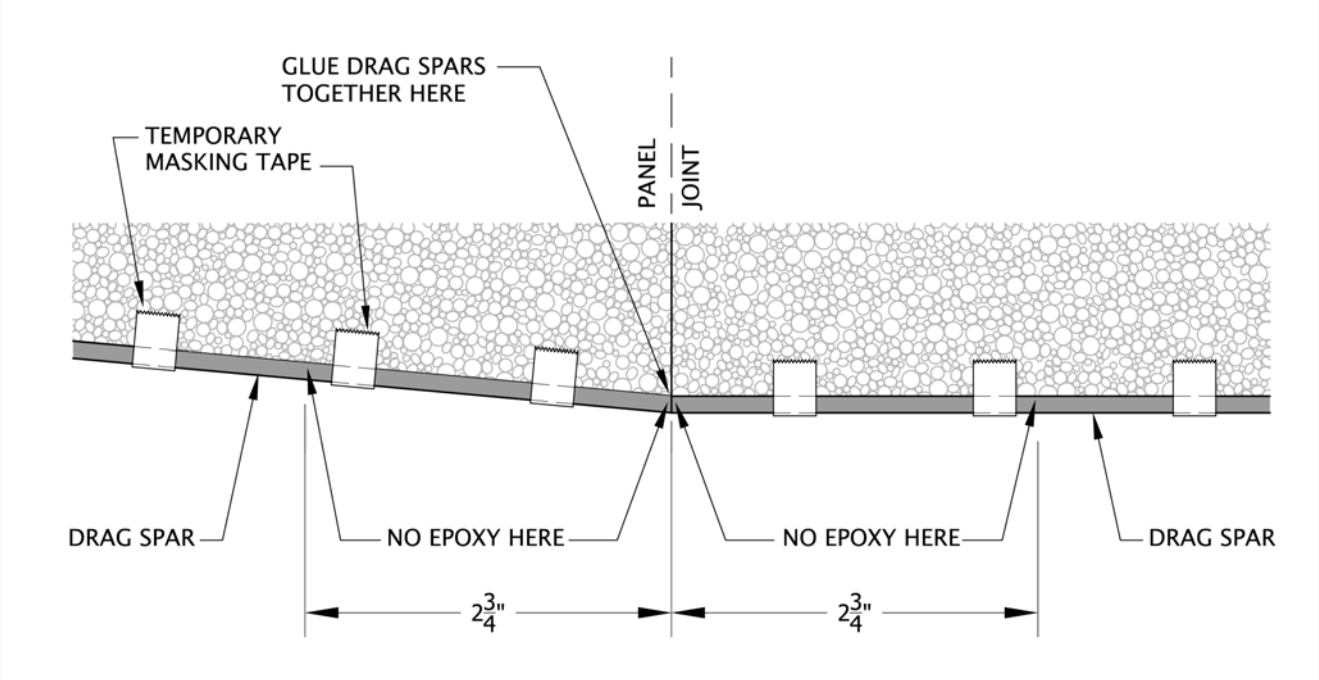


Diagram 1

Once positioned correctly, quickly secure the drag spars in place with short pieces of masking tape; begin from the bottom surface of the wing, then proceed around the drag spar, to the top surface (see Diagram 1).

When the epoxy has fully cured, remove the small pieces of tape and sand the outer tips of the drag spars to match the length of the each wing half. Later you will round off the ends to match the shape of the wing tips.

Step 8 • Install the Drag Spars Joiners:

Place the Drag Spar Joiner on top of the wing and butt it against the Drag Spars. Place the corner of the Joiner marked with a red ink next to the break between the center and outboard Drag Spars. In this position two edges of the Joiner should line up with the Drag Spars. Using a felt-tip pen draw two lines along the other two sides of the Joiner on the wing. Remove the Joiner and you should have the outline of the Drag Spar Joiner marked. Cut along the two lines you just drew and remove the diamond shaped piece of foam (see Diagram 2).

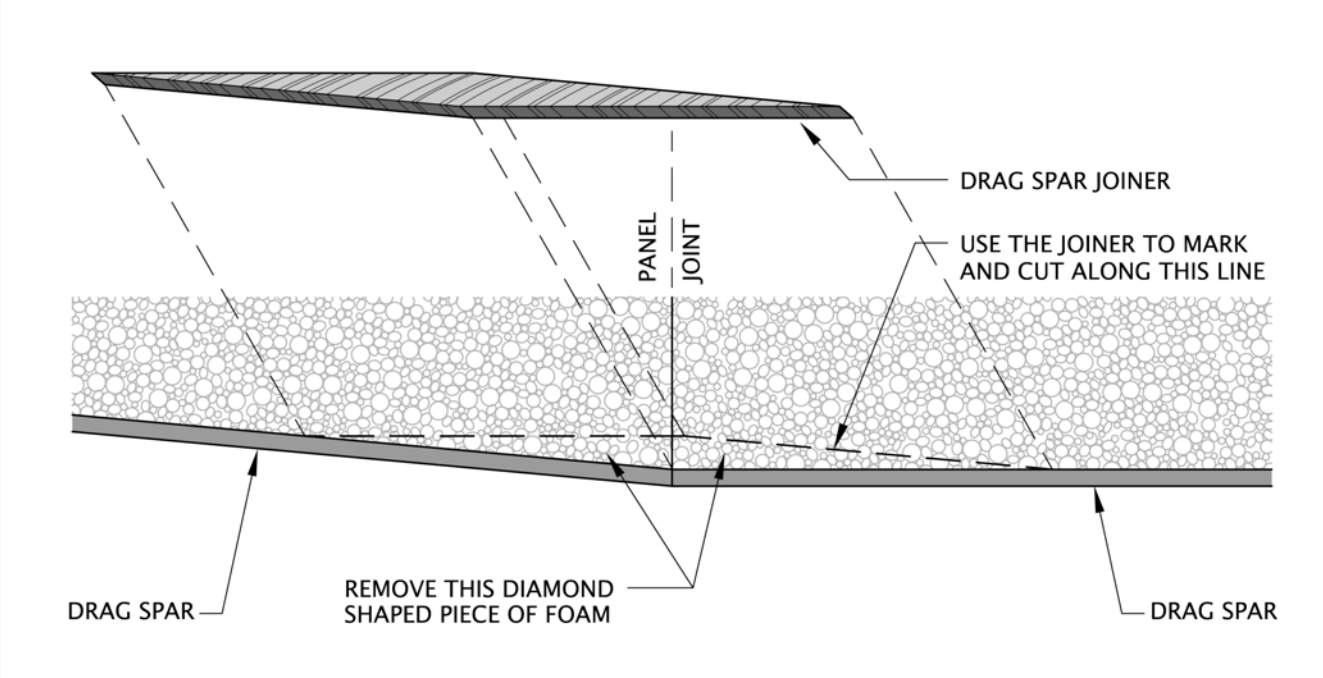


Diagram 2

Inspect the sides of the Drag Spars to make sure that they are free of glue residue and remove any you see by scraping it off with your knife.

Place the Drag Spar Joiner into the cavity you created and make sure that it fits tightly against the Drag Spars with no gaps. If the Joiner does not conform to the angle between the Drag Spars, go ahead and sand its sides until you have a perfect fit. (see Diagram 3).

