PLEASE READ THIS FIRST

Many thanks for buying the HP60!

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 CG!!!** 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 HP60 TO MANUAL SPECS.** 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 HP60 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.

IF YOU ARE PLANNING ON MOSTLY DS'ING: Please read the notes on DS'ing, near the bottom of pages 16 and 18. There are a couple of modifications you might want to consider. Namely, fin size & plan form, and elevon tip rounding. If your elevons seem too light for your tastes, throw some beefier ones on, too.

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 HP60

High Performance Slope Thing

For the bigger days, bigger slopes

Wing Span: 60” • 525 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.

www.northcountyflyingmachines.com

(858) 485-1137

~ N C F M ~

ASSEMBLY INSTRUCTIONS:

(Revision 7 – 6/30/2010)

Kit Includes:

(2) Wing Cores (CNC cut 1.9lb Density EPP)
(Note: Top Beds not Included)
(2) 28.5" Tapered Carbon Spars
(2) 30.5" Weight-Matched Elevons (outboard)
(2) 30.5" Basswood Drag Spars
(1) 13" Solid Carbon Fin Boom
(1) Spar Joiner (Angled Aluminum)
(2) 4" x 10" Balsa Fin Sheets
(1) Coroplast Fin Mount (w/ 2-sided tape backing)
(2) 2-5/8" Center Elevons (to be fixed stationary)
(1) 1/4" x 5" Triangular Basswood Gusset
(2) 1/8" x 4" Tapered Gussets
(8) Lead Slugs (Balance Weight, 4 Per Side)
(2) Elevon Control Horn Sets w/ 4 Machine Screws
(2) Du-Bro EZ Connectors
(2) Steel Clevises
(2) Foam Spar Channel Tip inserts
(6) 3"x3/8"x3/8" Balsa Spar Weighting Caps
(2) End-Threaded Control Rods
(1) Instruction Manual DVD (confirmed by reading this)

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. Presently, we prefer "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 is not really recommended for DSing, 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 HP60 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.***

Step 1 • Glue The Lead Balance Weight

The nose of the wing comes pre-cored for the provided Balance Weight. The Balance Weight consists of eight lead slugs (4 per side). It is very important to mask off the wing above and below the entire balance cavity, so the epoxy does not ooze out the of the core chamber. Use Goop or 30 Minute Epoxy to glue 4 slugs in each wing, into the pre-cored balance chambers.

Step 2 • Join the Wing Cores & Glue in the Spar System

NOTE: Under the 6/17/05 entry on our "Latest News" section of the website, there is a link to an in-shop 48" Halfpipe build, which contains 119 JPG photos, some of which show our process for using polyurethane to glue in the Carbon Spars; much of that process is exactly the same as on the HP60. 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 prefer the "Gorilla Glue" brand, given its specific expansive properties; Elmer's Ultimate Glue will work, but does not have quite the expansion volume 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

PREP: For a good glue bond, rough-sand the entire exterior of the aluminum spar joiner. Gently sand the first 7" of the inside of each Carbon Spar (thick end), and wipe clean. Pre-fit the Carbon Spars onto the Spar Joiner—they should slide smoothly up to the center bend of the Spar Joiner, without forcing. When satisfied, spread "JB-Weld" epoxy evenly on the Spar Joiner and insert it into each Carbon Spar. Since the tight fit will certainly squeeze out the majority of the glue, ensure that there is adequate coverage; pre-applying some JB to the inside of the shaft, and then very slowly turning the shaft onto the joiner works well. Have paper towels ready! 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.*
Prepare the Wing Cores: On a flat, straight surface, tape the bottom wing beds

together. Lightly sand the bottom of the Wing Cores underneath the spar channel, and tightly apply masking tape (2” wide tape is best) all along the bottom under the channel (to prevent too much glue from wicking out). Mask off each side of the spar channel on the top of the wing with masking tape. Cover both bottom beds with a long piece of wax paper or plastic wrap to prevent gluing the wing to the beds in subsequent steps.

Join the Wing Cores together: Apply Goop or 5 minute epoxy to the wing roots, bring the two cores together and place them in the beds. Ensure the wing is level, properly aligned and flush at the root. Use straight pin and judiciously placed weights in a few places to hold the wing snuggly in the beds, and let cure.

A Few Words About The Gluing Process:

We use PU glue for both gluing in the spars AND creating a domed spar cap above them, which is sanded flush and filled with spackle. This makes for an unbelievably strong, smooth, and torsionally rigid wing!

Instead of using a continuous spar cap, we use six, 3/8” x 3/8” x 3" balsa strips (3 per side), and weight them down with 2lbs each, on top of small, elevated cross-bridges. This allows 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 pressures from the glue can be very strong, and push the Spars AND Spar Cap out of the channel, curing above the airfoil. Do not worry about not having a continuous Spar Cap; In this case, the Spar Caps are merely a filler, replacing lost foam and allowing reshaping of the top of the Spars to the airfoil shape.

Prep: With the spar channel masked off on both sides, and the Carbon Spars epoxied onto the joiner, 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 bridge weighting system. When ☺, remove and set within reach, laid out exactly as it will drop in, since you will be “on the clock” once the glue goes in.

Glue The Spar System:

Lightly wet out the channel with water, using a small brush or dampened 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 channel, 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, 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 long sanding block and keep its long 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.*

**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. A "Ballast Tube" can also be installed now, centered directly on the CG, at 6-1/8" from the nose.

Using the provided Wingtip Pattern (Diagram "A"), planform cut and symmetrically round the tips to shape. Make the cut slightly oversize, then do the final rounding and smoothing with 120grit drywall screen or sandpaper. More speed with less pressure works best. You can also apply some "thinned Goop" over the tips at this point, which helps for better covering adhesion and more tip impact longevity.

Step 3 • Glue on the Tapered Gussets and Basswood Drag Spars

The drag spars are the two 1/8" x 1/4" x 30.5" 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! Prior to gluing the drag spars onto the wing, you will need to glue a 1/8" x 4" tapered gusset onto one end of each drag spar (using thick CA); the <u>non-tapered end</u> of each of the tapered gussets should be flush with the end of the drag spar (See Diagram 1 below). Trace and remove some of the foam at the TE to accommodate the shape of the gussets.

