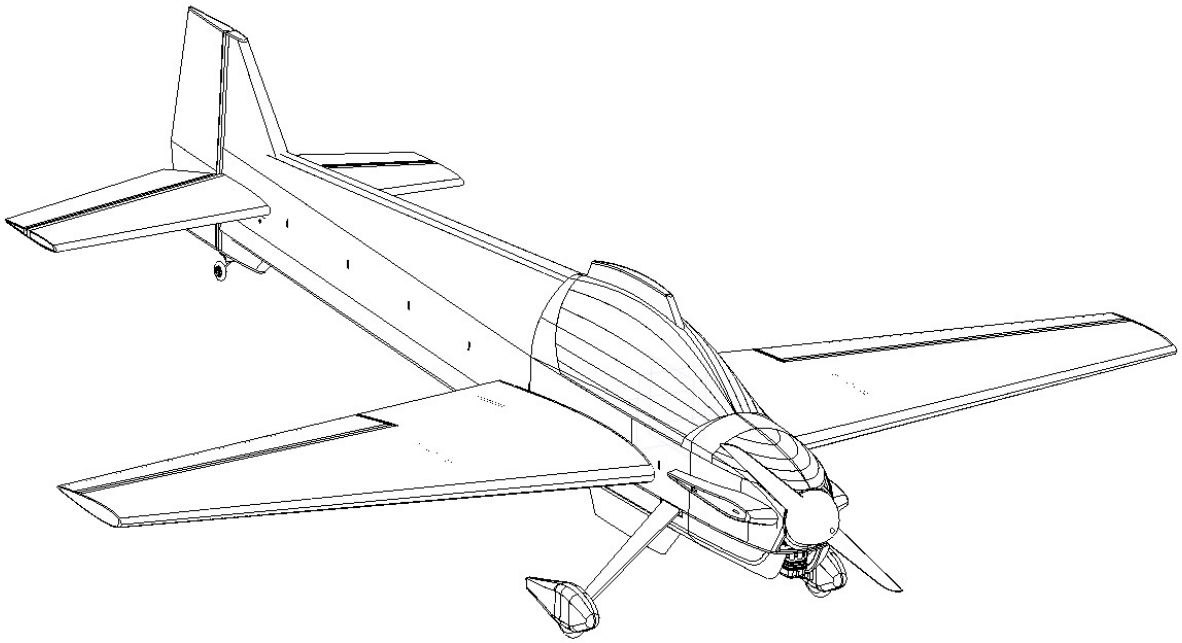
PENTATHLON

Designed by: Mark Hunt



Build Notes
Last Issued: 02-13-07

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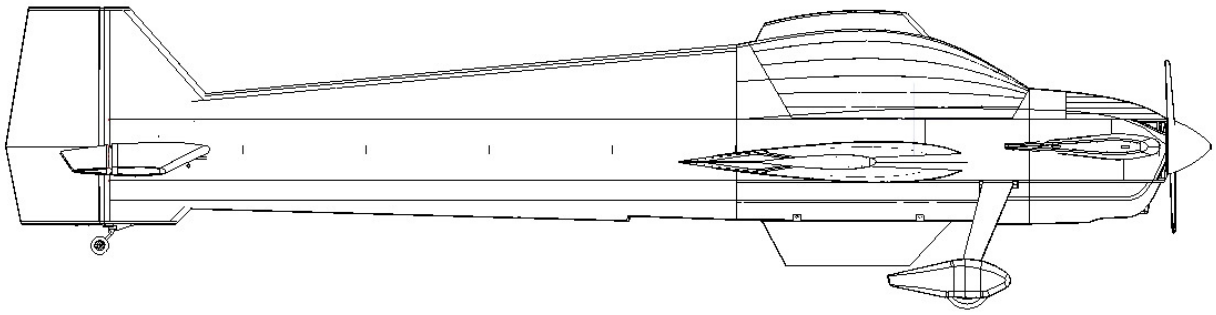
Introduction

I sincerely thank you for purchasing your Pentathlon kit. I know from experience that it may be possible to find enjoyment from building the aircraft. However, more enjoyment can be found through flying it.

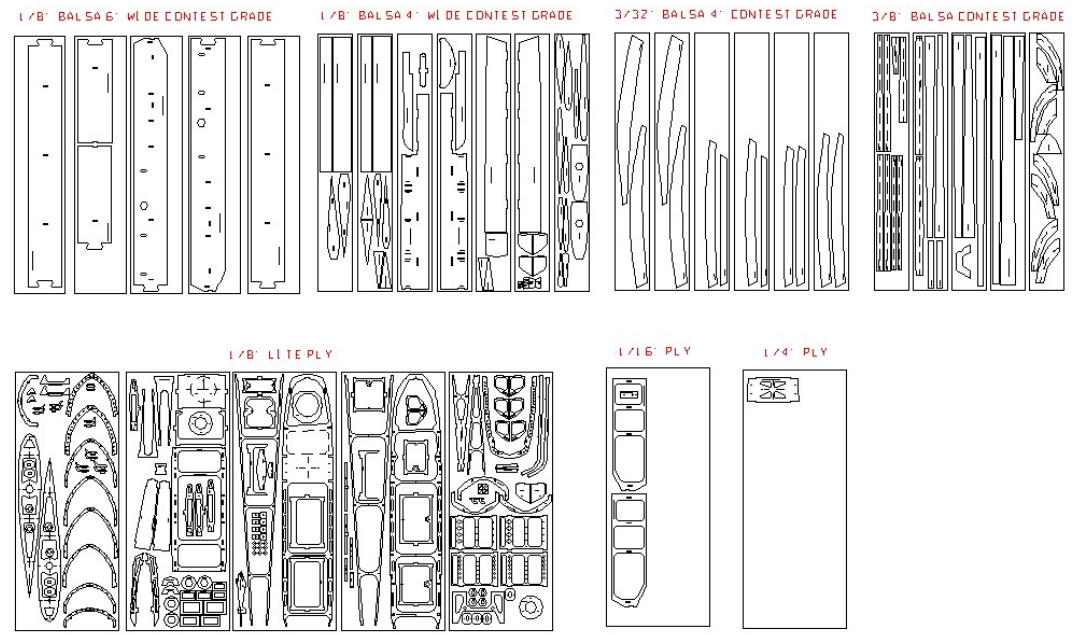
The design of the Pentathlon has been a culmination of experiences gained in the pattern community. I must thank all those whom I have so relentlessly questioned about why, and what they prefer to fly, and of course, how it should perform. This aircraft is more or less a combination of several key design elements that help it go together nicely, and fly very well.



Please use the supplied drawings and computer images (3D renderings) in conjunction with these build notes. I must apologize for any missing explanations or illustrations that are lacking. Even taking care to build the prototype with a digital camera handy, it could have been used much more. Please feel free to post questions and/or comments with pictures about your building experience. I will gladly update these notes as we collect more descriptive pictures and illustrations.

Parts List

Please examine the drawing below that depicts the laser cut sheets that should be contained within your kit.



You should have the following:

5 ea. 1/8” x 6” x 30” balsa sheets (fuse sides)
7 ea. 1/8” x 4” x 30” balsa sheets
6 ea. 3/32” x 4 x 30” balsa sheets (canopy planks)
5 ea. 3/8” x 4” x 30” balsa sheets (hinge caps, etc.)
5 ea. 1/8” x 12” x 30” lite ply sheets
2 ea. 1/16” ply (front fuse side doublers)
1 ea. 1/16” ply (mk tailwheel plate)
12 ea. 1/16” x 1” x 1” ply (hard point plates – optional)
1 ea. 1/4” ply (landing gear plate)

2 ea. 6” long x .278” OD carbon tube
2 ea. 6” long x .230” OD fiberglass tube (black in color)
2 ea. 0.5” wide x 6” long x 0.125” thick aluminum plate

2 ea. Foam wing cores
2 ea. Foam stab cores

2 ea. Foam front fin cores
1 ea. Top vertical fin core
1 ea. Bottom vertical fin core
1 ea. Top rear deck core
1 ea. Bottom rear deck core

If you plan to buy your own sheeting for the foam parts, you will need to have a minimum of 40 sheets of 1/16" x 3" x 36" contest grade balsa.

In addition to the basic kit contents, the builder may want to have the following items on hand to keep the build moving along quickly:

Tall landing gear (Bolly electric for example)
Wing tube (7/8" dia. X 30" long)
Stab tube kit (if using a flat, removable/adjustable stab)
Motor mount (setup fo Hyde or Budd type mount)
Nose ring
MK tailwheel
DEPS (if preferred over servos in the stabs)

Sheeting all that foam

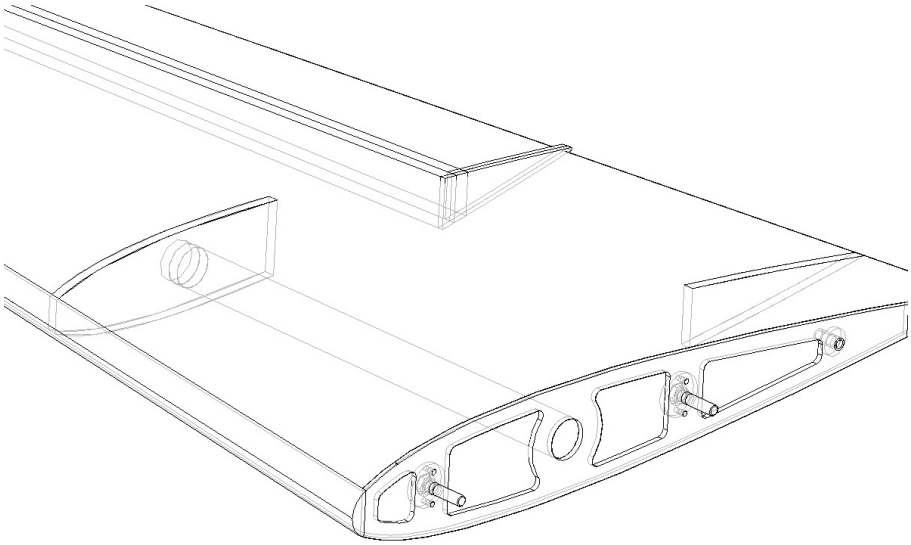
I prefer to start the build by sheeting all of the foam cores. My preferred method is to use a vacuum bag system and polyurethane glue. Epoxy (thinned) also works fine, as well as using a hard flat surface and lots of weight during the cure process.

I first edge trim all the balsa sheets. I will then pick out the best of the lot and set them aside for the wing panels.

If you are unsure of the method which you should use, I would highly recommend researching this aspect of the build before starting. There are some great sources available on the Internet (such as Terry Brox's website) and in video form.

Wing Panels

Find the 1/8” balsa sub-ribs. There will also be a set of trailing edge sub-ribs (see image).



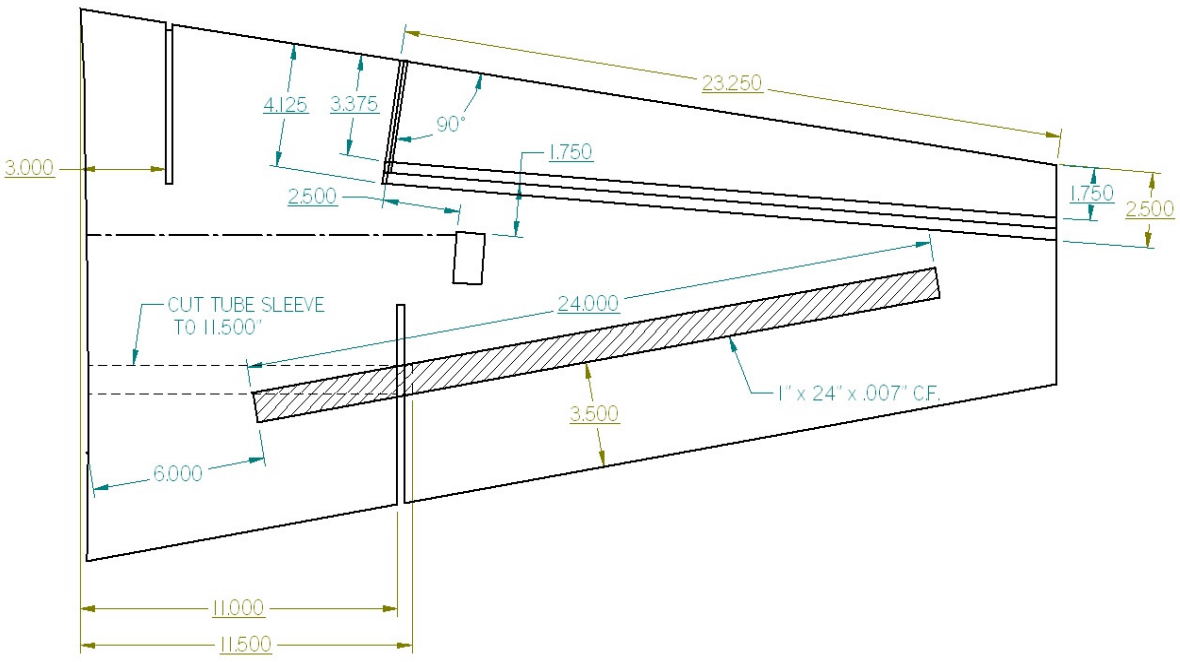
Cut two wing tube sleeves to a length of 11.50”. 1/8” will stick out from the foam core to catch the 1/8” lite ply root rib. Cap the outboard end of each sleeve with balsa. This will keep glue from getting inside the sleeve in addition to preventing the wing tube from working out further into the wing.