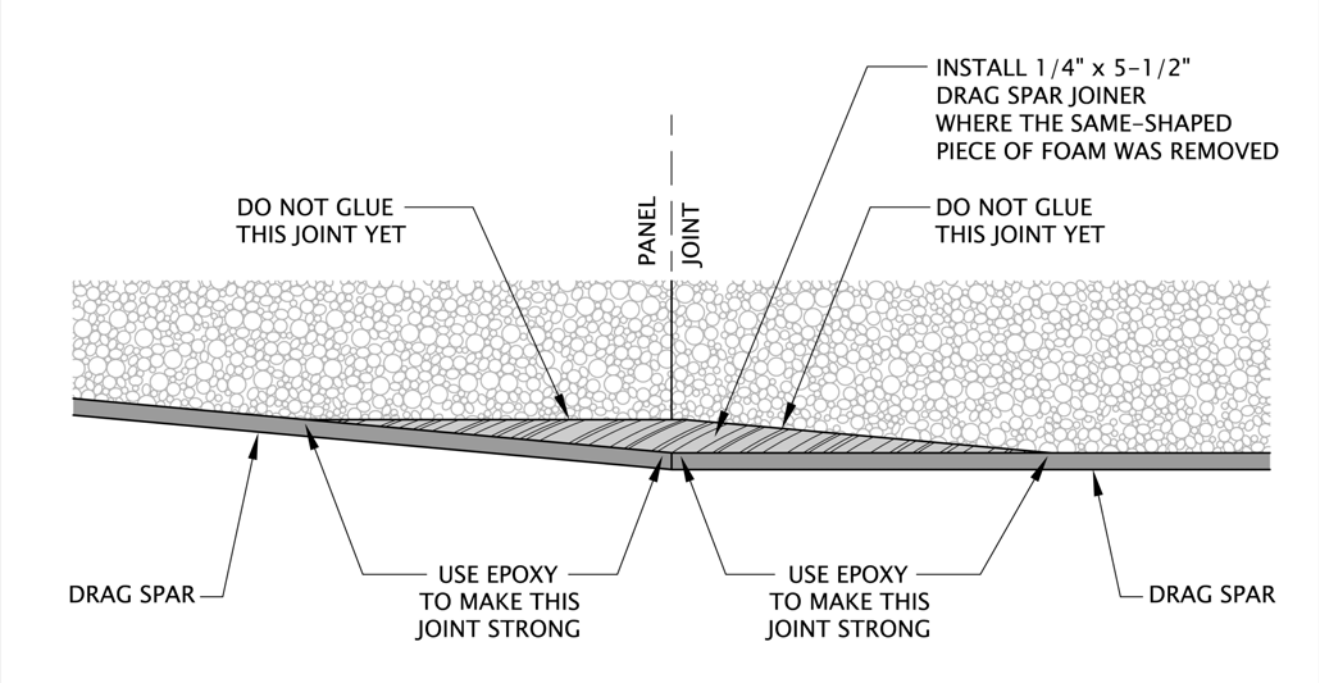


Diagram 3

As you might have noticed, the Drag Spar Joiner is slightly thinner than the wing thickness at the trailing edge. It is helpful to push the Drag Spar Joiner down towards the work surface until its bottom surface line up with the bottom surface of the wing. This way, after the assembly is complete, you can fill the top of the Drag Spar Joiner with filler material to bring it flush with the top surface of the wing. It is strongly recommended that you use epoxy mixed with Microballoons or Cabosil as filler in this area as it will increase the strength of the joint tremendously.

Use Epoxy to glue the Drag Spar Joiner to the Drag Spars. Make sure that there are no voids between the parts and that you have a tight fit.

After the glue has cured, sand the top and bottom of the joint lightly to remove any glue that might have oozed out.

Step 9 • Install the Ribs:

This step needs to be repeated for each one of the outboard wing joints.

Using a felt-tip pen, draw two lines, each parallel to the joint between the wing cores (panel joint) and 3/32" away from it. These lines should extend from the Main Spar to the Drag Spar on the top surface of the wing.

Repeat the above step on the bottom of the wing.

Use a sharp X-acto knife to cut along these lines clear to the other side of the wing. But for each line do this in two steps: Make a shallow cut along the bottom line. Then make a deep cut from the corresponding top line to reach the bottom cut you made.

Remove the sliver of EPP foam between the two through cuts. Using a sharp knife chip away at the cured PU glue that surrounds the Carbon Spar in front of the slot you just created, until you expose the masking tape you wrapped around the Carbon Spar in Step 4 on page 7. Cut though the masking tape on top and bottom of the Spar and remove it. You should now be able to see the back half of the Carbon Spar free and clear of any glue. You now have a 3/16" wide slot in the wing, clear through and from the Main Spar to the Drag Spar joiner.

Now it's time to cover the sides of the slot you've created in the wing.
The sides will be covered with the Ribs (part R). But since they need to be exactly 1/16" apart (the gap will fit the fin) you need to place a 1/16" thick shim between them. The plan is to temporarily glue the Ribs to each side of the Rib Shim and then glue them in the wing together in one step. This is much easier than installing them one at a time and is far more accurate. But to do this, some preparation is in order.

Place each one of the Ribs (part R) into the slot in the wing to test their fit. *The bottom of the Rib is marked with a red dot. Make sure you place the Rib in the slot so the red dot is on the bottom of the wing.* The round cut-out in the front should fit tightly against the Carbon Spar and the flat area in the back should just touch the Drag Spar Joiner without pushing it back. If the Rib is too long, sand the flat area in the back until you have a nice fit. Repeat the test for the other Rib.

Temporarily sandwich the balsa Rib Shim (part RS you cut out earlier) between the plywood Ribs (part R). Check the fit and make sure that the fronts (circular cuts) and backs match perfectly. If not, use sand paper to make adjustments.

Place the Ribs (part R) on the table parallel to each other with the circular cut on the same side and the red dots facing each other (see Image 2).

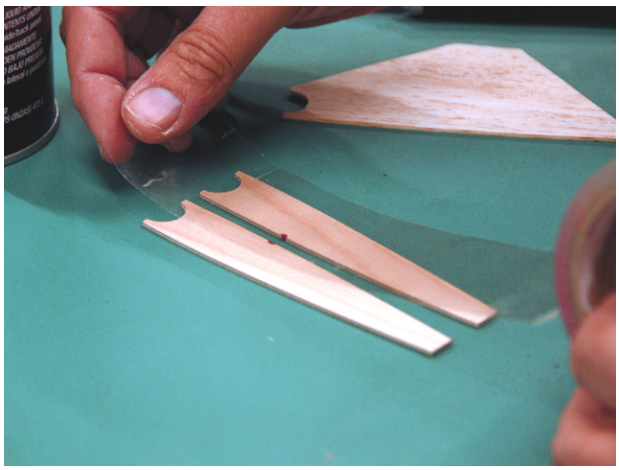


Image 2

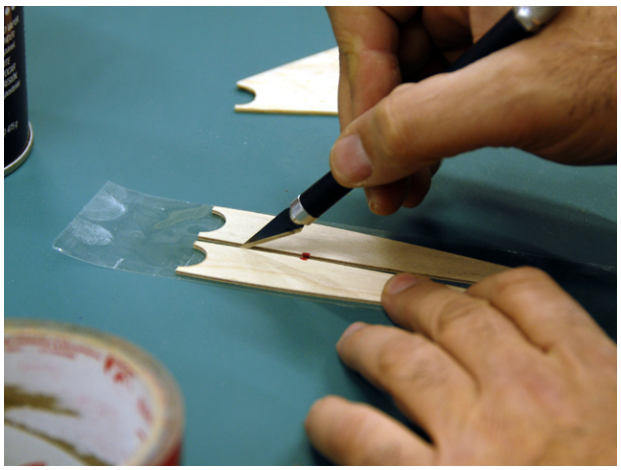


Image 3

Cover the top surface of the Ribs with regular clear poly tape (Scotch Tape will work if it's sticky and wide enough). Turn the Ribs over so the masking tape is on the bottom. Use your sharp knife to cut around the Ribs through the tape and discard the excess tape (see Image 3).