<u>These gussets are very effective in transferring the shear loads that result from hard impacts and diffusing them. Do not omit them!</u>

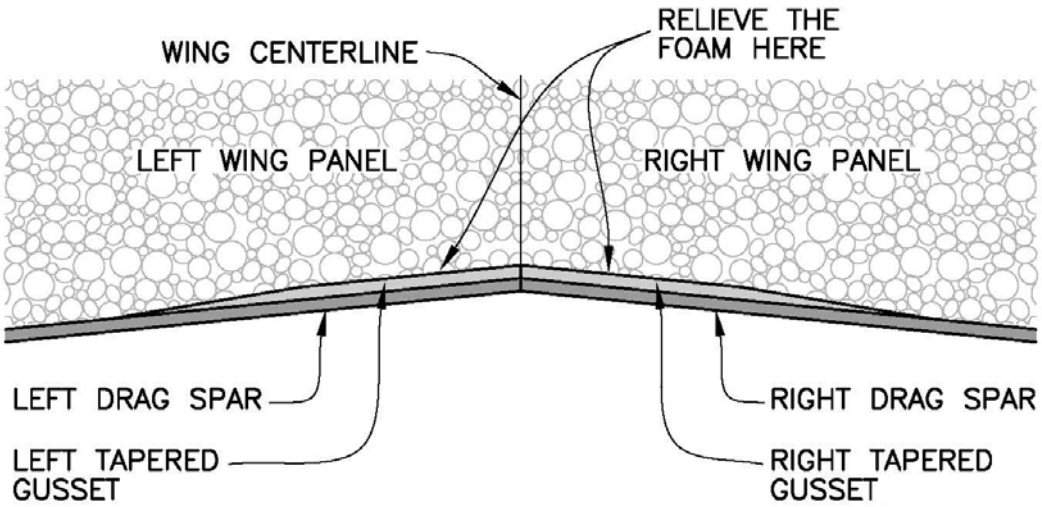


Diagram 1

Step 4 • Glue on the drag spars:

Using slow epoxy, glue the 1/8” x 1/4” x 30.5” drag spars (with the tapered gussets inward, of course) to the foam trailing edge of the wing. Once positioned correctly, quickly secure the drag spars in place with short pieces of masking tape (from the bottom surface of the wing, around the drag spar, to the top surface). 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, and gently round off the ends to match the shape of the wing tips.

Step 5 • Install the Triangle Gusset and Center Fixed Elevons

For a number of reasons, including elevon line-up and efficient flight trim, this is the most important step in the building process… please take your time and make sure the installation is precise and clean.

Prior to gluing in the Triangular Gusset, the correct root angle must first be established and cut/sanded into the center-joint portion of the two short balsa Fixed Center Elevons (see Diagram 7)--the two short Fixed Center Elevons should meet flush together at the center root of the wing; they are supplied oversized at 2-5/8” long each, but when finished should end up approximately 2-1/2” long each (or 5” when together, the exact length of the triangle gusset)

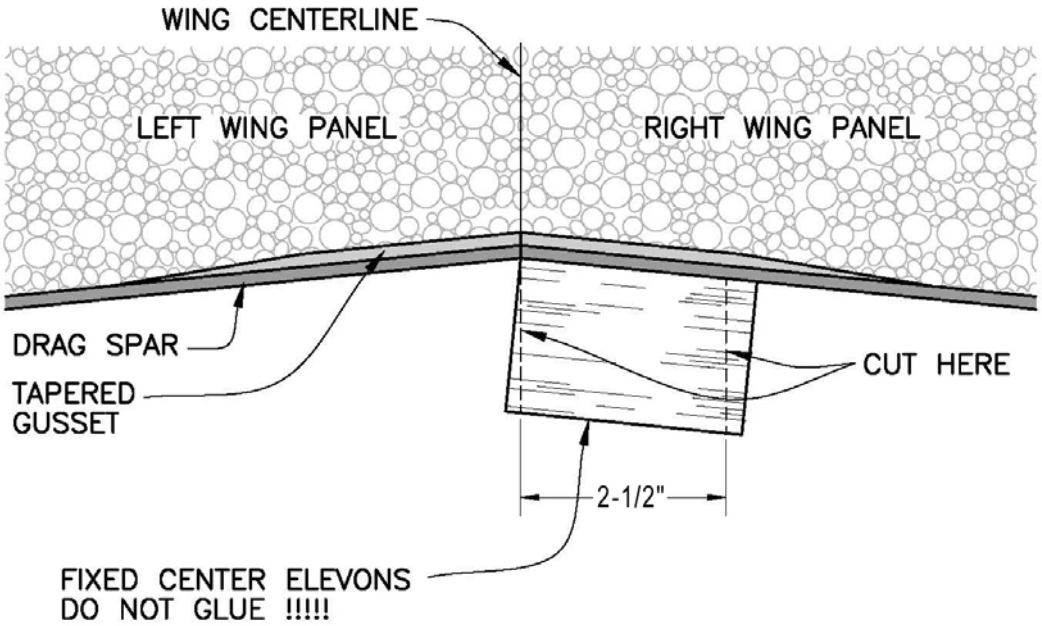


Diagram 2

So position each Fixed Center Elevon against the Drag Spar and make 2 cuts 2-1/2” apart and parallel to the wing centerline (see Diagram 2 above) to establish the root and outboard end angle.