I dry fit the tube sleeve and leading edge sub rib in the wing. I also dry fit the trailing edge sub rib. Both sub ribs should be slightly larger than the core thickness to allow for sanding flush later. If all is o.k., I install them using polyurethane glue or epoxy (be careful with polyurethane expansion). After cured, I sand these flush to the foam cores using a long sanding bar. At this time I mark the leading edges and trailing edges of the foam cores with a felt tip marker to use a sanding indicator later after the skins are on.

Warning: The following is only a suggested method for sheeting the wing panels...other methods are well documented and please use whatever method suits your liking best.

To begin layout of the wing skins, I check to see that the sheeting I have picked out is all of very similar thickness so that the skin will be easy to get smooth later. I tape together (tightly) as many sheets as needed to make up each skin. I lay the shuck onto the taped sheets and trace the perimeter, then trim the wing skin. Once, I have all four skins, I layout the location for the carbon fiber strips (1" x 24" x .007") that are used to strengthen the wing panels. Please refer to enclosed drawing to mark and glue your carbon fiber strip material to the inside of each skin.

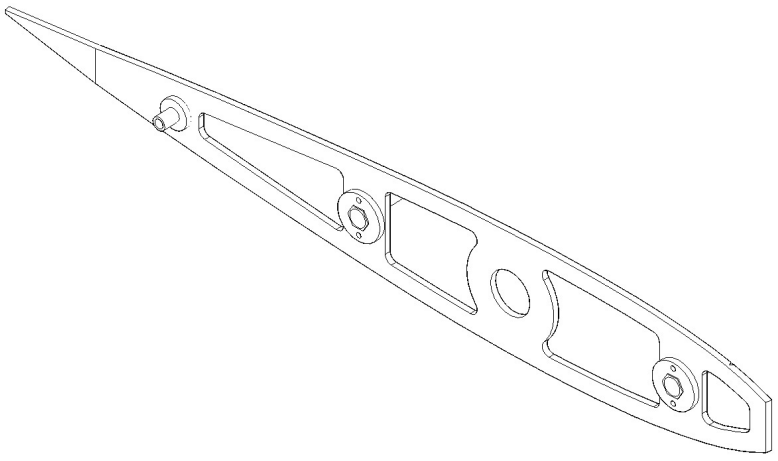
Double check the fit of the skin to the assembled core and shucks. Also double check the cores for any small deviations that should be sanded smooth (use a long sanding bar).



I apply polyurethane glue to the inside of one skin at a time and squeegee the excess adhesive away. I assemble the skins and shucks so the that skin leading edges and core leading edges are flush. When cured (vacuum or weight method), the edges may be sanded flush to the core. This is where I look for the marked surfaces of the foam as a sanding guide. I prefer a slightly thick trailing edge on the wings, so I sand the any overhanging sheeting back to the trailing edge of the foam core. On the prototype, the trailing edge of the foam between the skins was approximately 1/16" thick, making the trailing edge thickness 3/16".

I rough sand all of the remaining overhanging balsa sheeting. I do not final sand my wing skins until I am nearly ready for covering or glassing.

The root rib is laser cut from 1/8" lite ply. This requires a bit of sanding to get flush with the wing panel (please use masking tape to protect the balsa wing skins). You will notice that there are holes along the root rib. Two sets of holes are for the wing studs which will secure the wing to the fuse. The smaller aft hole is for the wing adjuster socket. Among some of the smaller laser cut pieces are several round lite ply pieces with a hex hole in the center. Using two of these per wing stud, assemble the wing bolt (aluminum 1/4-20 hex bolt) from the inside of the wing root and align the upper and lower pin holes in each hex donut. You will want to insert 1/8" diameter dowel into these holes to prevent the hex donut from unwanted rotation.



Inside view of wing root with hex donuts, hex bolts, wing adjuster socket, and wing adjuster donut in place.

Carefully layout the aileron hinge line location and cut away the aileron stock. There are 3/8" thick balsa aileron hinge caps located within the laser cut parts. There will also be laser cut parts for the aileron root, (wing and aileron surfaces), the wing tip, the wing leading edge, and the wing root (lite ply). When gluing the aileron leading edge on,

please take care to keep the aileron flat and straight while the glue cures (I use a light amount of polyurethane and tape the leading edges in place). The same applies for the hinge surface on the wing and the leading balsa parts. Be aware that the leading edge for each wing panel is made up of two pieces of 3/8" laser cut balsa.

I rough sand the leading edge and trailing edge (aileron hinge piece) balsa flush to the wing skin (use tape near these edges when sanding to prevent damage to the wing skin). I also rough sand the leading edge of the aileron (not bevel) flush with it's skin. I then tape the aileron to the wing panel using a 1/16" shim at the inboard end (root) of the aileron and no shim between the hinge caps. I sand the outboard tip of the aileron flush with the wing tip. Now is the time to cut the tip if you like (I cut wing tips and stab tips for that "raked" look). With the aileron still in place, I glue the laser cut wing tip on. After cure, I can cut through the wing tip and release the aileron. The aileron leading edge is then beveled and pre-hinged to keep everything in place.

Using the wing panel drawing, the aileron servo cutout can be placed. I prefer to line the inside walls of the cutout with 1/8" balsa. I used one of the laser cut servo plates (1/8" lite ply) to mount the servo on top of the skin. An alternate method would be to recess the servo mounting plate so that it will be flush with the wing skin.

Using a 1/2" diameter copper tube (sharpened at one end), I carefully cut an access hole from the root through to the servo pocket for the aileron servo wires.

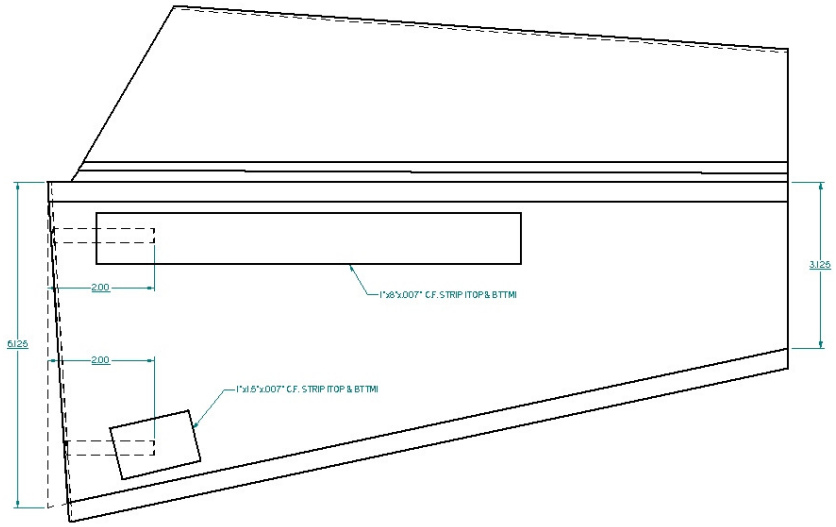
For hardpoints, 1/16" ply plates (laser cut to 1"x1") were used. The plates are embedded into the flying surface skin and sanded flush near the leading edge on the top and bottom surfaces. Many other methods are used and I assume that you may have your favorite.

Stabilizer Panels

Anhedral version:

You will notice the anhedral is already cut into the foam shuck. The root should also be cut with a slight angle to match up to the fuse side later. Lay out the 1/16" skins in a similar manner as described previously for the wing panels (wood grain must be parallel to elevator hinge line). As done on the wings, some carbon fiber strip material will need to be placed on the inside of the skins prior to gluing to the cores. Please refer to the anhedral stab layout drawing for the location and placement of your 0.007" carbon fiber. There should be aft and forward tube holes cut into each core. Included with the

anhedral kit will be stab spar tube and sleeve material. These will be inserted later.



With the stabs sheeted, carefully sand all edges flush with the foam cores. Now, it is time to cut away the elevators and cap the hinge line. The most accurate way to do this will be to dry fit the stab sleeves and tubes (cut to length using the drawing) so that both stabs are connected via the tubes and sleeves (no fuse in the middle yet). Set this assembly carefully back into the shucks on a flat work table. Now the top shucks can also be placed and taped so that the bottom and top shucks will stay flush with the leading edges and tips of each stab half. Now draw a straight line across the top of both shucks that will be the cut line for the elevators. Cut the rearward line first (leading edge line on the elevators), then move forward (3/4") to the cut the trailing edge line on the stabs. Do not cap the stabs at this time. Re-assemble (dry) the stabs, tubes, and shucks again and place the entire assembly on a flat work surface with the cut trailing edge against a straight edge (preferably something about 3" tall). This will be the jig setup to correctly glue the stab sleeves in place. Make sure the ends of the sleeves are capped with balsa and that the root end of the sleeves will stick out from the core about 1/8" in order to later capture the stab root rib. If the dry fit is all in order, the sleeves can be glued into the cores. My method is to disassemble the setup, add a few drops of polyurethane glue to each sleeve hole (in the cores), then use a mixing stick to spread the glue around on the inside surface of each hole. Then carefully insert each sleeve and wipe any excess glue away with a paper towel. Finally, I re-assemble the sheeted stabs into their shucks, then connect to the other stab with the stab tubes, then place with the trailing edge up against said 3" tall straight edge. With the top shucks taped on as well, I place a small flat board (MDF) on top to keep the assembly from moving around at all.

Stab skins with carbon fiber CA'd in place.

After curing, the root ribs may be glued in place and sanded flush to the stab skin (masking tape on the skins!). The trailing edge and leading caps can be glued onto the stabs. Also cap the leading edges of the elevators with the supplied 3/8" balsa pieces. Be careful not to induce any warp in the elevators when capping the elevators. I gently tape (masking tape) the leading edge stock onto the elevators and then place them back into their shucks with the leading cap stock hanging outside of the shucks to dry.

All of the caps can be sanded to shape after cure. Again, use masking tape to protect the skins while sanding the caps. You can now trim the tip if desired, and cap the tip of the elevators and stabs with the supplied 1/8" balsa tip. The inboard tip of the elevators may also be trimmed for clearance of the rudder, then capped with 1/8" balsa.

Hardpoints may be added later as needed, depending on control horn placement.

Non-anhedral version:

For this version, you will want to use a gator or similar type of stab tube and front adjusters. There will be a rearward hole drilled in the stab cores to locate the tube sleeve.

The root should also be cut with a slight angle to match up to the fuse side later. Lay out the 1/16" skins in a similar manner as described previously for the wing panels

(wood grain must be parallel to elevator hinge line). As done on the wings, some carbon fiber strip material will need to be placed on the inside of the skins prior to gluing to the cores. Please refer to the flat stab layout drawing for the location and placement of your 0.007" carbon fiber.