Turn the Ribs over yet again so the masking tape now faces up. Spray a light coat of 3M77 adhesive over the clear tape (see Image 4).

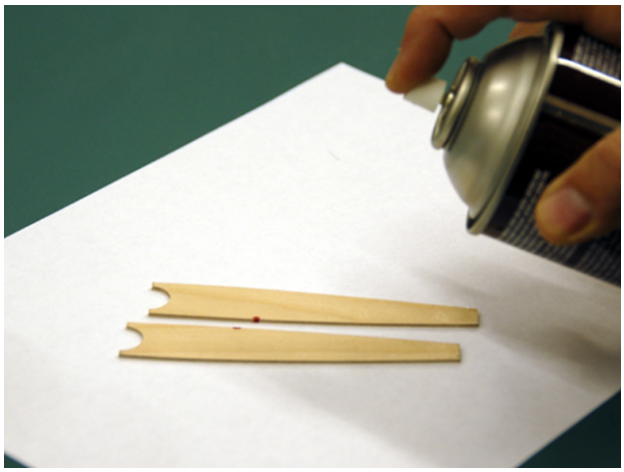


Image 4

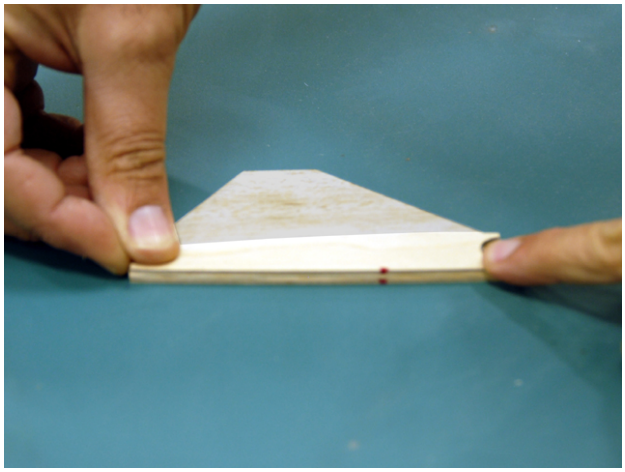


Image 5

After a few minutes, when the adhesive is no longer wet, sandwich the balsa Rib Shim (RS) between the plywood Ribs (R) yet again. You now have a rib sandwich of sorts!

Note : It is vitally important that the front, rear and bottom of the Ribs (R) align perfectly with the Rib Shim (RS). (see Image 6)

Do not compromise here; be as precise as you can. If the alignment is not perfect, remove the offending part(s) and repeat the sandwich process. Even though the glue/tape holding the Rib Sandwich together is temporary and the Rib Shim will be removed a few steps from now, an imperfect Rib Sandwich will result in a Fin that is not square.

Test fit the Rib sandwich in the slot you created in the wing. It should fit nicely without putting pressure on the Drag Spar. If it is too long, sand it to length. If it is slightly short (no more than 1/32") squeeze a sliver of plywood in the gap. Once happy with the fit of the Rib Sandwich, apply epoxy to the foam sides of the slot in the wing and the exposed faces of the plywood Ribs. Slide the Rib Sandwich into the slot and wipe off the excess epoxy that will squeeze out the other side! Make sure the front (circular cuts) and the flat ends in the back of the Ribs are wet with epoxy and are positively glued to the Carbon Spar and the Drag Spar Joiner. Try, as much as possible, to keep the Rib Shim free of epoxy. It will make your job easier down the line!

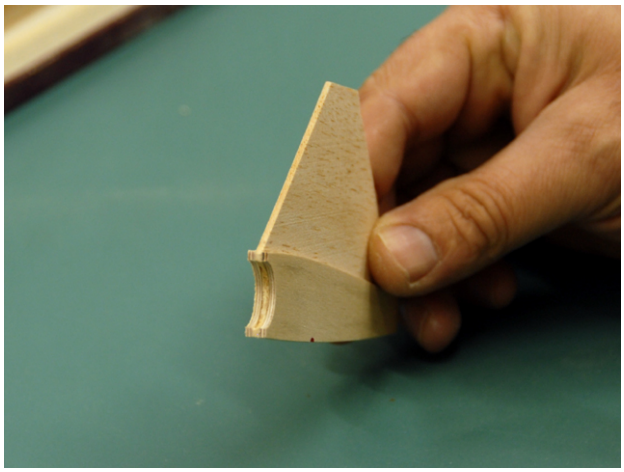


Image 6

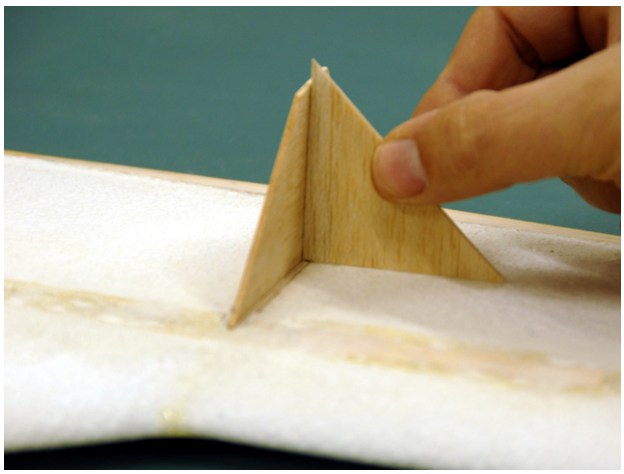


Image 7

While the Epoxy is curing, and before it sets, use the triangle piece you cut earlier (Part T) to make sure that the part of the Rib Shim that extends above the wing is perpendicular to the top surface of the outboard wing panel. If the Rib Sandwich is not square, put pressure on it and hold it in the correct attitude until the epoxy has cured (see Image 7).

Once the Epoxy has cured, remove the Rib Shim and discard it. To loosen the Rim Shim, you might have to slide a putty knife between it and the clear poly tape glued to the Ribs to break the bond. Gently pull on the Rib Shim while rocking it back and forth until it pulls out of the slot. If it breaks during the process, just use your putty knife to push the broken parts that are stuck in thr slot out the other side.

Once the Rib Shim is removed, peel the masking tape off of the Ribs (unless the tape came away with the Rib Shim!).