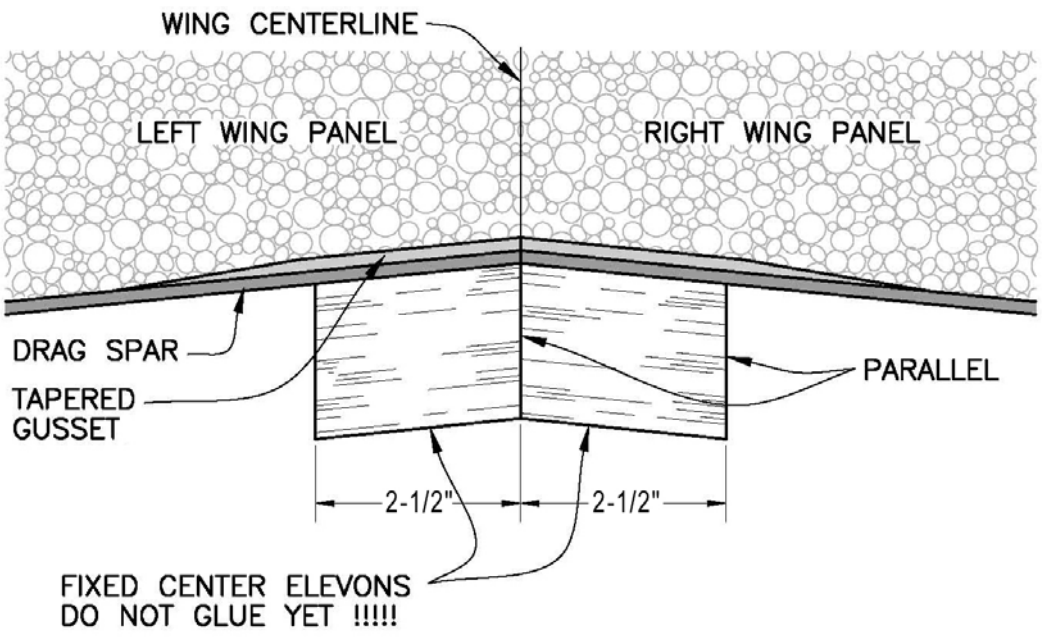


Diagram 3

Once you have completed the cuts for each Fixed Center Elevon, butt them together and position them against the Drag Spar (see in Diagram 3 above) They should come together flush in the middle and flush with the Drag Spars.

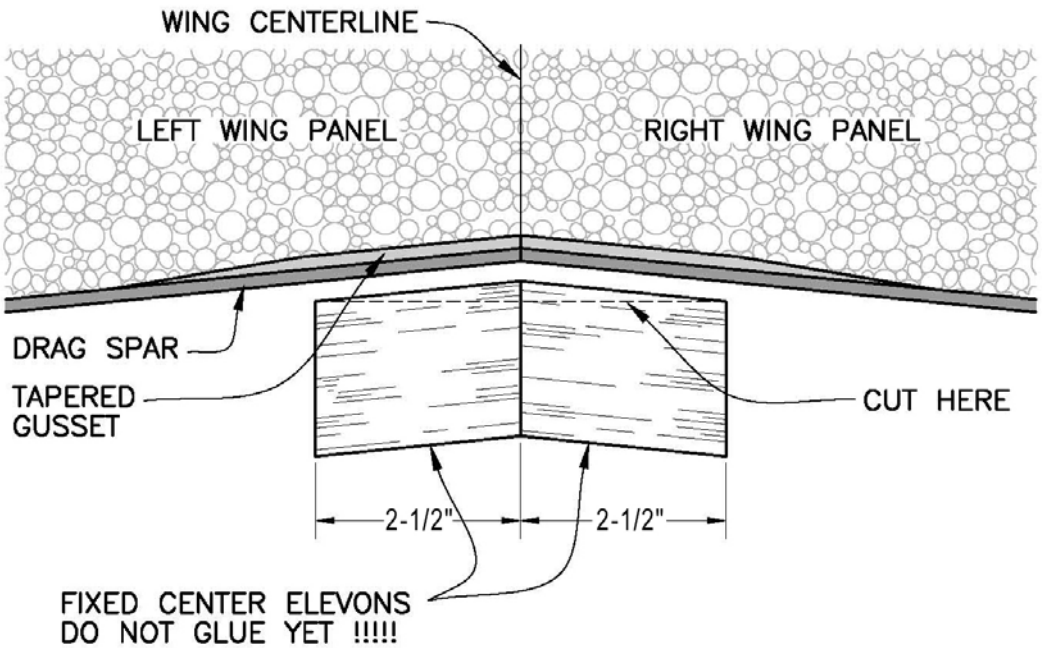


Diagram 4

Now pull the Fixed Center Elevons away from the Drag Spar and, while still together, using a fine point pen draw a line along the dashed line you see in Diagram 4 above. Cut along the line you just drew and discard the small triangular balsa pieces. *The triangular pieces of balsa you just cut away will be replaced by the Triangular Gusset in the next step.*

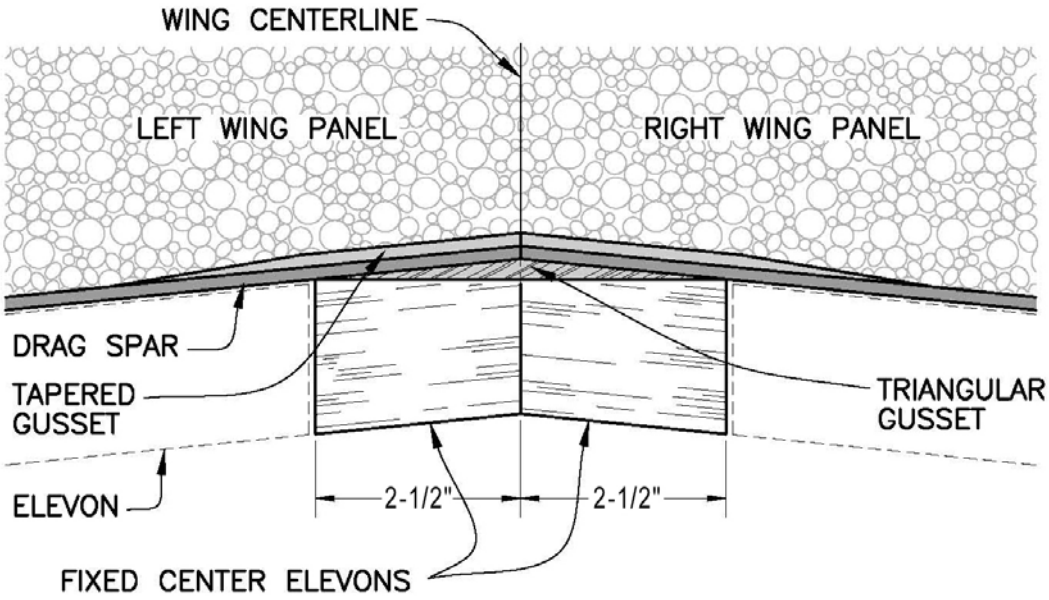


Diagram 5

Place the Triangular Gusset against the Drag Spars. *If the Triangular Gusset does not conform to the angle between the Drag Spars, go ahead and sand its sides until you have a perfect fit.* Now position the Fixed Center Elevons behind The Triangular Gusset. Test fit the parts to make sure they fit as you see them in Diagram 5 above.
Important Note: <u>Do not bevel the leading edge of the Fixed Center Elevons.</u>

Once you are satisfied with the fit of the parts, you are ready to start gluing them to the drag Spar. Start with the Triangular Gusset:

Using thick CA, glue in the basswood Triangular Gusset, insuring it is centered and flush with each drag spar (make this joint strong!).