With the stabs sheeted, carefully sand all edges flush with the foam cores. Now, it is time to cut away the elevators and cap the hinge line. The most accurate way to do this will be to dry fit the stab sleeves and tube (cut to length using the drawing) so that both stabs are connected via the tube and sleeves (no fuse in the middle yet). Set this assembly carefully back into the shucks on a flat work table. Now the top shucks can also be placed and taped so that the bottom and top shucks will stay flush with the leading edges and tips of each stab half. Now draw a straight line across the top of both shucks that will be the cut line for the elevators. Cut the rearward line first (leading edge line on the elevators), then move forward (3/4") to the cut the trailing edge line on the stabs. Do not cap the stabs at this time. Re-assemble the stabs, tubes, and shucks again and place the entire assembly on a flat work surface with the cut trailing edge against a straight edge (preferably something about 3" tall). This will be the jig setup to correctly glue the stab sleeves in place. Make sure the ends of the sleeves are capped with balsa and that the root end of the sleeves will stick out from the core about 1/8" in order to later capture the stab root rib. If the dry fit is all in order, the sleeves can be glued into the cores. My method is to disassemble the setup, add a few drops of polyurethane glue to each sleeve hole (in the cores), then use a mixing stick to spread the glue around on the inside surface of each hole. Then carefully insert each sleeve and wipe any excess glue away with a paper towel. Finally, I re-assemble the sheeted stabs into their shucks, then connect to the other stab with the stab tube, then place with the trailing edge up against said 3" tall straight edge. With the top shucks taped on as well, I place a small flat board (MDF) on top to keep the assembly from moving around at all.

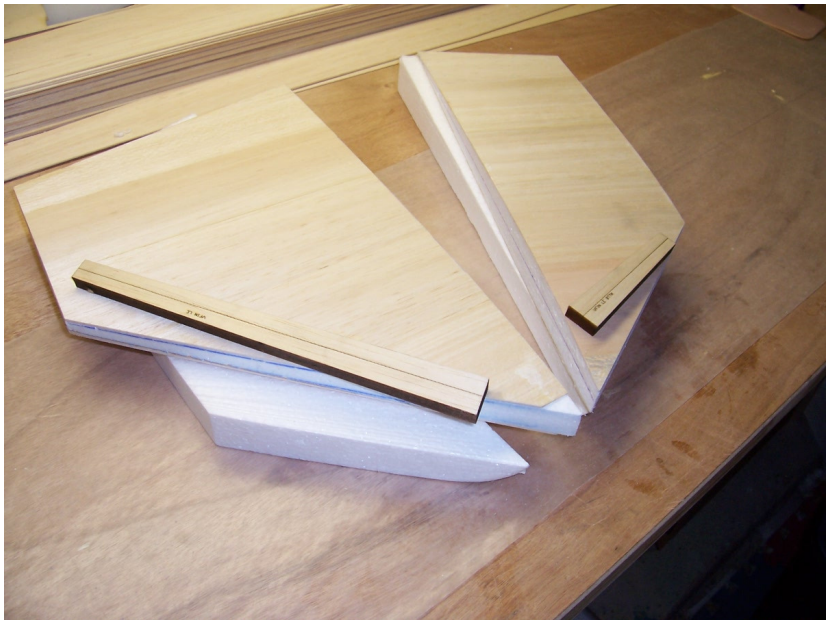
After curing, the root ribs may be glued in place and sanded flush to the stab skin (masking tape on the skins!). Do not forget to mount the front adjusters to the backside of the root rib before gluing the sheeted stab. There will be a laser cut hole near the front of the root rib that will locate the adjuster. The fuse will have a matching hole for the 1/8" aluminum rod that is normally used with these adjusters. The trailing edge and leading caps can be glued onto the stabs. Also cap the leading edges of the elevators with the supplied 3/8" balsa pieces. Be careful not to induce any warp in the elevators when capping the elevators. I gently tape (masking tape) the leading edge stock onto the elevators and then place them back into their shucks with the leading cap stock hanging outside of the shucks to dry.

All of the caps can be sanded to shape after cure. Again, use masking tape to protect the skins while sanding the caps. You can now trim the tip if desired, and cap the tip of the elevators and stabs with the supplied 1/8" balsa tip. The inboard tip of the elevators may also be trimmed for clearance of the rudder, then capped with 1/8" balsa.

Hardpoints may be added later as needed, depending on control horn placement. Included with the kit are several 1"x1"x1/16" ply plates for this purpose.

Vertical Fin/Rudder

Begin work on the vertical fin/rudder by inspecting the cores (there will be an top fin and bottom fin core). Gently sand if necessary. Use the same process described previously to sheet the cores. I prefer to sheet the top and bottom pieces separately, then sand all overhanging balsa flush to the cores and then join to the top and bottom pieces together. I place each sheeted fin back into on side of the shuck and lay them together on a flat table. They should match up with respect to height from the table surface. If slightly off, one shuck may be shimmed to get the height just right. I use a light amount of polyurethane glue with wax paper around the joint. I place a small piece of MDF on top of the assembly to cure.



Vertical fin pieces ready to join.

After curing, the cuts for the hinge line can be laid out and cut (see pdf detail Pentathlon drawings for hinge line and fuse cut layout). There will also be a cut to remove the area

where the fusebox will be. Now there will be a small vertical fin, a smaller dorsal fin, and the rudder. The rudder leading edge can be capped using the 3/8" balsa piece (labeled "RUDD LE"). The trailing edge of the upper vertical fin can also be capped using the vertical fin post (labeled "VFIN TE"). Notice that the top end of this piece is labeled and should be positioned flush with the top end of the sheeted vertical fin. Glue this piece carefully to keep parallel with the vertical fin. The leading edges of the vertical fin and dorsal fin can be glued on and sanded to shape. The top of the vertical fin and rudder may be capped with the supplied 1/8" balsa pieces. Hardpoints may be added to the rudder now or later in the build as desired.

The small bottom dorsal fin will be left unattached to the rudder post (vertical fin TE) until after the vertical fin and post are glued onto the fuselage assembly.

Flow Straightening Devices (those other fin thingy's)

These cores are rather small and can be sheeted in the same manner as described for the wings. These will not require any carbon fiber material embedded within the skin. After sheeting and sanding the balsa flush with the cores, you can add the leading edge stock to both and sand to shape. On the top F.S.D. that will sit atop the canopy, you will find 1/8" lite ply templates for cutting the root and tip to shape. The tip (top) end will be capped with 1/8" balsa and sanded flush. I left the bottom without any wood cap and later sanded it by hand to fit to the top of the canopy.

The bottom FSD is to be used in its full size. The tip can be capped and sanded flush. The root rib will have two hole locations laser cut that are set to the correct spacing for mounting to the aluminum brackets that will be under the belly of the fuselage. Before gluing the root rib to the sheeted core, I routed out the foam at both hole locations on the root cap. I then installed hard balsa blocks (sanded to a taper to fit in the sheeted foam core) using polyurethane glue. Afterwards, I glued the root cap on and sanded flush to the sheeted fin. To attach this fin to the aluminum brackets, I carefully drilled through the laser cut holes into the balsa blocks using a #29 drill (0.136"). I tapped these holes using an 8-32 tap. I CA'd the tapped holes and ran the tap in again. Later, I used 8-32 nylon bolts to attach the fin to the aluminum brackets. More on that later.

Bottom FSD mounted and in place.

Top Rear Fuselage Deck

The top rear deck foam core should be inspected and lightly sanded if necessary using a long sanding bar. Lay wax paper into the bottom of the shuck. The sheeting can be cut to fit each side of the deck and tape along the top edge as a tape hinge. This may require a couple of triangular shaped pieces and perhaps a splice to get the required overall length (41.5”). With the deck core laid on its top (small flat along top), the sheeting will lay open on the table (hinged at top edge).

Apply polyurethane glue or epoxy and gently tape each skin down to the side of the core. Wedge the core and sheeting back into the wedge shaped shuck to cure. Weight may be added to the top of the assembly, but I have not found it to be necessary to get good adhesion of the balsa to the foam. Afterwards, sand the sheeting flush to all edges of the foam core.

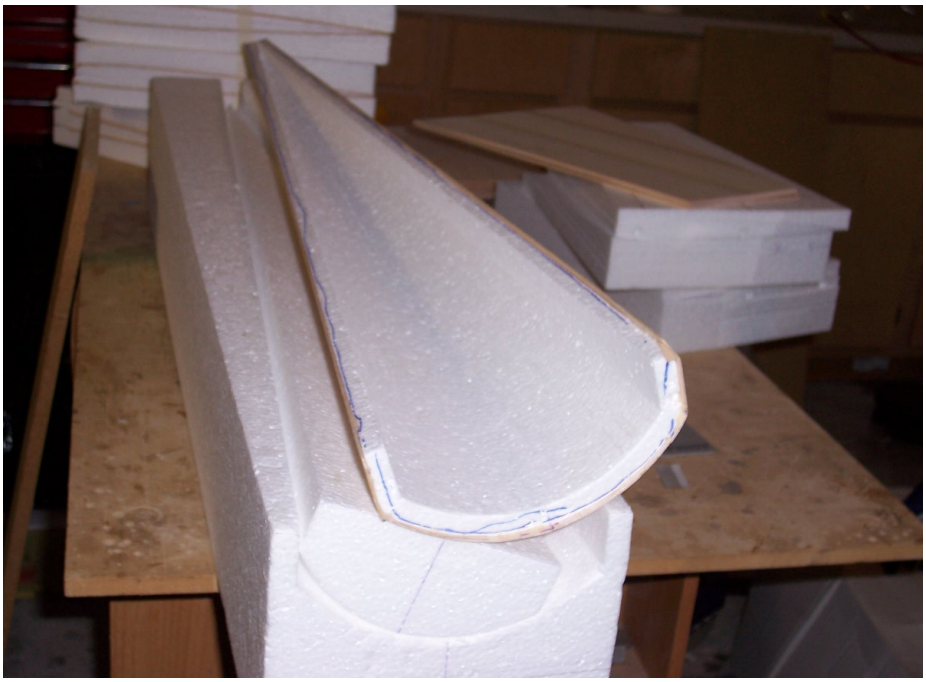
The aft end of the deck will require a cutout for the vertical fin to pass through later when assembling to the fuse. Using the laser cut templates, assemble the vertical fin cutout jig and slide it over the aft end of the deck. Using a dremel tool, the airfoil shaped cutouts can be cleared out. Be aware, the sides of the sheeted deck will end up quite thin after making the cutout.

Note: perform this operation before gluing the deck to the fusebox!

The top rear balsa (3/8”) balsa spine may be glued on and rough sanded to shape. It will likely be better to final sand the spine after the deck is attached to the fuselage.

Bottom Rear Fuselage Deck

The bottom rear deck core can be sheeted in two stages. I taped sheets together and trimmed them to wrap around only the bottom, round portion of the deck. After applying glue, I taped this skin in place with tape along the edges where the round portion meets the flat sides of the deck core. When cured, I sanded the overhanging balsa flush with the flat sides of the foam core. In a second process, I sheeted the flat sides of the deck using masking tape to hold the skins in place. During curing, I simply wedged the core and skin back into the shuck. With the side walls sheeted, I sanded all edges flush with the core and set it aside for installation to the fuselage later.