Use a sharp knife to chip away at any excess glue that might have squeezed into the space between the Ribs especially at the Carbon Spar.

You should now have a Fin Slot that is exactly 1/16” wide and perfectly square to the top surface of the outboard wing panel (see Image 8).

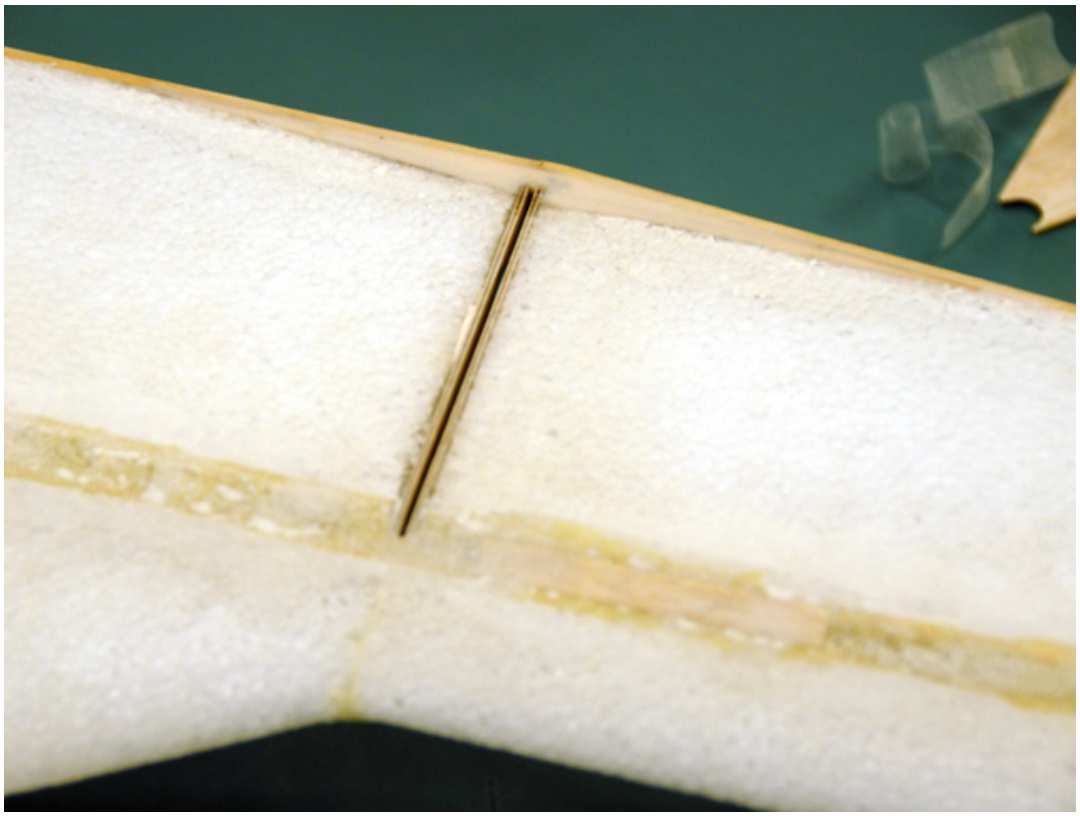


Image 8

Test fit the Fin Tang (plywood part FT) in the Fin Slot. Insert the Fin Tang “front-first” until the circular cut in the front mates with the Carbon Spar. Then swing the back end down into the slot until the square notch in the back rests against the Drag Spar/Drag Spar Joiner. Make small adjustments to the shape of the square notch with a rat-tail file until you have perfect fit and the Fin Tang can be inserted and removed smoothly.

Remove the Fin Tang from the Fin Slot and sand the top and bottom surface to remove any portion of the Ribs that might be protruding above and/or below the wing.

Now you are ready to finish the Drag Spar and Tapered Gusset assembly.

Step 10 • Install the Tapered Gussets:

Place a tapered gusset on top of the wing on-edge, forward of the Drag Spar Joiner, such that its tapered end rest against the Drag Spar and its straight body against the Joiner (see Diagram 4)

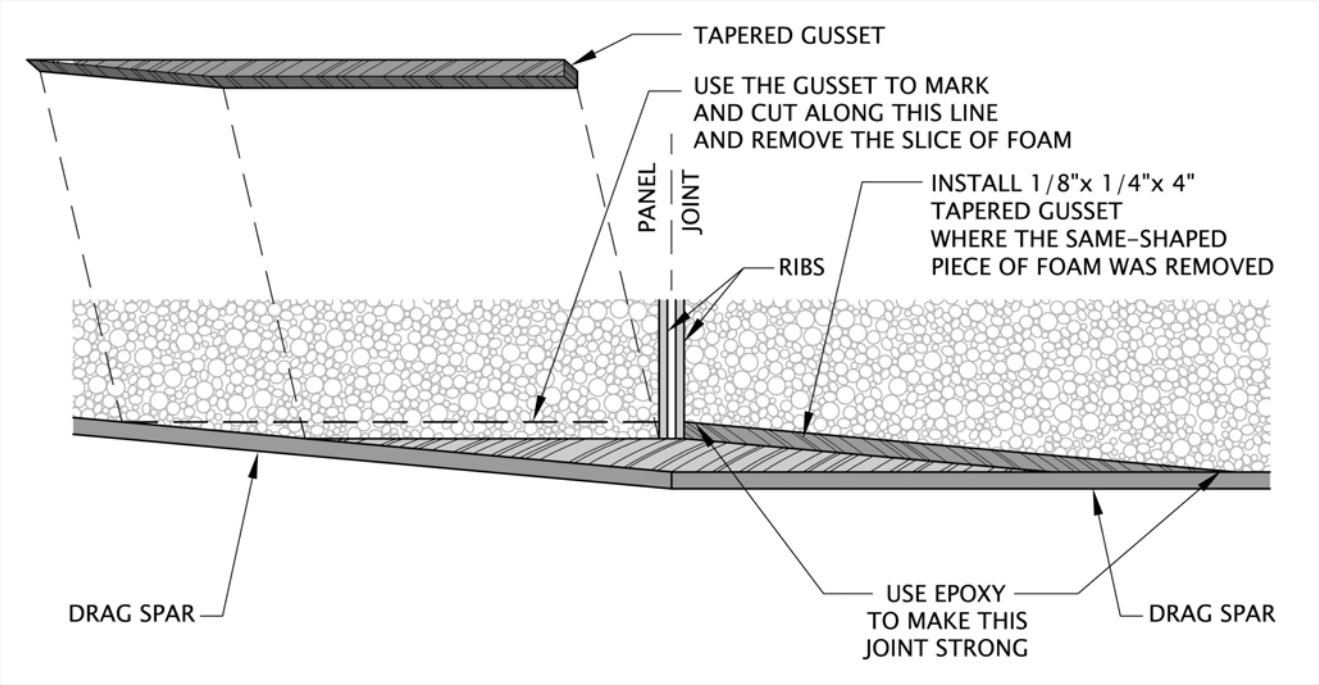


Diagram 3

Use a pelt-tip pen to trace the outline of the tapered gusset on top of the wing. Also, mark the joint between the Rib and the tapered gusset. Remove the gusset and shorten it to the mark you just made. Cut along the lines you drew on the wing core and remove the thin sliver of foam. Place the Tapered Gusset inside the cavity you just created and test its fit. The Tapered Gusset should:

a) Fit tightly against the Drag Spar.

b) Fit tightly against the Drag Spar Joiner.

c) Fit tightly against the back side of the Rib.