Now it's time to glue the Fixed Center Elevons to the Triangular Gusset. But first you need to make sure they mate perfectly:

Without the wing beds, place the wing flat on your work surface and press down on the center rear of the wing so that the bottom rear half of the airfoil is flat against your work surface. Slide the left Fixed Center Elevon into position

against the Triangular Gusset; In this position there might be a slight gap between the two (if you don't see it on the top surface, then look from the side and check below). If the gap is there, the face of the leading edge of the Fixed Center Elevon needs to be sanded slightly. Repeat this procedure for the right Fixed Center Elevon.

You have a perfect fit when you have all of the 4 conditions below:

1. The bottom of the rear portion of the wing and the Fixed Center Elevon are flat against the work surface. (see Diagram 6 below)

2. The Fixed Center Elevon and the Triangular Gusset mate flush face to face.

3. There is a slight reflex (up elevator) in the Fixed Center Elevons. (see Diagram 6 below)

4. The two Fixed Center Elevons fit flush together in the center.

When the Center Elevons are able to fit flush together and flush against the back of the gusset, glue in the left Fixed Center Elevon first, using thick CA. When cured, glue in the right Fixed Center Elevon (you will also now be gluing the two Fixed Center Elevons together, at the root joint).

Double check the assembly to make sure that the slight reflex (roughly 1/16") at the TE of the wing is still there, you can check this by laying a straight-edge across the top of the airfoil.

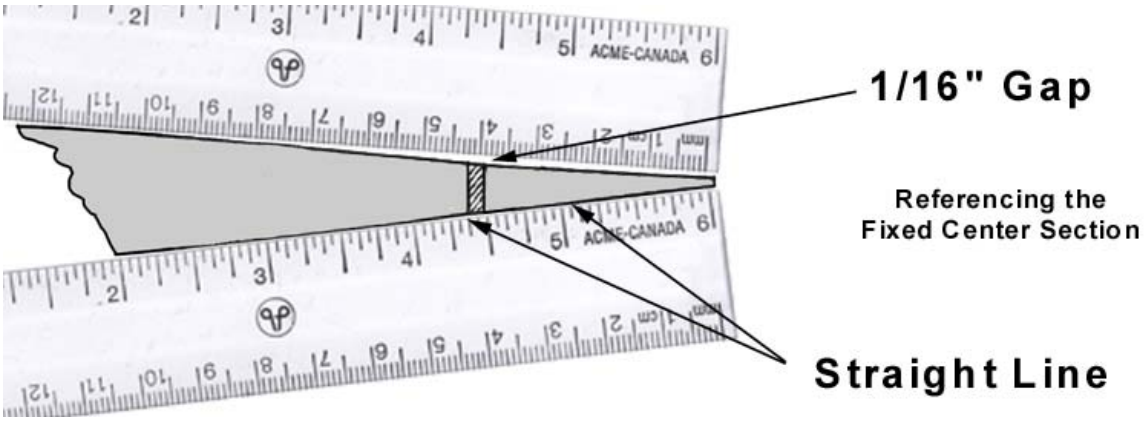


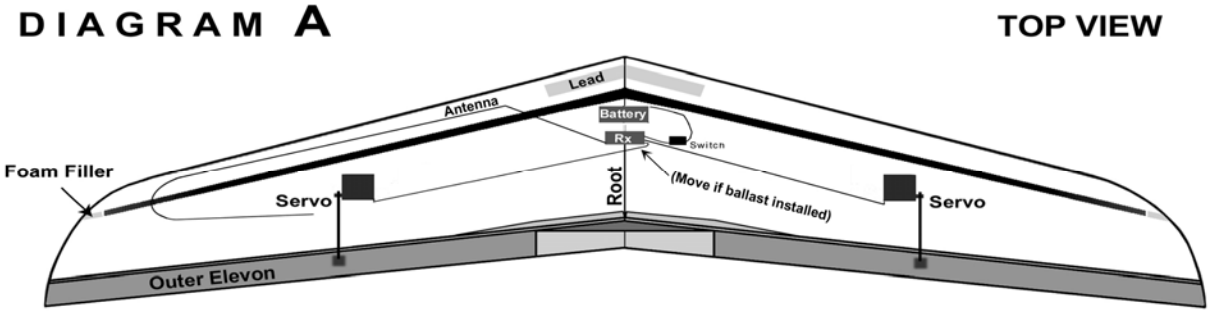
Diagram 6

Step 6 • Installing the Servos

The HP60 was 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 the plugs will reach the Rx, once the servos are buried in the wing at the recommended location.

*** If you plan on using control rod fairings, and/or have a soft, grassy landing zone, the servos can be mounted on the bottom of the wing.**

This will increase flight efficiency, though makes them a little more vulnerable.



See Above • Position the servos on the top (* see bottom of page 9) of the wing, just behind the main spar. If maximum torque is desired, it is best to have the servo arms driving at the center of the elevons, which would be located at 16-1/8" out from the root; using calipers or something similar, make sure *your* servos will fit in the wing at this point--it is thin out there! Otherwise, pull them 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. Important: Slightly rotate the servos so that the drive arms/control rods will be exactly parallel with the center root line of the wing, and direction of flight (do not right-angle them to the LE or TE). Trace around the servos with a pen and rout out just enough foam so that the servos fit flush inside the wing (make sure to relieve a little foam so the servo arms can go freely go through their full range of motion).

Potting the Servos: Since the HP60 has the ability to see extreme speeds, and the necessary elevator throws are very little, you will not want ANY wiggle in the servos themselves -- we strongly recommend "potting" them. Do one

servo at a time: (a) When you are finished routing out the servo cavity, wrap the servo in a poly sandwich bag or 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, and try to avoid the area where the servo drive arm is located. (c) Press the *wrapped* servo into the cavity while the epoxy is still wet, making sure it is perfectly positioned, and either slightly below, or flush with the airfoil (not sticking up above the surface of the wing). (d) When the glue has cured, remove the servo only, then peel the plastic bag away from the epoxy.

You should now have a perfect mold of your servo shape, allowing the servo to "snap in", with near zero movement. Cut or rout out a shallow channel for the servo leads to reach the receiver. The servos will be capped in Step 7.