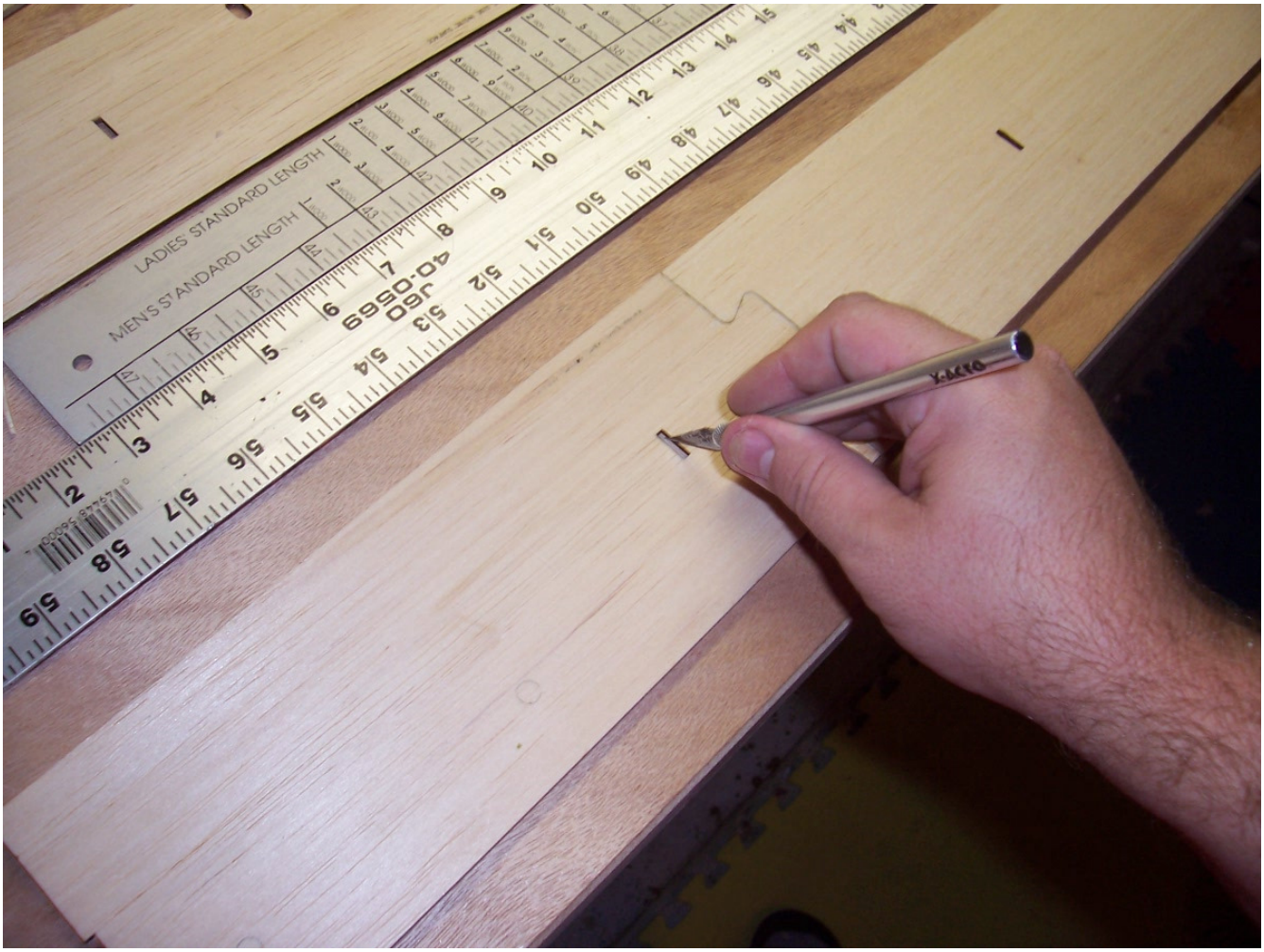


Sheeted Bottom Rear Fuse Deck

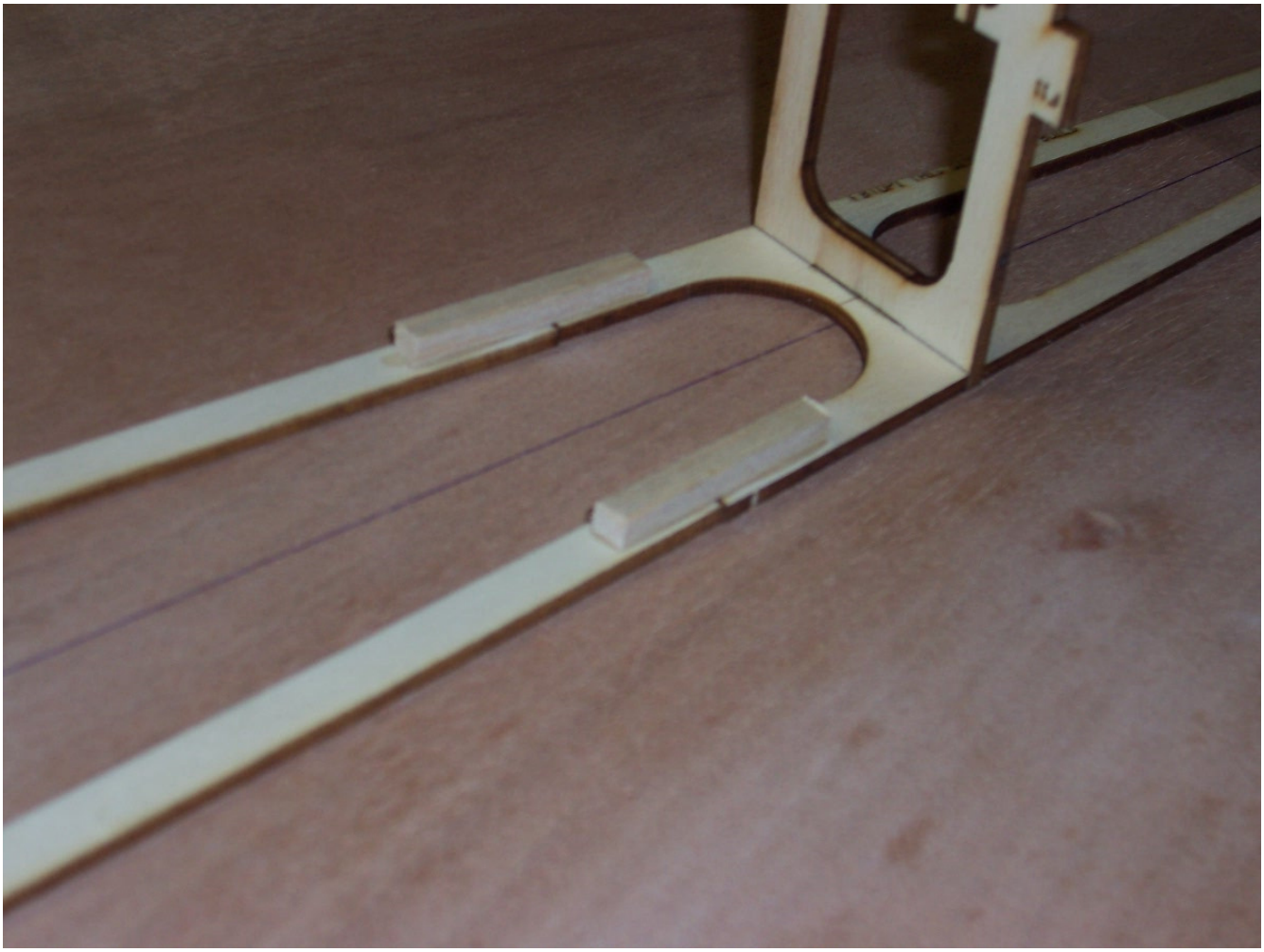
Fusebox Frame

Before starting to actually frame up the fuselage, the fuse sides will need to be assembled. Each fuse side is made up of 3 pieces of 1/8" balsa. Dry fit these with one edge placed against a long straight edge before gluing together at each of the jigsaw shaped connections. Each fuse side will have a laser cut 1/16" ply fuse doubler that will need to be placed on top of the fuse side. DO NOT GLUE to the fuse side. Place this doubler carefully (flush to the nose and top and bottom edges) and use a pen to mark the end of the doubler. This line will be the start of the balsa fuse side doublers that will run the rest of the length of the fuse side all the way to the tailpost. Set the 1/16" ply doublers aside and begin sheeting cross grain (vertical) to the fuse side grain. This will take approximately 3 sheets of 3" wide, 1/16" contest grade balsa, cut into 4" lengths to complete both fuse sides.

Flip the fuse side over and trim all the overhanging 1/16” balsa flush to the top and bottom edges of the fuse sides. Also, open each rectangular slot (for each former later) through the 1/16” sheeting. Set the fuse sides and 1/16”ply forward fuse doublers (not glued on) aside.

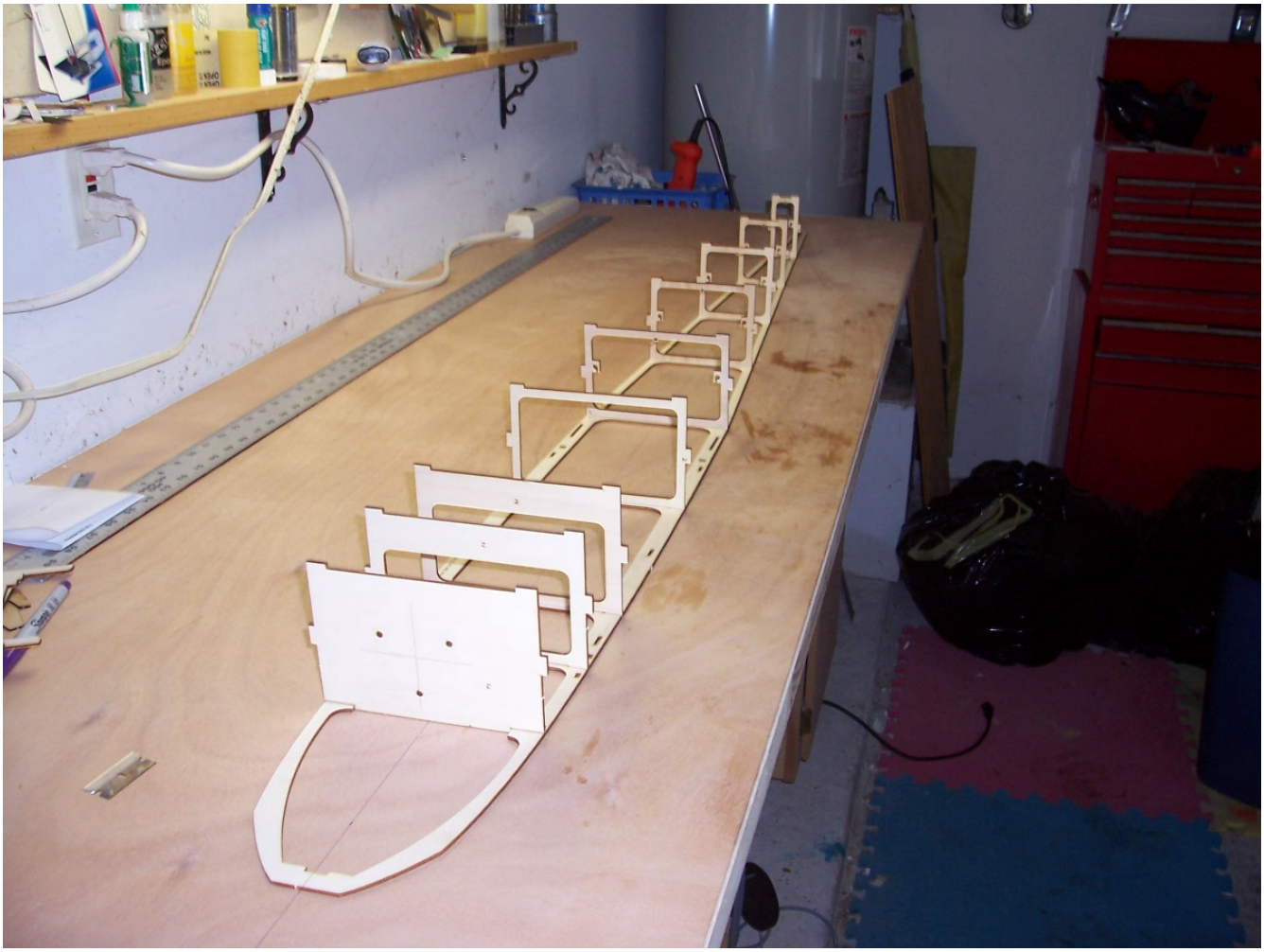


In order to build the fusebox, you will need a flat, clean work table with a straight line drawn down the middle. The fusebox is framed upside down such that the landing gear plate will be facing up. Start by finding the fusebox top deck pieces (3) and tab them together using the centerlines on the wood pieces lined up with your drawn line on the work surface. At each of the fusebox top joints (weak) I used a scrap piece of 1/4" square balsa (1" long) to strengthen each joint.