Repeat this process for all of the 4 Tapered Gussets.

Once happy with their fit, use epoxy to glue the Tapered Gussets to the Drag Spars, the Drag Spar Joiners and the Ribs. After the glue between the wood parts has cured, squeeze some epoxy between the Tapered Gusset and the wing core (foam) to complete the installation. After the epoxy has cured completely, sand the top and bottom of the wing to remove any wood part that might be protruding above the surface. Fill any low spots with epoxy and filler (microballoons) and sand flat when cured.

Shape The Wingtips:
Using the provided Wingtip Pattern (Diagram “C”) and a sharp blade, mark and cut the curved shape of the wingtips. Make the cut slightly outside of the line you marked and work your way back to the line as you shape the tips to their final shape. For the optimum shape of the wingtips, see the “Shaping Sharp Wingtips” in the “How-To” section of this DVD.

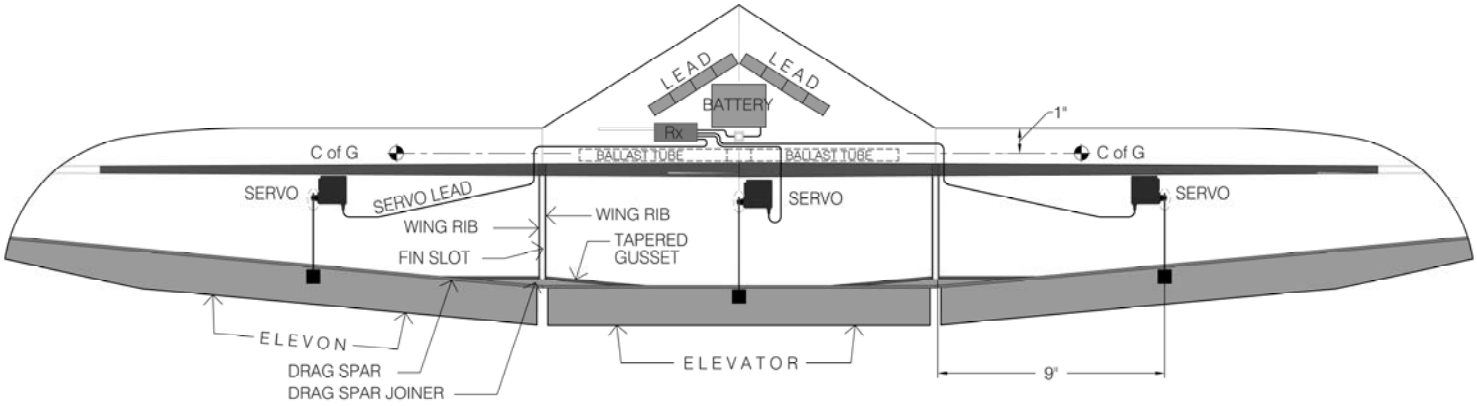
If you decide to not follow the steps shown in the above article, then at least sand the wingtips so they are rounded in cross section when viewed from the front or back. Do not leave the tips unshaped! Unshaped wingtips will slow the Bluto down!

Do the final shaping and smoothing with 120 grit drywall screen or sandpaper. More speed with less pressure works best. In cross section, a good wingtip shape is one that carries the sharp leading edge all the way back to the trailing edge. After the desired shape is achieved, you can also apply polyurethane glue (PU) over the wingtips, to help stiffen them. This improves covering adhesion and increases impact longevity. Apply the PU straight from the bottle and without any water mixed in or applied to the EPP. Knead the glue into the pores of the EPP at the wingtips until wet. Remove all PU from the surface by scraping it off with an old credit card. After the glue has cured (preferably with minimal foaming) sand the wingtips smooth. If you end up sanding down to the EPP, you can re-apply and repeat. If satisfied with the result (stiffer wingtips in the shape you desire) you can flood the PU’d areas with thin CA (applied in small quantities over small areas) and sand with 320 grit sandpaper to a gloss!

The superstructure of the wing is now complete.
In the next step you will install the servos, receiver and battery pack.

Step 6 • Installing the Servos

The Bluto has been designed to use Hitec HS-85MG or similar size/torque servos, which typically come with an 8" – 10" wire lead. You will need to extend the leads (by either soldering or purchasing extensions) by 6" +/-, so that the plugs will reach the Rx once the servos are buried in the wing at the recommended location. Additionally, consider the fact that the servo lead will have to cross the Spar System to reach the receiver which is mounted in the front. <u>You must plan this crossing very carefully.</u> The Spar is very close to the top and bottom surface of the wing (at the Outer Panels) and if not planned for, the leads will extend above the surface of the wing.

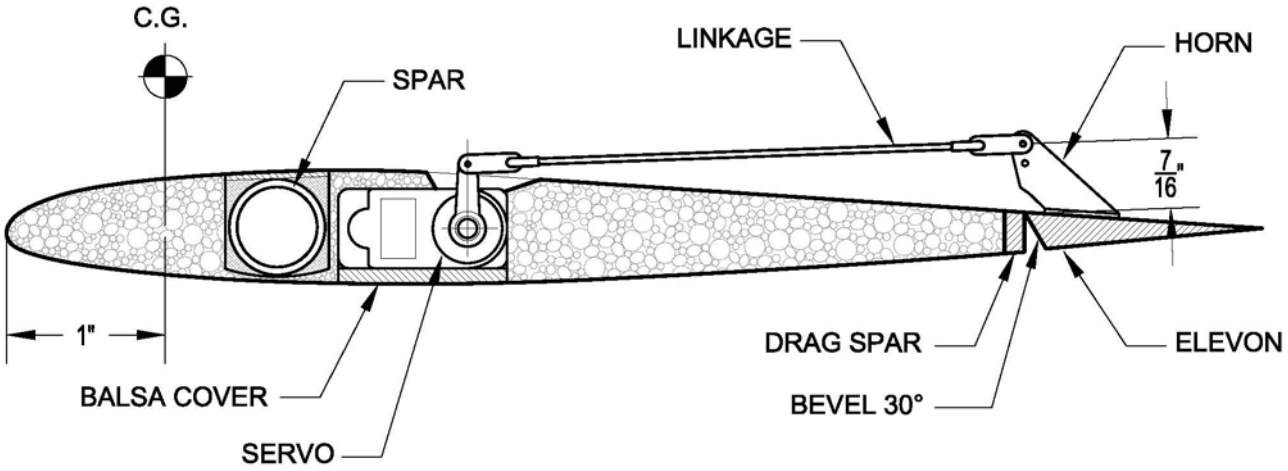


D I A G R A M " A "

The servos are best installed from the bottom of the wing. After the servos are potted you can cut openings for the servo arm through to the top of the wing.