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 and rout out the foam for the battery (centered 4" +/- back from nose, behind the spar), the receiver, and any switch/charging jack you plan to use; they should sit just slightly below the surface of the airfoil. The Rx needs to go pretty much "anywhere it can", especially if a ballast tube is installed; (we actually mounted a Berg vertically). Cut or rout a shallow channel for all of your wiring, including the antenna, 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 HP60, 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 Goop, etc., to the bottom of the servo well, to help keep them locked in.

Cap all of the gear with scrap foam or balsa, sanding flush with the airfoil, to provide a clean surface in preparation for covering. We use a piece of double-sticky carpet tape to stick scrap balsa to the exposed area(s) of the gear (including servos), sanding 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 servos with a small square of masking tape. Spray the inner 15" of the wing, top and bottom, and the front 1" of the LE, top and bottom, with adhesive spray; let dry at least ½ hour.
Wrap a long piece of strapping tape, span wise, around each LE, from the nose to just where the tip starts to round (if rocks or trees are a common part of your landings, use two layers). Then, apply strips of 1" or 2" wide strapping tape, nose to TE, top and bottom, starting from the center; you will extend about 7.5" onto each wing half; blade off the strapping tape at the TE of the wing… do not wrap around the drag spar or fixed center area. The whole center 15"+ of the wing (top and bottom), plus each LE, should be now covered with strapping tape: Use a hot iron to shrink the tape tight, being careful not to change the angle of the fixed center area. Strapping tape shrinks at a much lower temp and gives no warning; be careful!

Now, add a 2nd layer of strapping tape in the other direction, SPANWISE, top and bottom. In essence, apply a new, 15" layer of strapping tape over, but perpendicular to, the first layer, to increase the overall tensile strength at the rear of the wing, especially over the gusseted sections.

Covering the Wing:

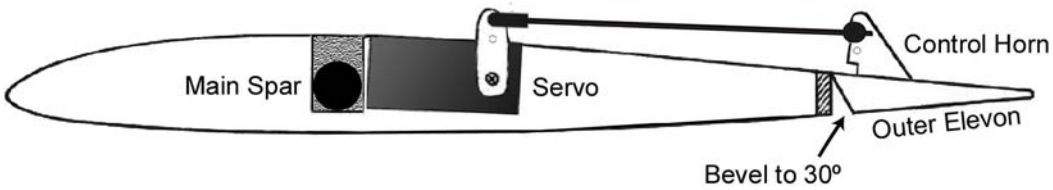
First, make sure your servo control arms are vertical and centered when everything is turned on and neutral; if so, you can deflect them to near the surface of the wing and turn everything off—this makes for easier covering. Whichever covering material you use (we recommend Ultracote), first mist the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

Cut or sand the inner edge of each elevon to match the exact angle of the fixed, center elevons. Smooth-sand the elevons 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 Drawing at Top of Page 13).

Cut the elevons to length, and round/shape them to match the wing tip. Cover the elevons and insure 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 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, and that there is 1/32” to 1/16” of airspace between each elevon root and its adjacent fixed center section.

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 <u>exactly</u> 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 install the Du-Bro EZ Connectors to the control horns. The edges of the outer elevons should line-up exactly with the fixed center elevons, when sighting from the TE. Cut off any excess control rod past the EZ Connector, though leave enough for any potential adjustments.

<u>Setting the Elevon Travel Distances:</u>

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 preferential, 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.

Step 11 • Make The Coroplast Fin Mount, The Fin and mount the Fin

Make The Coroplast Fin Mount:

Cut out the Fin Mount Pattern (Diagram "C") and overlay it onto the no-tape side of the provided piece of Coroplast. The pattern should be lined up so that its exact center runs along the exact middle of the center flute of the Coroplast. Trace and cut.

Optional: For optimum aerodynamic performance it is preferred that the edges of the Fin Mount facing the airflow are not blunt but rather thinned like the leading edge of the wing. These thinned edges will also make the job of securing the perimeter of the Fin Mount easier. To thin the edges you need to remove the flutes from the inside of the coroplast near the edges. You can accomplish this by routing out the flutes using a Dremel tool (easier) or cutting them of one-by-one using a sharp knife (tedious!). We recommend using a Dremel tool with 3 of the smaller #420 Dremel cut-off wheels stacked together and chucked onto one mandril. This setup will give you enough 'reach' to rout the flutes in an area about ½" wide inside of the coroplast perimeter (see Diagram "C") Remove the flutes along the long sides and the front edge of the Fin Mount only; Do not rout out the central flutes along the V-section at the rear egde of the mount, as this is where the fin boom slides in.

To avoid binding or tearing of the Coroplast Fin Mount, slightly round one end of the carbon fin boom.To pre-fit, firmly slide the fin boom in about 4" into the center Coroplast flute; this "pre-fit" will limber up the plastic and make the boom easier to insert once the fin has been attached to it. Remove the carbon fin boom.

Make the Fin Pattern:

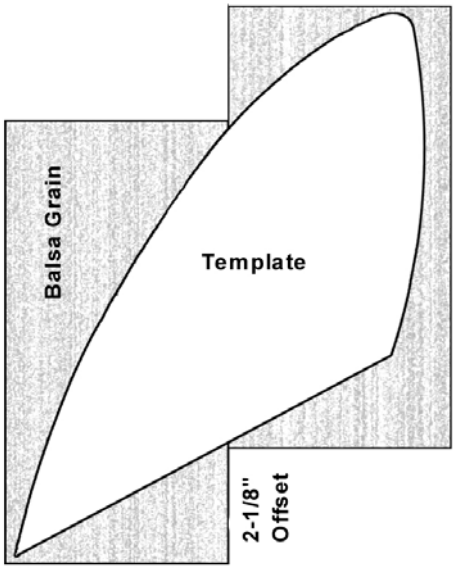
Cut out the provided fin patterns in Diagram "B" at the end of this manual.

(The pattern is too big for the pages of this manual, so it is provided in two pieces.)

Position the two pattern pieces next to each other as directed in the diagram and tape them together to make a single fin pattern. The join line between the two patterns should be lined up with the joint between the two pieces of balsa you'll be gluing up in the next step. This will ensure that the grain of the balsa runs in the appropriate direction and makes positioning the pattern on top of the balsa stock easier.