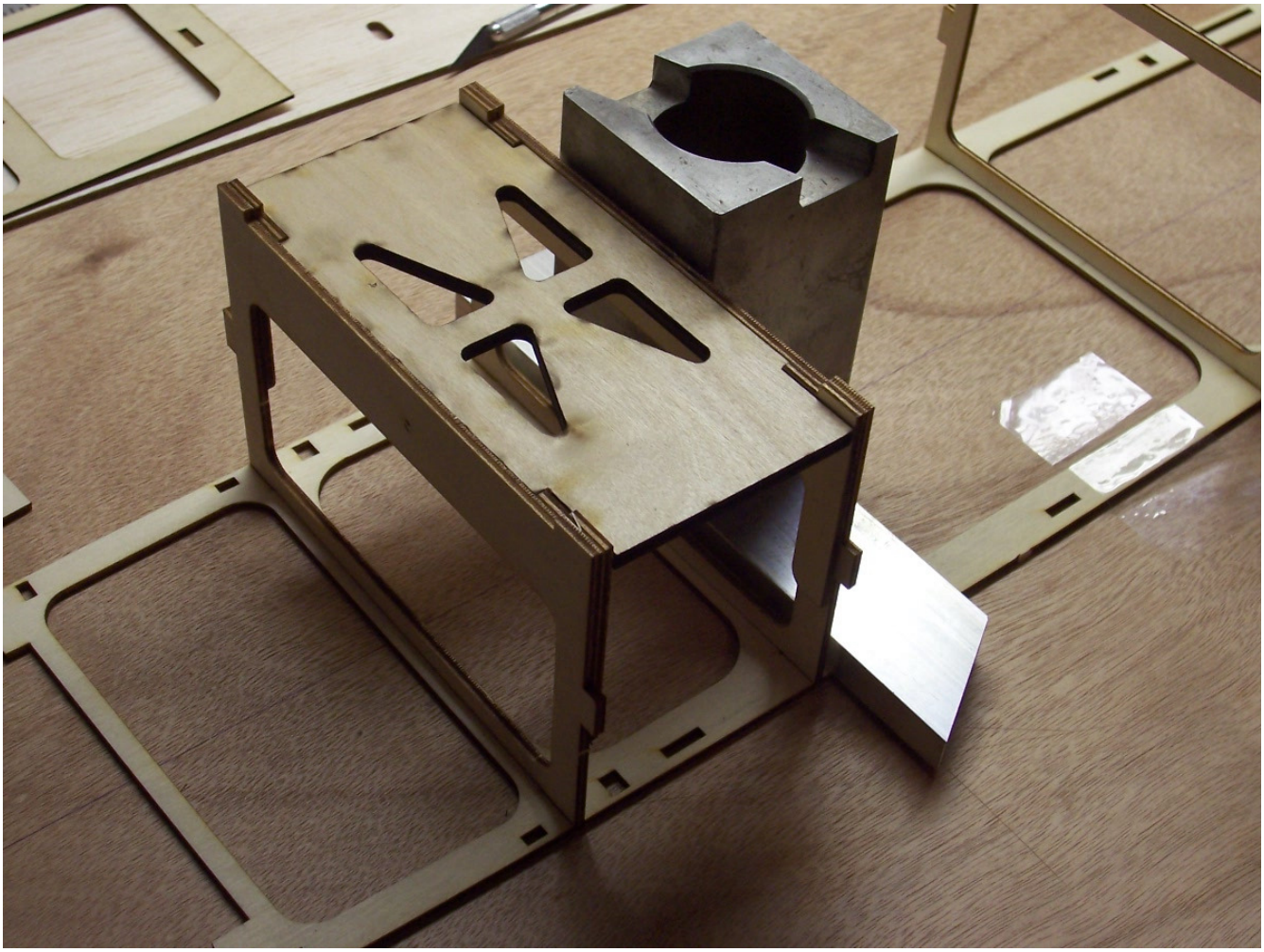


With the fusebox top pieces assembled and centered over the build line, I taped it securely to the work table (I placed a small strip of waxpaper under the fusebox top piece at each former location). Find the landing gear formers and doublers (F4, F4B, F5, F5B). Please review the illustration carefully before gluing the doublers ("B") to each of the formers. When glued together, the bottom edge of the former and doubler should each create a 1/4" deep pocket for the gear plate to sit in later.

Find all the remaining formers, starting with F2 and begin placing them into their respective slot locations. If the fit is too tight, carefully trim the tabs on the former to get the fit right.



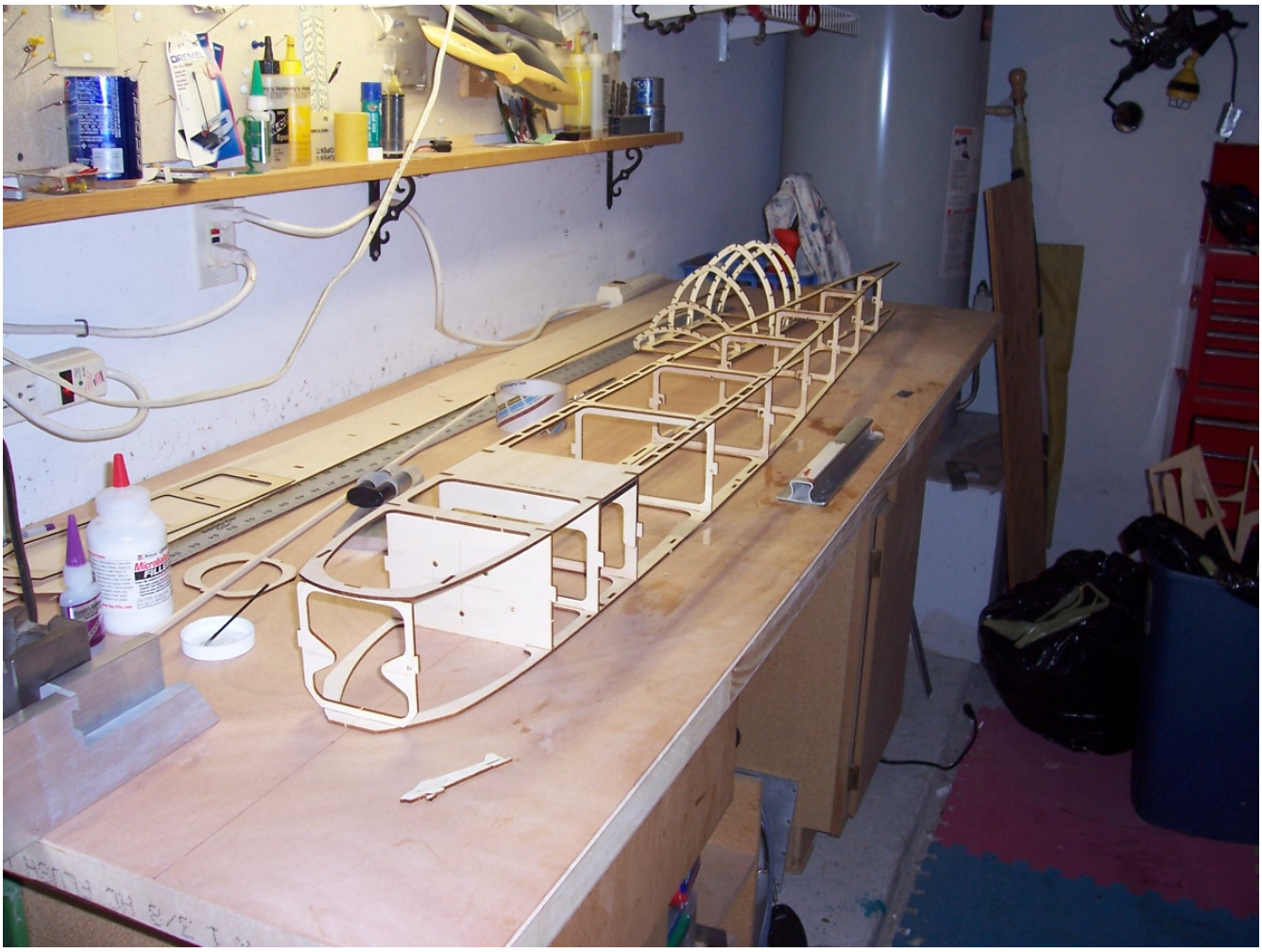
With all the formers dry fitted in place, use a small square and glue each former to the fusebox top (I recommend removing the former, applying glue to the tabs and entire top edge of the former, then inserting back into the fusebox top).



The 1/4” thick ply landing gear plate can be dry fitted to the F4-F5 formers. Before gluing in place however, you may want to clamp the landing gear legs to the plate and pre-drill holes through the landing gear from the backside of the landing gear plate. The landing gear plate will have centerlines laser marked for reference while performing this operation. I used 8-32 blind nuts in the landing gear plate, then used epoxy and microballons to glue the gear plate in place between F4 and F5. The bottom surface (face up) should be set a flush as possible with the bottom edge of F4 and F5 formers as this will be capped with the 1/8” lite ply bottom fusebox piece. There is a matching laser cut hole pattern in the bottom fuse deck piece for the landing gear holes (not shown in the picture of the prototype kit).

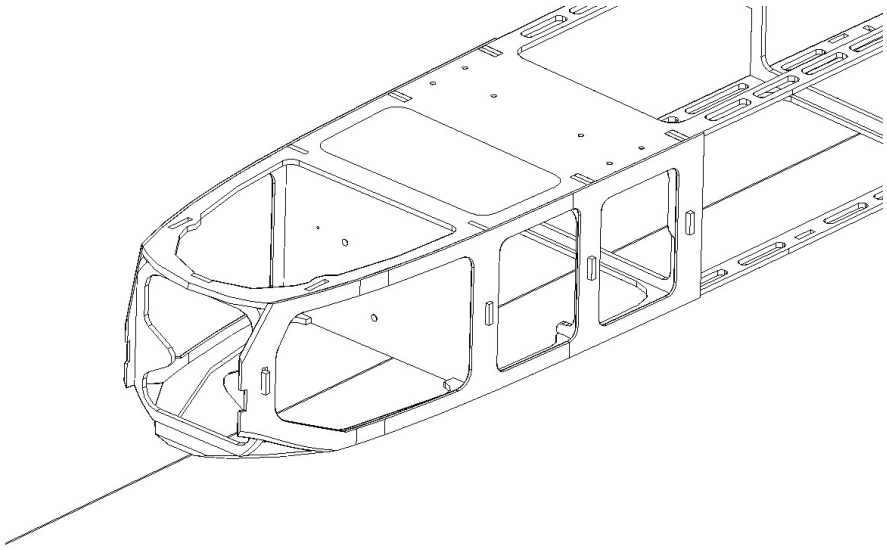
The bottom fusebox pieces may now be fitted to the frame. Dry fit the forward fusebox bottom piece. If all is o.k., use epoxy to glue this section of the bottom fusebox to the base of the formers. I then fitted the middle fusebox bottom piece and finally the aft

fusebox piece. You should now have a completed framework.

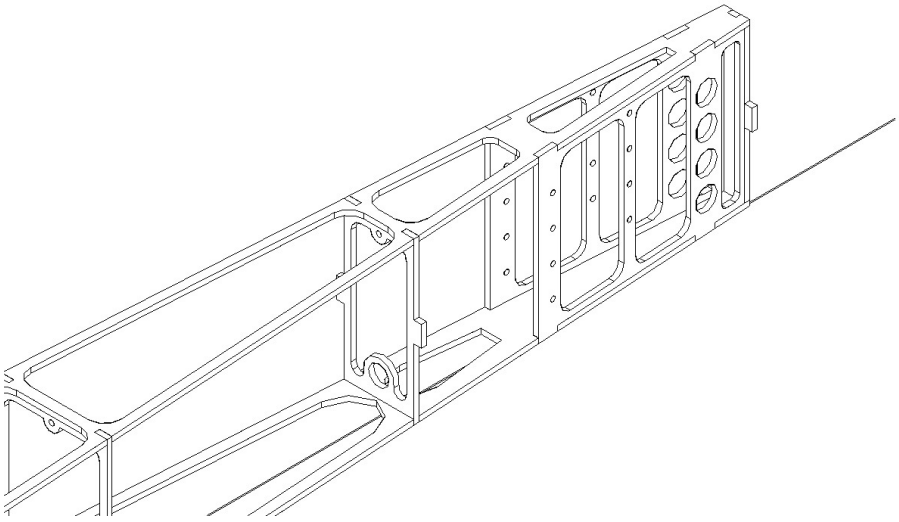


At this time, I added hard balsa triangle stock behind the firewall at the top and bottom joints.