Position the servos on the bottom of the wing, just behind the main spar (see Diagrams "A" and "B"). Since maximum torque is desired, it is best to have the servo arms driving at the center of the elevons, which would be located at about 17" out from the root. Using calipers or a similar tool, make sure *your* servos will fit in the wing at this point—the wing is thin out there! If too thin, pull the servos in a little bit, which also helps keep outboard weight down. The drive arm should always be at the aft side of the servo, for the shortest threaded control rod length. <u>Important:</u> Position the servos so that the drive arms/control rods will be exactly parallel with the Fin Slots in the wing, and direction of flight (do not install them perpendicular to the TE). Trace around the servos with a pen and rout out the cavity to within 1/8" of the <u>top surface of the wing</u>.

Tip: As usual, it is easier to cut along the servo outline with a sharp knife first. This way, when the router bit (Dremel or similar) gets close to the outline, the foam will fall away and you will end up with a perfectly straight cavity wall.



D I A G R A M " B "

Potting the Servos:

Since the Bluto has the ability to see extreme speeds, and the control surface travels are very small, any sloppiness in the mechanical side of the Control System (servos, servo arms, clevises, control rods and control horns) will adversely affect performance. This is why you do not want ANY wiggle in the servos themselves and for that reason we strongly recommend "potting" them.

"Potting a servo" is the process of creating a hard-shell lining for the cavity the servo will fit in. This is accomplished by temporarily gluing the servo in its cavity with epoxy and then removing it after the epoxy has cured. If enough epoxy is used, it will fill the gaps and voids between the servo and the foam cavity and leave a perfect impression of the servo for a tight fit. To help facilitate the removal of the servo, it is usually wrapped in a soft plastic bag.

Pot one servo at a time:

a) When you are finished routing out the servo cavity, remove the servo arm and wrap the servo in a plastic sandwich bag or a piece of a plastic grocery bag.

b) Mix a batch of 5-Minute epoxy and apply it to the walls and bottom of the servo well in the wing. Try to avoid the area where the servo drive arm is located. In other areas be generous with the epoxy application.

c) Press the *wrapped* servo into the cavity while the epoxy is still wet, making sure it is perfectly positioned, and is pushed all the way into the cavity.

d) When the glue has cured, open the bag and remove the servo from the cavity by wiggling it.

e) Peel the plastic bag away from the epoxy.

You should now have a perfect mold of your servos shape, allowing the servo to "snap in" with near zero movement. Mark the location of the servo arm in the cavity. Cut out a small opening in the cavity to allow the servo arm to pass through to the top of the wing. Cut or rout out a shallow channel for the servo leads to reach the receiver. The servos will be capped in the next step.

After the R/C installation is complete, relieve enough foam from around the servo arms so they can go freely go through their full range of motion.

Step 7 • Install the Battery, Receiver, and Antenna

(See Page 2 for battery and receiver requirements)

Referencing Diagram A on Page 10, mark the location of the Battery, Receiver and Antenna (is any) on the bottom of the wing and rout out cavities for them. The Battery in particular should be centered on the wing centerline and directly behind the balance weights as far forward as it can go (due to it's heavy weight). All equipment should sit just slightly below the surface of the airfoil and covered with thin balsa for protection. Today's modern receivers are small enough to install almost anywhere. But the best place here is directly behind that battery and in front of the Ballast Tube. Cut or rout shallow channels for all of your wiring, including the antenna (if any), and position everything into place; nothing should be sticking up above the airfoil. The gear will be capped flush and taped over, shortly.

Testing the gear and centering the servos:

Create a new Tx program for the Bluto, insuring all physical and digital trims are "zeroed". Turn everything on and make sure your servos are working, traveling cleanly, and in the right direction. Assuming top-mount servos, the left servo arm should move toward the LE, and right servo arm toward the TE, when left stick is applied; opposite for right stick; both toward the LE for back stick, and both toward the TE for forward stick. Remember, once the wing is taped and covered, having to swap wires in the Rx will mean cutting through your beautiful covering job… now is the time to make sure all is correct! At this point, you can apply a small dot of glue to the bottom of the servo well, to help keep them locked in.

Cap all of the gear with scraps of foam or balsa, sanding them flush with the airfoil, to provide a clean surface in preparation for covering. You can use a piece of double-sticky carpet tape to stick scrap balsa to the exposed area(s) of the gear (including servos) if you wish to have easier access to the gear, still make sure you sand the balsa flush with the airfoil; you will also have some scrap balsa left over, after making the fin. *Optional, but recommended:* Apply "Lightweight Spackle" over the spar, capped gear, servos, wiring, tips (pre-

goop), fixed center elevons/gusset area, foam/drag spar joint, etc. Let dry overnight and very gently fine-sand until flush with the airfoil.

Step 8 • Strapping and Covering the Wing!

Strapping the Center Section (very important!): Temporarily cover the center servo with a small square of masking tape. Spray the middle 16" of the wing (between the two fin slots), top and bottom, with 3M77 adhesive spray; let dry at least ½ hour. Do the same for the front 1" of the LE, top and bottom.

Apply 8 strips of 2" wide strapping tape from LE to TE between the two fin slots. Each strip should start at the LE on the bottom, wrap around the TE in the back and stop at the LE on the top. Each strip should butt against the other strips and NOT overlap them. Each strip should lay flat and not be wrinkled.
The easiest way to do this is to start from the center and work your way out toward the fin slots. Place a strip on the bottom and line it up with the center of the wing. The free end of the tape should be at the LE and the roll of tape toward the TE. Smooth the strip out and trim it along the LE. Turn the wing over and wrap the tape around the TE and bring it to the LE making sure its edge lines up with the center of the wing. Smooth the strip out and trim it along the LE. Now repeat for the other strips and butt each one against the previous. Once finished, rub the strips you laid down with acetone to remove the release agent and allow the covering to stick better.

On the right wing, place a 1" strip of strapping tape along the Leading Edge (LE) with the front edge lined up with the sharp edge of the LE. This should extend from the nose to just where the wingtip curve starts.

Repeat this for the left wing half and the bottom of both wings (4 strips in all). The front edges of the top and bottom strips should just kiss (!) at the sharp edge of the wing and they should lay flat without wrinkles.

Apply an overlapping 1" wide strip of strapping tape along the leading edge that covers the front half of the top strip and wraps around to cover the front half of the bottom strip you placed earlier.
The best way to do the above is to place a few pen marks, about 4" apart, on the middle of the 1" strip on top of the leading edge. Now lay the 1" overlapping strip so that the back edge lines up with the pen marks you made. Once completed, the front ½" of this strip should hang over the Leading Edge. Now using your thumbs, slowly and gently roll and bend the strip of tape over the Leading Edge to the bottom so it covers the front ½" of the bottom strip. Be patient and you can avoid creasing the tape and introducing wrinkles (yuk!).

Covering the Wing:
First, make sure your servo control arms are vertical and centered when everything is turned on and neutral; if so, you can deflect them to near the surface of the wing and turn everything off—this makes for easier covering. Whichever covering material you use (we recommend Ultracote), first mist the

entire wing with adhesive spray and let dry ½ hour before applying the covering. Cover the bottom first, at the lower, recommended temp, just to melt the adhesive backing, but not to shrink the covering. Increase the temp for the tips and edge points, though be careful, as too much heat or shrinking of the tip covering will suck in the drag spar/foam, leaving a gap at the LE end of the elevon. Lower the temp again and repeat for the top. When the wing is completely covered, begin shrinking from the middle outward, continually referencing the wing to the bottom beds (if you are not covering the wing on them), to insure that there are no warps or twists. Again, be careful not to change the angle of the fixed center area by over-shrinking that section—double check the 1/16" reflex when finished.