Make the Fin:

Position the two 4"x10" pieces of balsa fin material side by side on a flat surface, so they fit flush together. Sand the edges, if necessary, to ensure a good fit between the two with no visible gaps.



To accommodate the fin pattern, you will need to slide/offset one of the balsa pieces by 2-1/8", against the other, with the grain running vertically; the fin will *just* fit, diagonally. Using thick CA, join the two pieces of balsa.

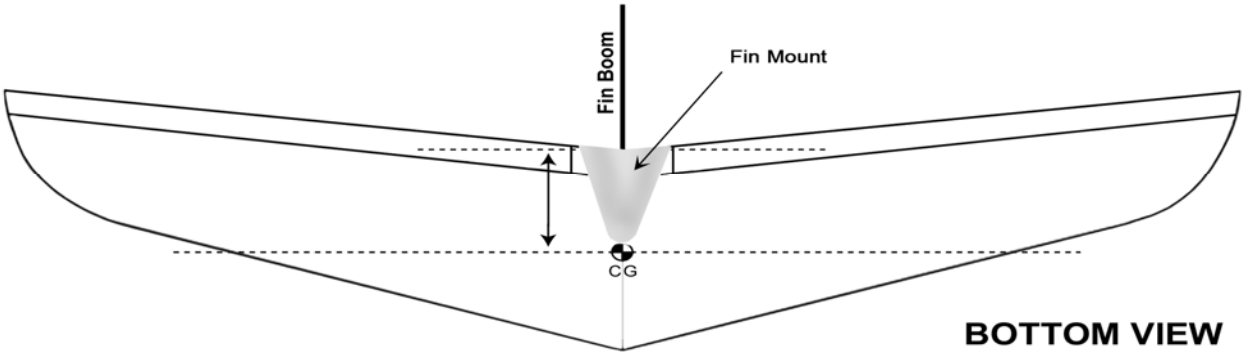
Position the fin pattern on top of the balsa as shown in the image to the left.

Trace the fin pattern onto the balsa and cut out the fin. Sand the LE round, bevel the TE edge **and cover** the fin, insuring no warpage; leave the very bottom edge uncovered, as it will later be glued to the carbon fin boom.

Attach the Balsa Fin to the Carbon Fin Boom:

This method is simple, and may not sound like much, but it is *very strong* and takes impacts well. Lightly rough up the top "fin area" portion of the carbon rod for a good glue bond. Using thick CA, securely and straightly glue the fin to the carbon rod, with the TE of the fin terminating at one end of the carbon. When the glue has cured, tape the fin to the boom with one 8.25" long piece of 2" clear poly tape: the tape should wrap around the bottom of the carbon, extending up onto either side of the fin about 7/8". Press the tape down cleanly at the glue joint to make a nice fairing along the base, with no gaps between the tape and the fin; trim off any excess. Test fit the boom into the rear of the Coroplast Fin Mount.

Next, mask off the fin with newspaper, etc., leaving the extending front 3.5” of carbon rod exposed. Mist the carbon with adhesive spray and let dry AT LEAST 5 hours (overnight is best). The adhesive spray provides additional rotational grip, as well as an interesting lock: Once inserted in the Fin Mount, as you attempt to rotate the fin with firm pressure, it will first resist, then finally “pop” and move more freely; when left alone for 10-30 seconds, it will reset to the previous firmness….. this attribute creates a great balance between flight stability and impact safety!
When the adhesive spray has dried, insert the exposed 3.5” portion of the fin boom fully into the rear, center flute of the Fin Mount (wider end), so the LE of the fin stops at the Fin Mount, with the pre-installed 2-sided tape facing up… make sure the fin is at a perfect right-angle to the mount.



Attach the Fin Mount to the Wing:

With the Fin Boom now inside the center of the Coroplast Fin Mount, position everything on the bottom of the wing, so that the v-notch in the rear of the mount matches the center angle of the fixed TE, and lightly tack with a piece of masking tape (do not yet peel the backing off of the 2-sided tape). Sighting from the nose, make sure that the fin is perfectly vertical, and absolutely in-line and continuous with the centerline of the wing root. To help you reposition the mount, trace the perimeter of the Coroplast Fin Mount onto the bottom wing covering. Remove the masking tape, peel-off the tape backing from the bottom of the Fin Mount and very lightly tack the mount to the bottom of the wing within your tracing marks… sight it once again and, when you have it lined up perfectly, mash it in tight!
Finally, using a strong tape (2” vinyl or PVC tape is great), secure the perimeter of the Coroplast down to the wing; this might be easier with the fin boom removed, though be careful not to shift the Coroplast Fin Mount when removing the Fin. If you routed out the perimeter flutes, the edges of the Coroplast Fin Mount will squeeze down as you press the tape down. Do this for better aerodynamics and make sure there is no wiggle in the base.

If you plan to DS your HP60 (you know…Dynamic Soaring?!)

The best fin anti-rotation system we have found is to insert two small carbon rods (about 3" long each) halfway into the flutes on either side of the central flute where the Fin Boom is inserted. The 1.5" length of the rods outside of the Fin Mount are then glued to the sides of the main Fin Boom using JB Weld. The short rods will keep the Fin from rotating under heavy side loads and still allow the fin to be removed. The short rods are not provided in the kit. They need not be as thick as the main Fin Boom if it makes insertion and removal difficult. They can be of smaller diameter as long as there's no slop in the installation.

Step 12 • CG the HP60 & Get Ready to Fly!

The starting CG on the HP60 is 5-7/8" from the very back center "V" of the balsa trailing edge of the wing and/or 6-1/8" back from the nose. Since the plane will not fly properly if the CG is 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 sharpened Popsicle sticks clamped 5" apart and vertically level in a vice, or pound a couple of long nails through the bottom of a 2x4, etc.

Place a 6" long strip of masking tape on the bottom of the wing and mark the CG thereon. Since you cannot reference the LE or TE, given their angles, you will need to make your initial CG mark on the center root-line, then carry it out a few inches in either direction, at a *perfect* 90º angle to the exact center root. You should now have a thin, 6" line, exactly perpendicular to the center root / direction of flight, located on the CG.

Balancing:

Position the HP60 on the balance jig so the vertical points are dead-on the CG marks. 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 on your marks.
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 HP60 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 HP60 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 of lift (which we recommended against), be aware that you CAN get this plane to "flick", if pushed too hard.