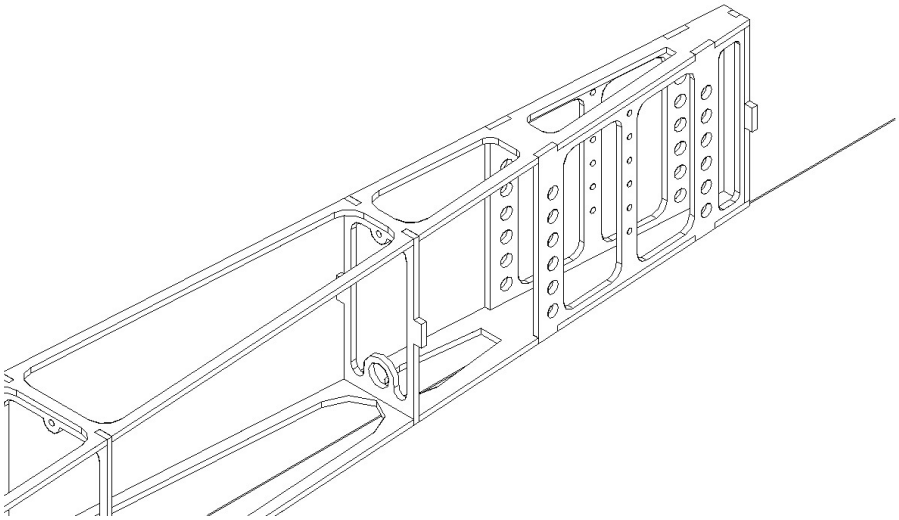
The 1/16” ply forward fuse doublers can be dry fitted to the fuse frame. Open the slots on the doubler as necessary to get a good fit on the former sides. Apply a thin coat of epoxy the forward former sides and fit the 1/16” ply fuse doublers. Use masking tape to keep the doubler tight to the curvature at the nose and tight against F2.



At the aft end of the fuse frame, the stab doublers must be fitted. Be sure to use the stab doublers that coincide with your stab version. The Non-anhedral stab doubler will have a set of larger holes near the rear for a gator stab tube type setup with a set of small diameter holes near the front for the 1/8" rod that typically keys into the front adjusters. The Anhedral doublers will have a set of holes at the front and rear that are the same diameter which will be used with carbon fiber tubing included with the anhedral kit. Carefully trim the tabs slightly if needed to allow for an accurate fit of the lite ply doubler to the sit in the aft fuse framework. Glue in place with epoxy. See illustrations below.

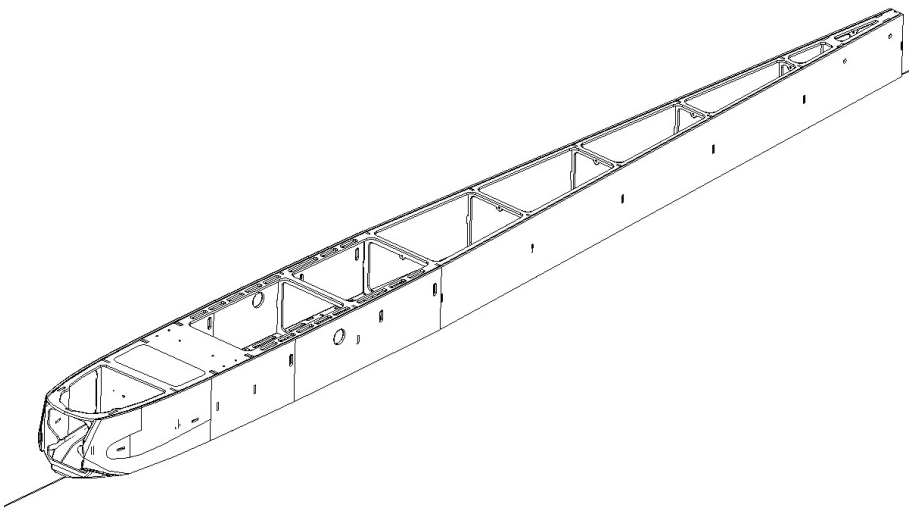


Standard flat Stab Doublers installed



Anhedral Stab Doublers installed

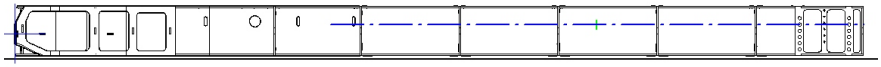
With these in place, the balsa fuse sides can be test fitted. Open slots in the fuse sides as necessary to allow the fuse sides to sit naturally on the former side tabs. I used 15 minute epoxy (thinly applied) to glue each fuse side onto the frame.



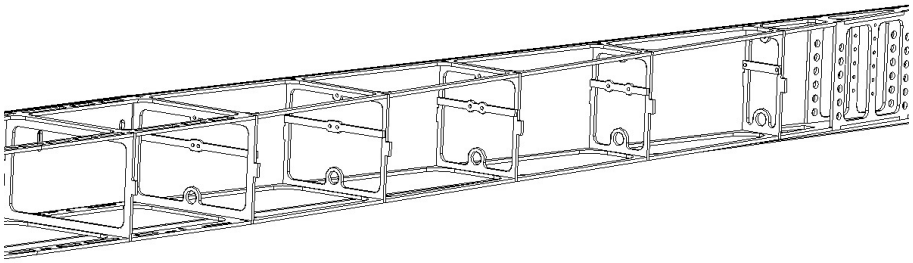
Fuse Sides installed

If you plan to use a Dual Elevator Pushrod System, now is a good time to install it. Included with the laser parts are 5 lite ply crossbars that have laser cut holes spaced out to support a DEPS with the correct angle toward the elevator control horns to prevent binding. By locating the height of the elevator servo arm from the bottom (face up) of the fusebox, the start height of the DEPS can be marked. With a little effort, the height position of the elevator control horn can be estimated. Mark this height at the tailpost

end of the fusebox and string a line between them. The height of the string at each former will be transferred and marked on the face of the former inside the fuse.



Each DEPS crossbar can then be glued to the face of each former at that height position.

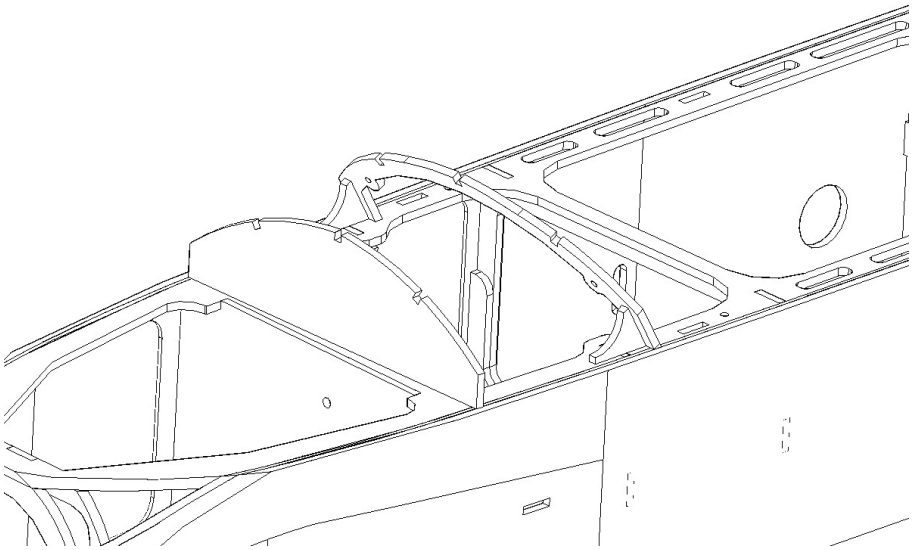


If the builder prefers to use servos mounted in the stabs, a paper tube should now be inserted through the holes in the tops of the formers to carry the servo extension wires.

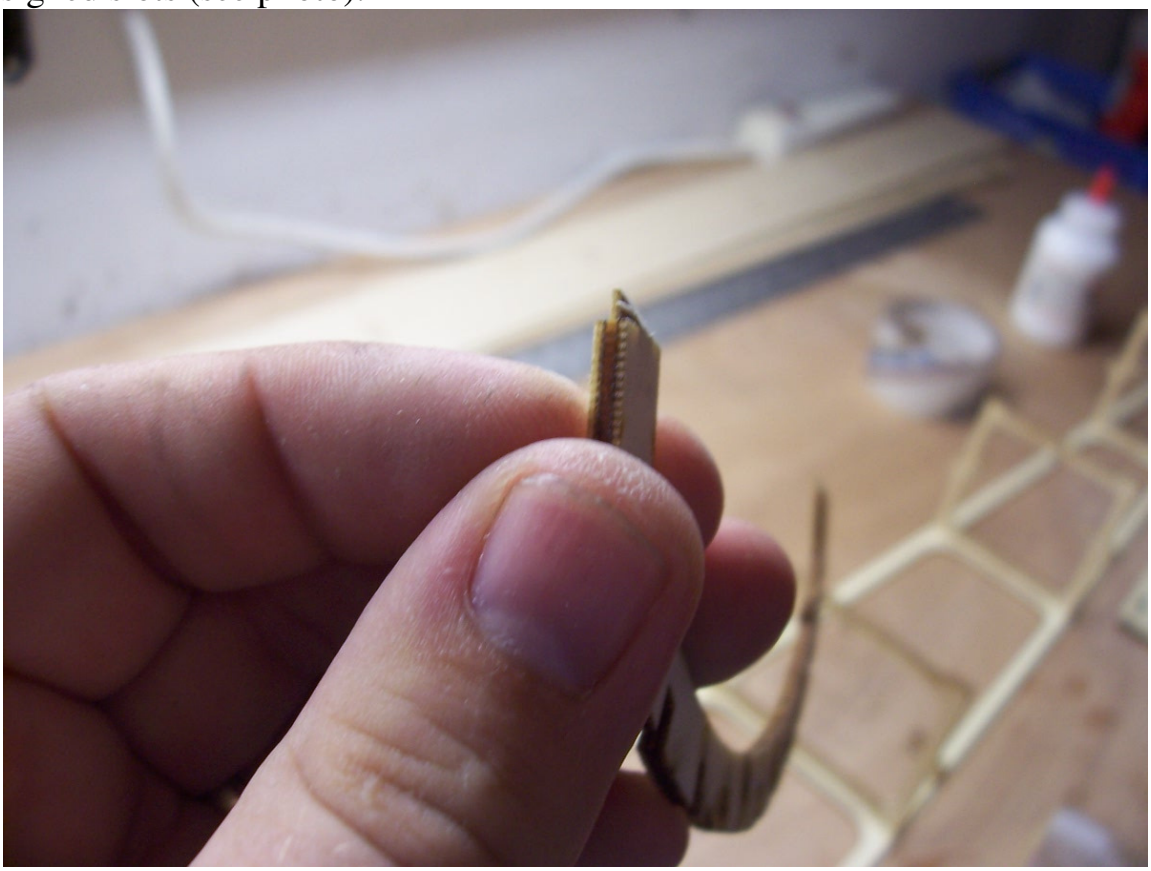
The antennae wire tube can also be inserted through the small holes in the bottoms of each former.

Forward Top Fuse Deck

The fusebox can now be released from the table and flipped over. Now that the top of the fusebox is facing up, work can begin on the front and aft fuse decks. Locate the forward deck formers (FD-F2, FD-F1) and the gussets for FD-F2 (FDF2). The former tabs should fit into the slots atop the fusebox. FD-F1 is laser cut from 1/8" balsa, while, FD-F2 is cut from 1/8" lite ply.