Step 9 • Cut, Sand and Cover the Ailerons and Elevator

Cut the trailing edge of each aileron to match the image in Diagram "C". Sand the underside of the outboard portion of the aileron (which is now thicker where you cut it) so the trailing edge thickness matches that of the un-cut portion.

Cut or sand the inner edge of each aileron to match the exact angle Wing Slot and be about 1/8" away from it (see Image 12). Cut and shape the ends of the ailerons match the wing tip.

Cut or sand the inner edge of the elevator to be square and be about 1/8" away from the Wing Slot.

Smooth-sand the ailerons and elevator with a sanding block, making sure they are no thicker than the drag spar. Bevel the LE of both elevons to 30 degrees, to allow optimum down deflection – (see Diagram "B").

Cover the ailerons and elevator and ensure there are no warps or twists.

If you are familiar with "Butterfly", or "Over-Under" hinging, apply a few sets of those to each wing/elevon, prior to fully affixing them in the next step.

Now, fully affix the elevons to the wing with full length, ½ span strips of poly tape (a tape thickness of 3mil or greater is recommended, and we like the clear vinyl tapes); make sure the elevons can move through their full travel without binding.

After the Fins are installed in Step 11, make sure there is at least 1/16" of airspace between ends of the ailerons and elevators and the Fins and that they won't come in contact with the Fin through out their entire path of travel.

Step 10 • Install the Control Horns and Push Rods

If you haven't already, make a tiny slit in the covering to expose each servo arm. Turn the plane on and center all controls. Now, turn the plane off, then the Tx, and install the control horns on the elevons. Make sure they are in-line with the servos, and exactly parallel to the center root of the wing (and direction of flight). Install a black steel clevis on the threaded end of each control rod, and connect them to the control horns. The bottom edges of the ailerons and elevator should line-up exactly with the bottom of the Fins. After the plane is trimmed, don't forget to put a drop of CA on the threaded rods at the clevises to make sure they don't unwind.

Setting the Elevon Travel Distances:

The **elevator** function requires very little movement, about 1/8 of an inch, total (**1/16" up, 1/16" down**) or less, but no more than that. This is HUGE!!! Even if you think you won't have enough elevator throw, do not exceed these travels, until you have flown it, and are certain you want more.

The **aileron** function is a little more dependent on your personal preference, and requires more movement. The total aileron/roll throw should be approximately 3/4 of an inch (**3/8" in either direction**), or less. Once the plane has been trimmed and flown, you can increase or decrease the servo travel distances for more or less sensitivity.

It is recommended that you use the mixing capabilities of your transmitter to mix in elevator function with the ailerons. This means that when applying elevator control, all surfaces (elevator and ailerons) will move up and down in unison and with the same amount of travel. For aileron control however, only the ailerons will move. This setup will make the Bluto very responsive to elevator input in the turns and is desirable in racing.

Make sure the top of all control surface are inline with the top surface of the wing. This means you will start the trimming process with no reflex (no up aileron or up elevator)

Step 11 • Make and Mount the Fin

Use the balsa parts you cut using Diagram “C” from the 1/16” balsa sheets (2 Fin Cores and 4 Fin Skins) and the 2 laser cut Fin Tangs to make the Fins. (Image 9 shows the material for one Fin)

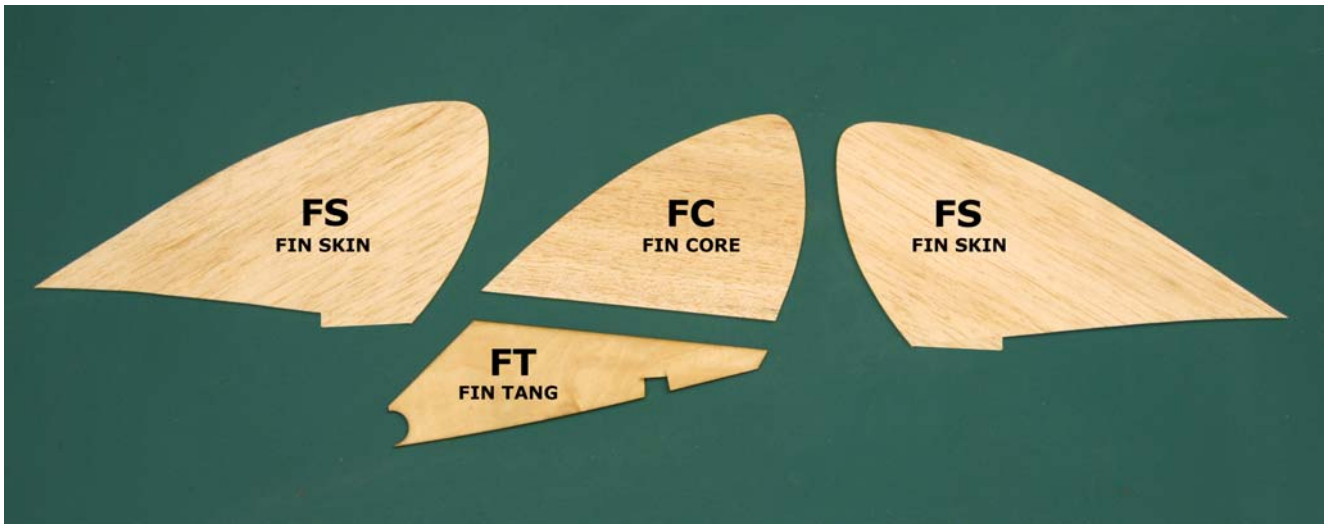


Image 9

The following steps describe the process of making one fin. Repeat it for the other:

Test fit the Fin Tang in the Fin Slot in the wing. Insert the curved front first and push it against the Spar (same as you see in Image 11). Now swing the back end of the Fin Tang into the slot. You might have to make adjustments to the the shape of the square cut-out in the Fin Tang to ensure a good fit around the Drag Spar, Drag Spar Joiner and the Tapered Gussets.

Once happy with the fit of the Fin Tang, remove it from the Wing and, on a flat surface, glue the 1/16” balsa Fin Core (part FC) to the 1/16” plywood Fin Tang. This is a butt-joint and will hold better if you use thin CA for adhesive. Use a piece of wax paper under the parts to prevent them from becoming glued to the work surface. Sand both sides flat after the glue dries.

Test the fit of the bottom curve of the Fin Skins (part FS) against the top surface of wing at the Fin Slot. Sand where needed to make sure there is a tight fit between the bottom of the Fin Skins and the top surface of the wing.

Place the Fin Tang/Fin Core assembly into its Fin Slot and press down until it is seated.

Use a sharp pencil to trace the top of the wing on both sides of the Fin Tang.

Remove the Fin Tang/Fin Core assembly from the wing and glue a Fin Skin to each side. Make sure you line the bottom of the Fin Skin with the pencil mark you made on the Fin Tang.