Notes for DS'ers: The HP60 is designed for big lift and high speeds, and is an excellent DS bird. However, it was *not* designed *specifically for* breaking any world records, in its stock configuration. If you are building it as a DS only plane, beef it up a little! You might consider making the fin smaller, and, perhaps, even a split-fin setup, i.e. 50% top, 50% bottom, similar to the old Blutos. The opposing loads are much better for higher speed fin stability, and you should be able to get away with, at least, 50% less fin area (at those speeds). Check out the tip at the bottom of page 16 for an anti-rotation device for the fin to prevent any excessive, unwanted rotation. One other strategy might be to round the elevon tip planform (just at the tips), to prevent excess deflection on high-speed runs and/or high wing loading maneuvers.

HAPPY AIR & THANKS FOR CHOOSING THE HP60!

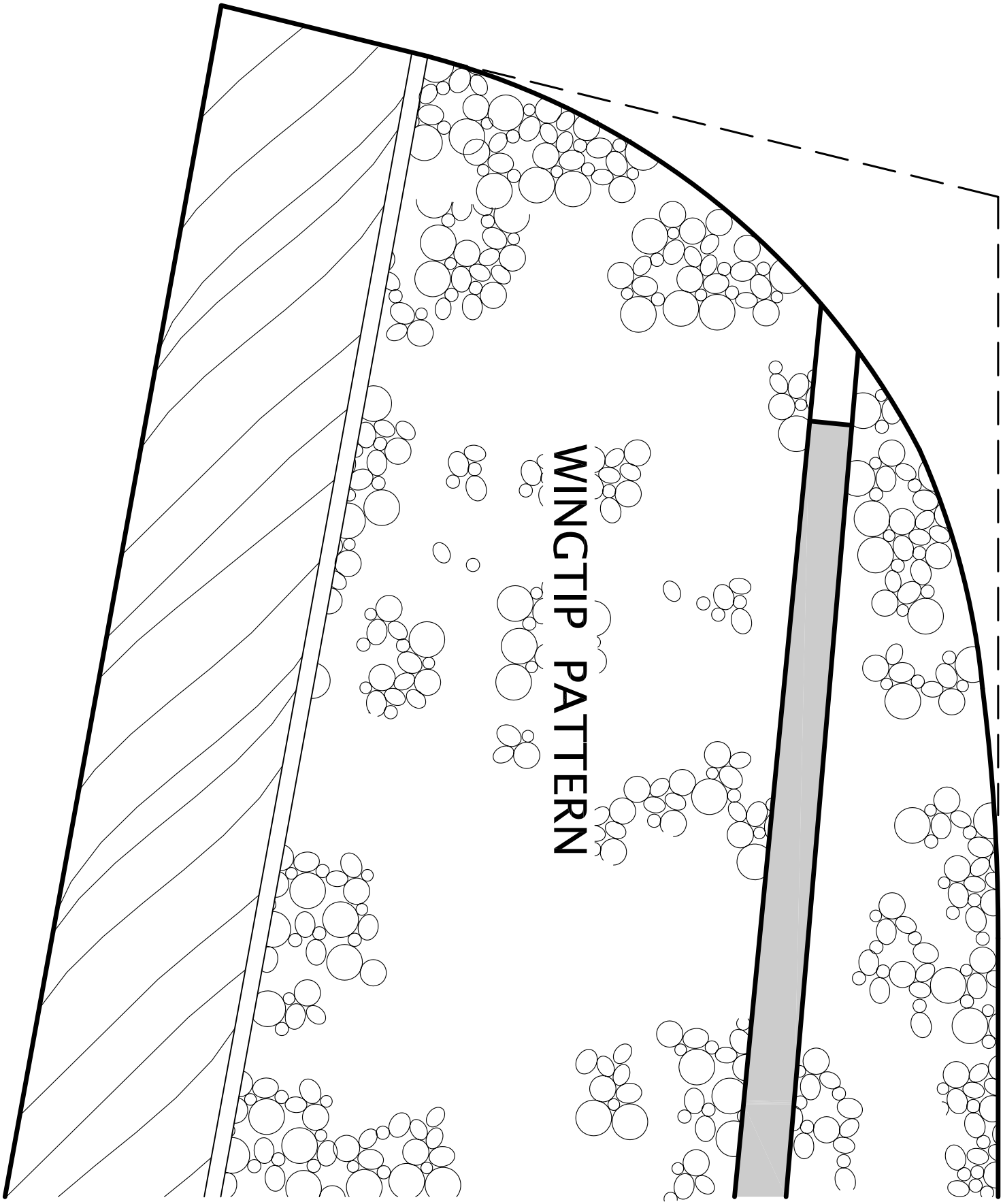


DIAGRAM "A"

HP60 WINGTIP PATTERN

FULL SIZE

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0" 1" 2"