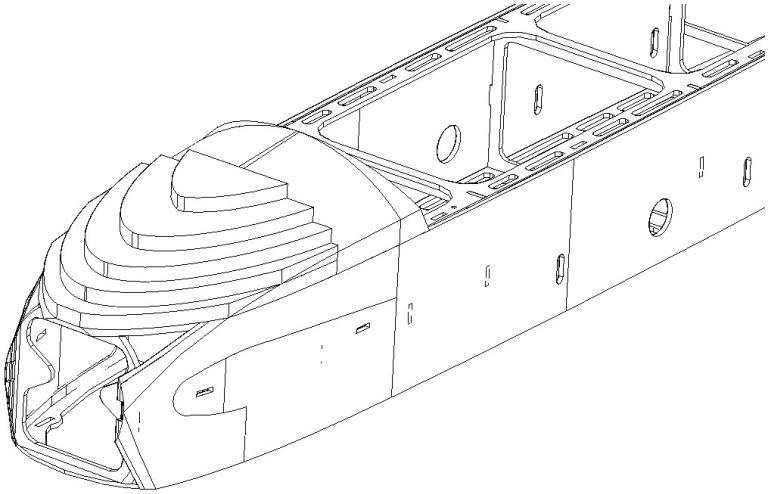
Please note: when fitting a former that is designed to lay at an angle to the mating piece, it may be necessary to sand the tabs slightly to allow the former to sit correctly in the designed slots (see photo).



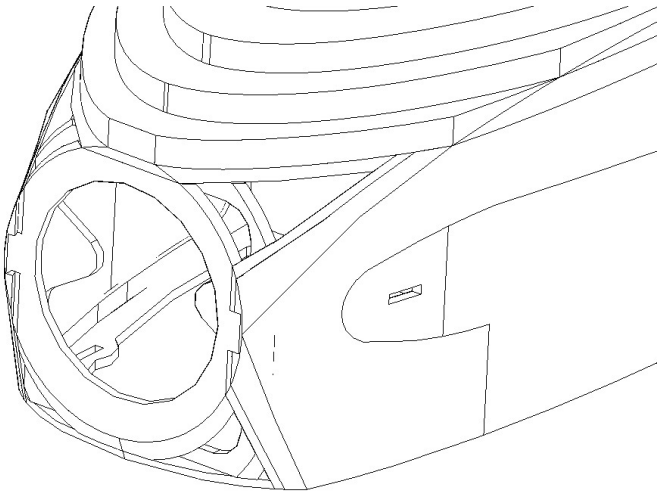
1/8” square balsa stringers can be placed between these two formers. Then sheet over the entire surface with 3/32” contest grade balsa. It is easiest to plank the flat sides,

then sand flush with the tops of the formers, then sheet over the top the curved section of the formers. Afterwards, sand and overhanging sheeting flush with the end face of each former.

The large front deck sections (3/8” thick balsa pieces) may now be assembled and glued on in front of FD-F1.



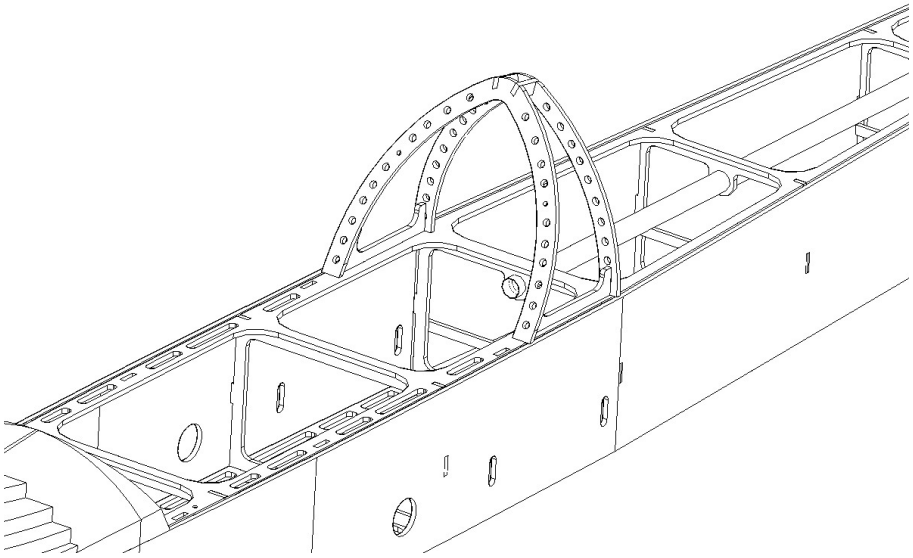
These front deck slices can be sanded to shape later when the fuse is more complete. The F1 fuselage former can now be carefully glued into place using tape to pull the front edge of the fuse sides inward to clamp the sides of F1.



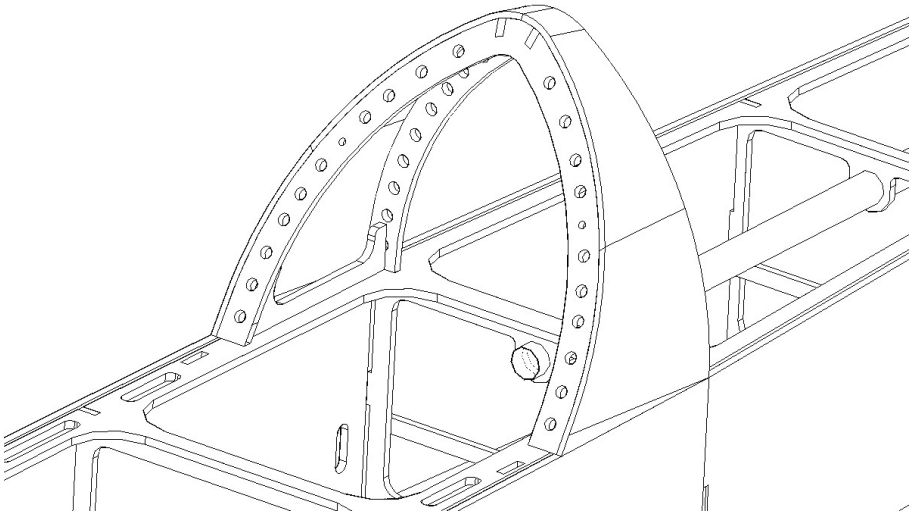
The open areas between the nose formers and fuse sides will be filled in later with 3/8” thick scrap balsa.

Aft Top Fuse Deck

Moving on to the rear deck formers that start at the back end of the canopy area. Find and install TRD-F1, TRD-F2, and gusset pair "TRD FORMER SUPPORT". At the top of these formers, two lite ply pieces will be installed that will act like stringers to keep the correct spacing of the tops of these two formers (2ea. "TRDSTRGR").



With this assembly in place, they can be sheeted with 3/32" scrap contest grade balsa. Please be careful not to apply too much pressure to the formers when sheeting, which would displace or warp the structure. Use narrow planks if necessary to sheet all the way up each side and over the sharp radius of the top. Sand any overhanging sheeting flush with the front and back faces of each of these formers.

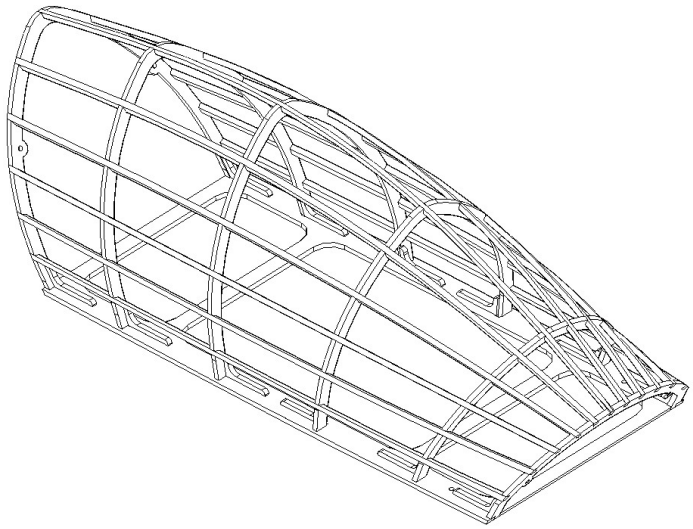


Top Rear Deck Formers with Sheeting in place

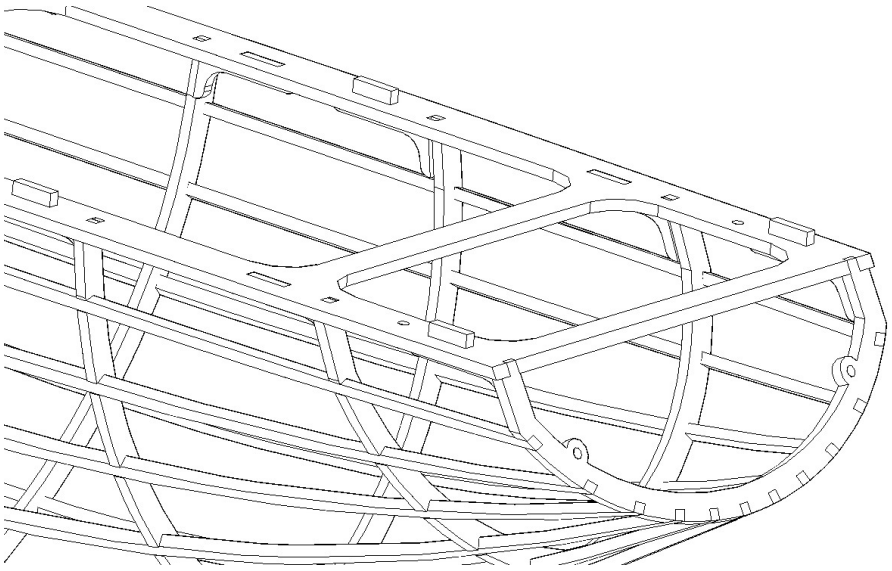
The top rear sheeted foam deck will be added later.

Canopy

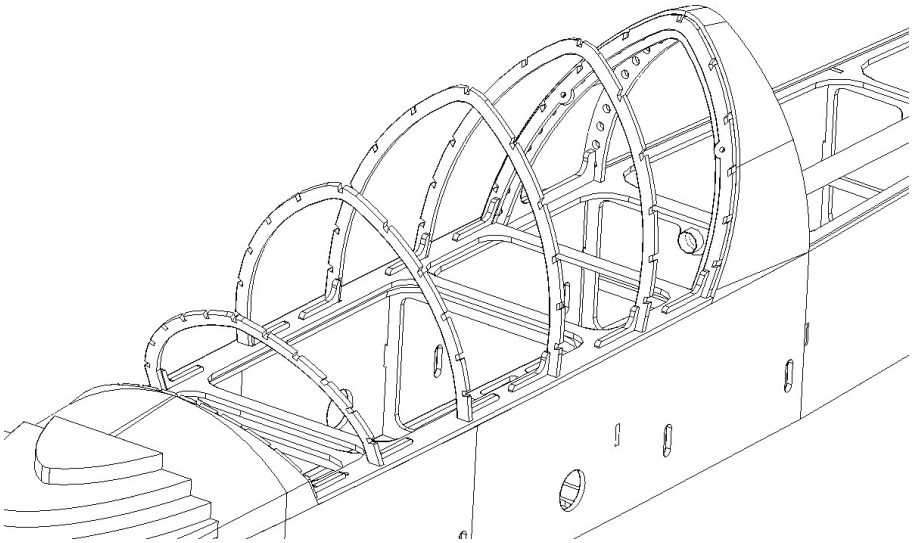
All of the canopy formers, gussets and base will have a prefix of "CA". See the illustration below for reference.