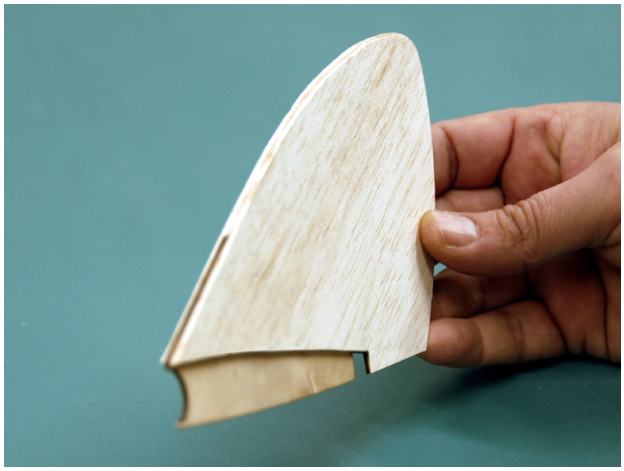


Image 10

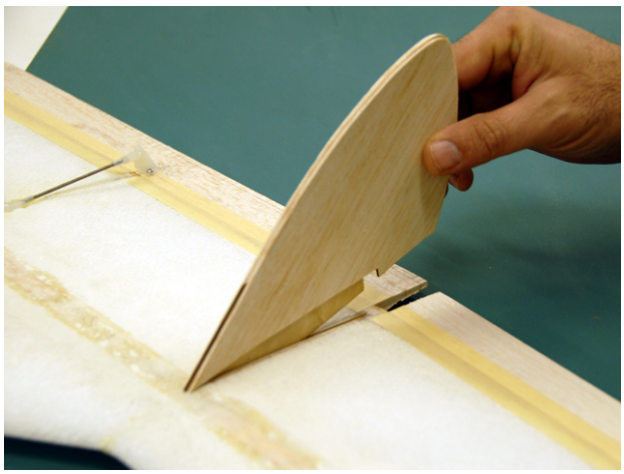


Image 11

Sand the edges of the Fin until all 3 layers are flush. (see Image 10).
Sand the leading edge round and taper the trailing edge to a sharp edge. The taper should start about 1.5” forward of the trailing edge.

Test fit the Fins in their Slots. They should fit snuggly, be flush with the bottom surface of the wing, fit tightly against the top surface of the wing, and when viewed front the front or back, be perpendicular to the top of the wing. (see Image 12) The Fins are meant to be removable, so <u>don’t glue them on</u>.

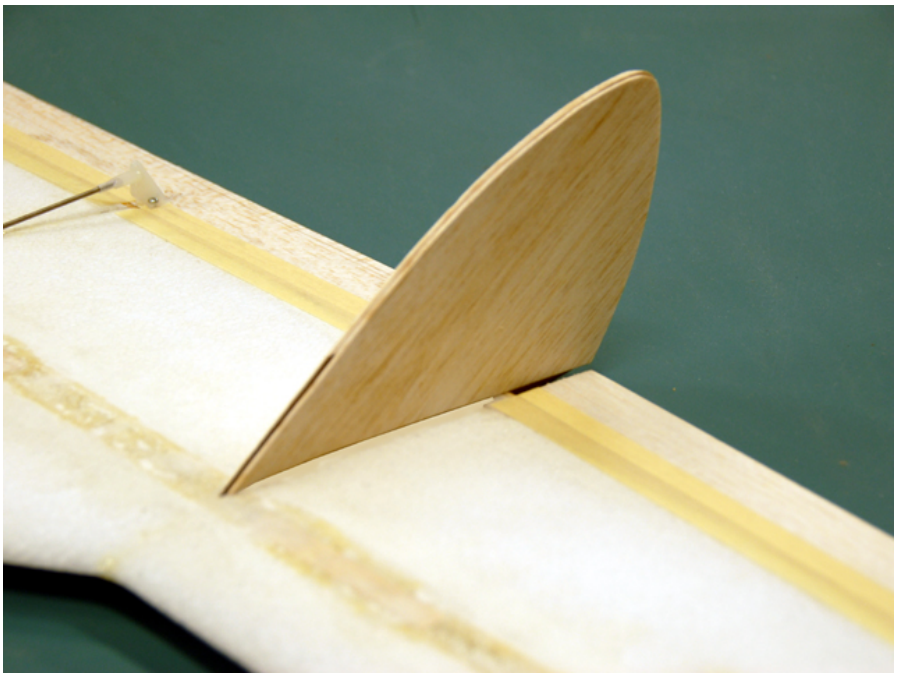


Image 12

Step 12 • CG the BLUTO & Get Ready to Fly!

The starting CG (Center of Gravity) on the BLUTO is 1” from the Leading Edge of the outboard section of the wings.

Since the plane will not fly properly if the CG is even as little as 1/16” off, please do not rush this process. “Fingertip” balancing will absolutely not work, so make a quick balancing jig using a couple of hobby knives clamped 5” apart and vertically level in a vice or stuck into holes you drill in a piece of 2x4. Attach the self-adhesive HardPoints on the bottom of the wing and you can balance the Bluto without the knives puncturing the wing.

To position the HardPoints correctly, first place a 20” long strip of masking tape on the bottom of the wing and centered so each end extends past the Fins. Now place a pen mark, 1” back from the leading edge at each end of the tape. Use a long straight edge and connect the two points with a line. The plane should balance on this line. To install the HardPoints, mark their location on the tape using the balancing jig you made earlier. Remove small sections of the tape where the HardPoints should go and install them making sure the middle graduation on each, lines up with the line on the masking tape. Mark this graduation with a felt tip pen so you can easily reference it.

Balancing:

Position the BLUTO on the balance jig so the tips of the knives engage the graduation you marked as the CG. It is helpful to place a block of wood or other object an inch or so below the fin, as a stop, to keep the tail from falling backward off of the balance jig (when tail-heavy). Place small lead weights on the top of the wing, where necessary, so the plane balances perfectly horizontal.

As with most high performance flying wing airfoils, the CG is critical. When the necessary amount of weight has been determined, place a temporary tape cover over the lead for the first few flights (unless using stick-on weights), until the CG is well established… you can then hide the lead with a method of your choice.

Fly!

The BLUTO should now be charged, shop CG'd / travel adjusted, and elevon trimmed. If possible, also set up an alternate dual rate switch with less elevator throw, just in case. For the maiden toss, transmitter-trim about 1/16" of up-elevator (also just in case), and give it a straight, firm, and level launch, with a good follow through…not too wimpy, not too hard… more like a javelin than a baseball. Carve your turns for a little while, until you become used to it, then follow the "Fine Tuning" steps below.

Fine Tuning

Important: Begin moving a supplemental 7 gram sticky weight back until the plane feels smooth yet very peppy on the turns and vertical pumps. Make very small movements with the weight, about 1" at a time. Properly CG'd, the BLUTO will be fast, stable, maintain energy extremely well in both medium and heavy lift, fly effortlessly inverted, snap turns, and have great spiral and yaw stability. If it doesn't have ALL of these properties, it is likely due to one or two things: (a) Your CG is not yet perfect; (b) You have too much elevator throw. In our experience, it is usually both. If you are flying this big, heavy airplane in too light lift conditions (which we recommended against), be aware that you CAN get this plane to "flick", if pushed too hard.

HAPPY AIR & THANKS FOR CHOOSING THE BLUTO!