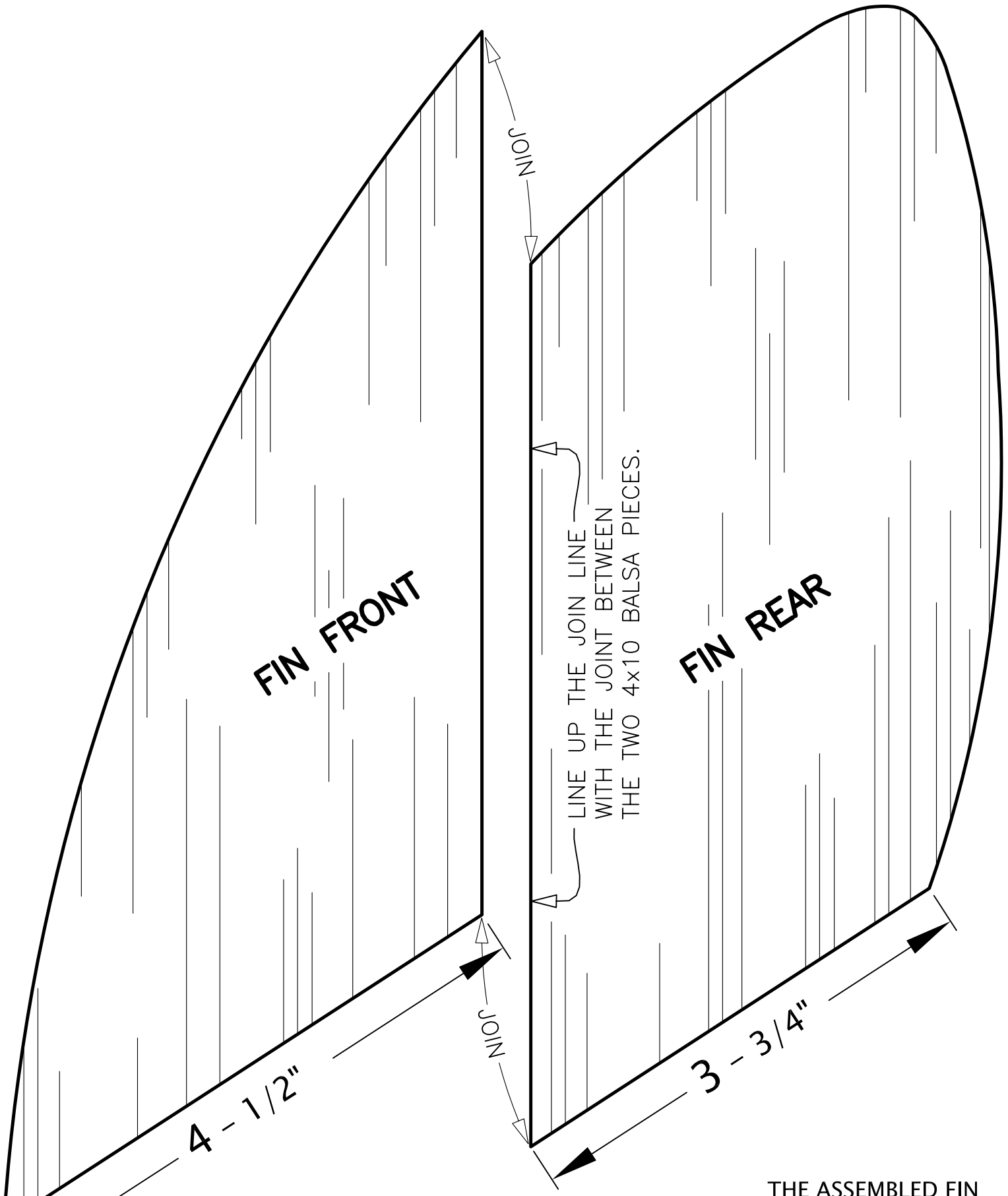

DIAGRAM "B"

BALSA FIN PATTERN

FULL SIZE

HP60

THE ASSEMBLED FIN
SHOULDMEASURE
8-1/4" AT THE BASE

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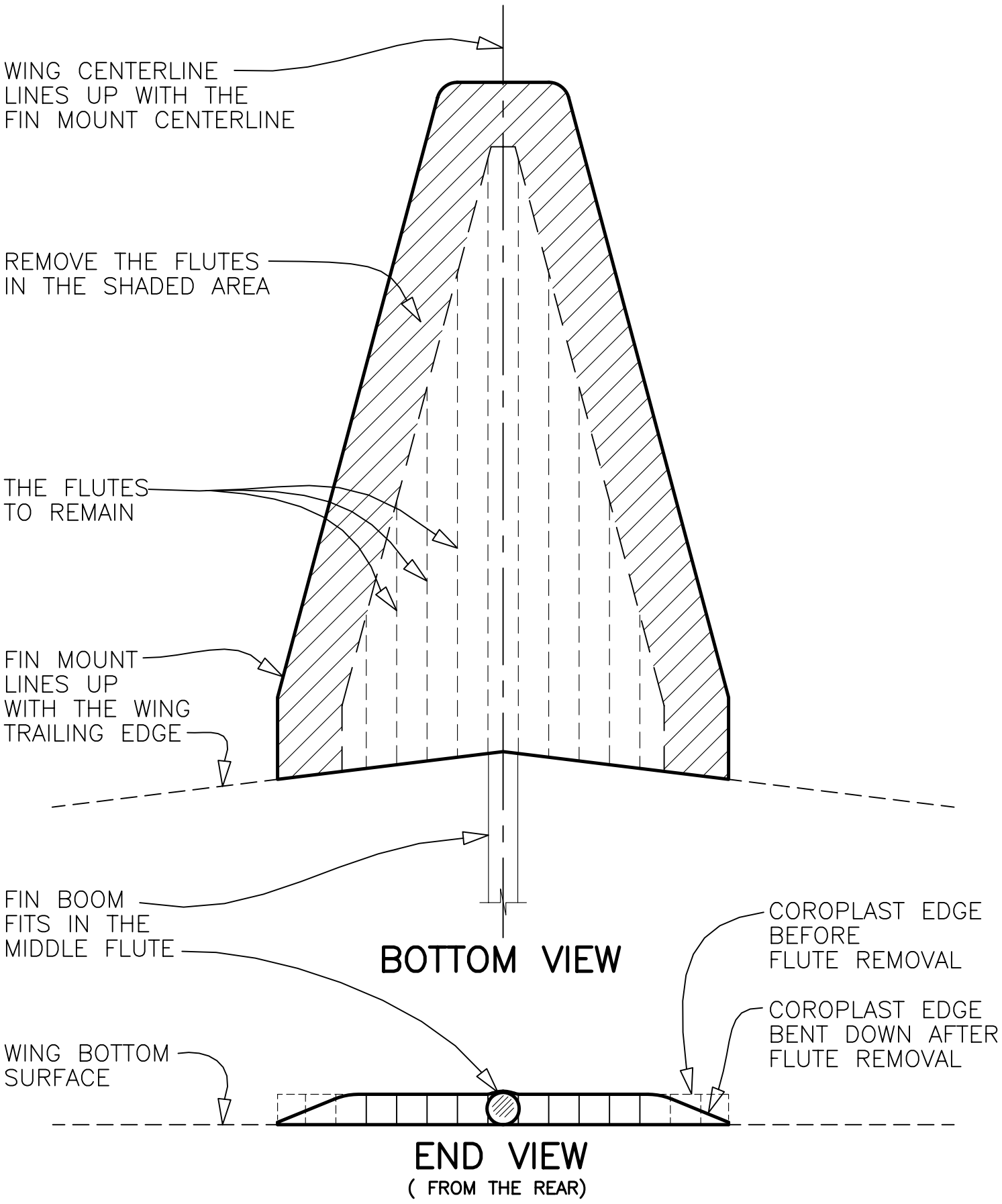

D I A G R A M " C "

HP60 COROPLAST FIN MOUNT PATTERN

F U L L S I Z E

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