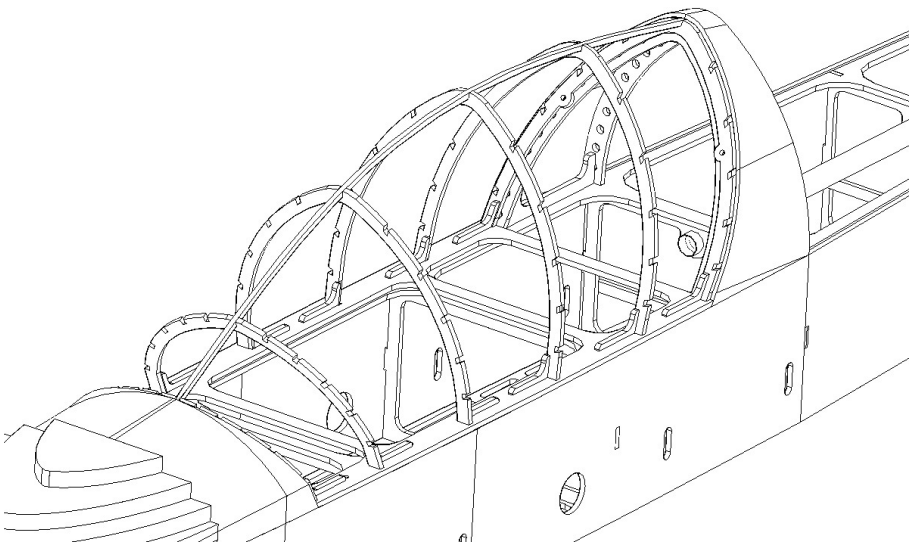
In order to most accurately assemble the canopy frame and namely, the "fit" of the canopy to the fuselage, the assembly process will be performed on top of the fusebox. With the fusebox sitting flat on the work table, the area where the canopy will mount can be covered with wax paper or saran wrap. Test fit the large canopy base piece and if necessary, sand (bevel) the front and trailing edges of this piece to fit properly between FD-F2 and TRD-F1. Starting with CA-F1, sand the tabs slightly if necessary to insert it into leading edge of the canopy base, using the CA-F1 gussets to help position and hold CA-F1 in place. Notice that the CA-F1 gussets are designed to extend downward through the canopy base and into slots on the top of the fusebox. Sand these tabs slightly if necessary to prevent too tight of a fit. These tabs are designed to simply give the canopy a better fit to the fuselage.

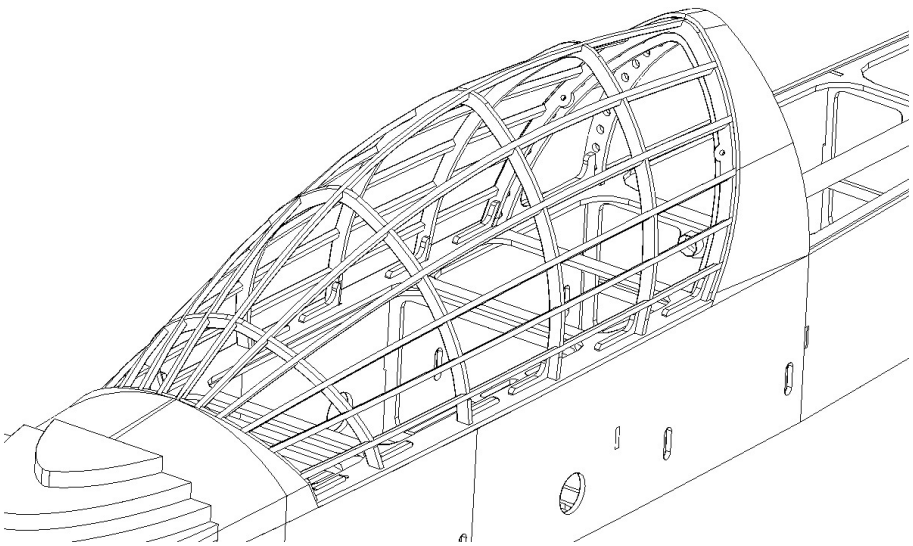


Assemble the gussets and formers along the canopy base with it placed on the fusebox.



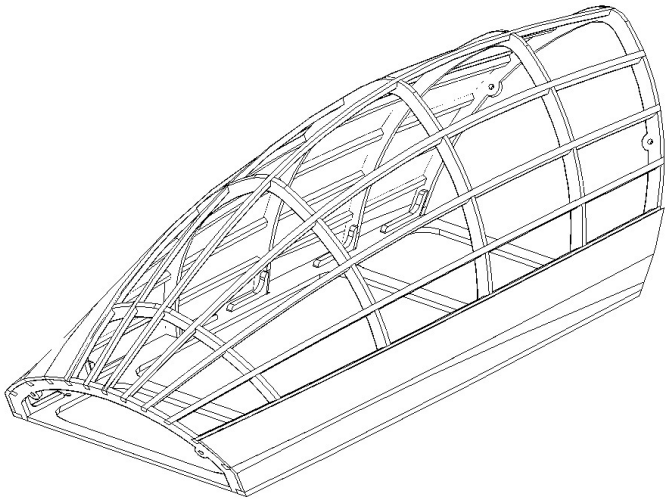
CA-F1 and CA-F6 need to be placed and secured to match the mating fuse deck formers as closely as possible. While still on the fusebox, carefully place the top stringer (1/8" sq. balsa) starting by inserting into the slot in CA-F4 and working toward each end of the canopy. Carefully trim the ends of the stringer and glue into CA-F1 and CA-F6.





Perform this same process to get the rest of the stringers glued in place.

The canopy frame may be removed at this time for sheeting. 3/32" contest grade balsa sheeting planks have been laser cut. Please note that these planks are only approximations of the required final plank shapes needed to sheet the canopy frame. Start at the base and apply one plank on each side of the framework. Each plank should finish at the next stringer position. Take your time and make slight adjustments to get each plank to final size. It is also important to keep aware of using too much force to hold the planks in place, which can pull the front and rear formers out of alignment, creating slight gaps when placing the sheeted canopy back onto the fuse.



Sheeted (“rough”) canopy.

Filler and final sanding will be required to get the canopy to its final shape.

Vertical Fin Install

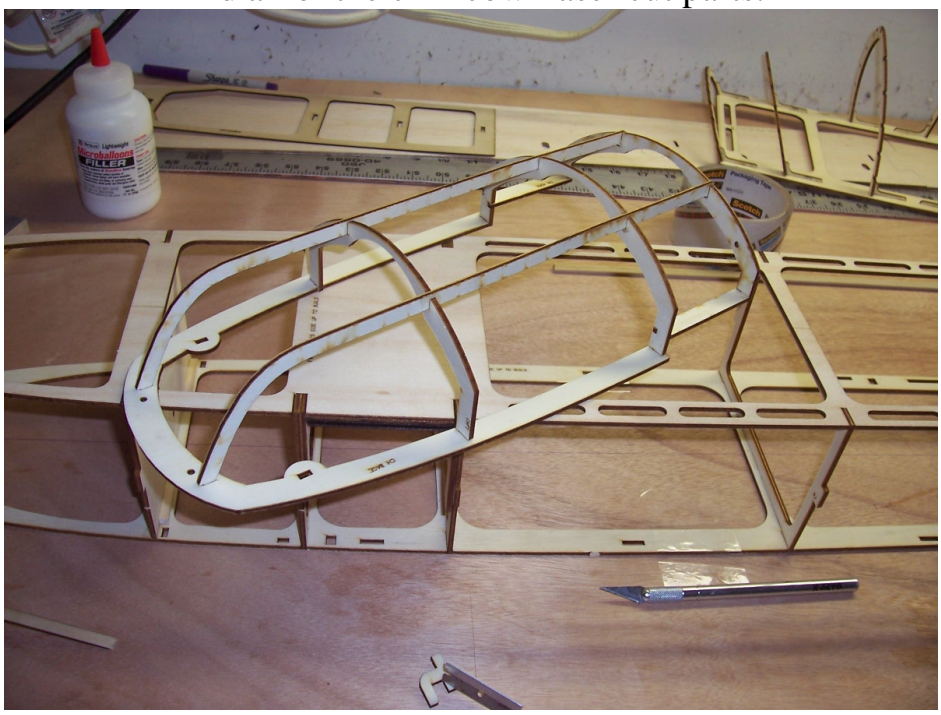
With the fusebox sitting flat on the work table, the vertical fin may now be installed. Because the tailpost length will hang below the fusebox, the tail end of the fusebox may be set at the end of your work table. Secure the fusebox to the table, and pre-fit the vertical fin and tailpost by resting the base of the sheeting vertical fin on top of the fusebox frame. Glue the tailpost in place, making sure that the centerline of the tailpost is perpendicular to the worktable.

Top Rear Fuse Deck

The sheeted top rear deck can be test fitted to the fusebox and around the vertical fin. If the fit is o.k., it can be glued into place (polyurethane or epoxy).

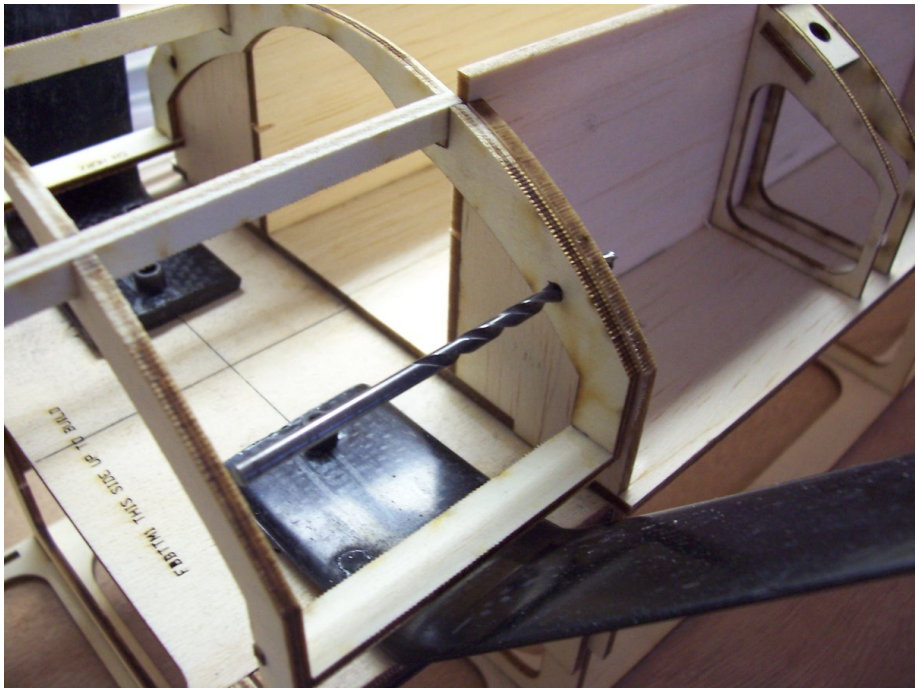
Chin Cowl

All the chin cowl parts will have the prefix "CH". See the photo below for reference to find all of the chin cowl laser cut parts.

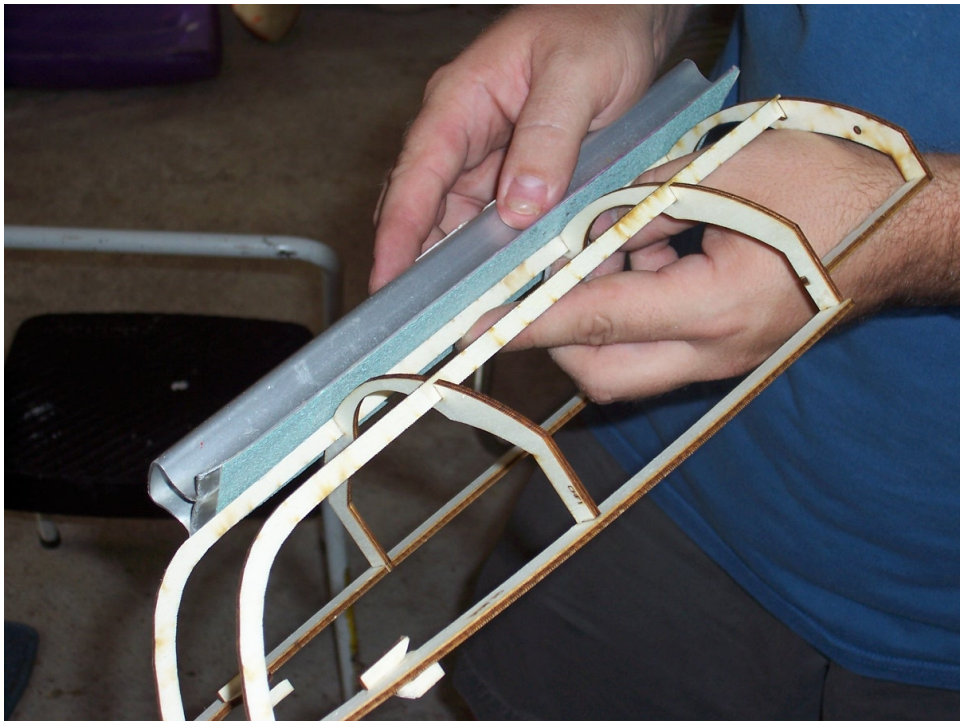


Assemble Chin Cowl Frame

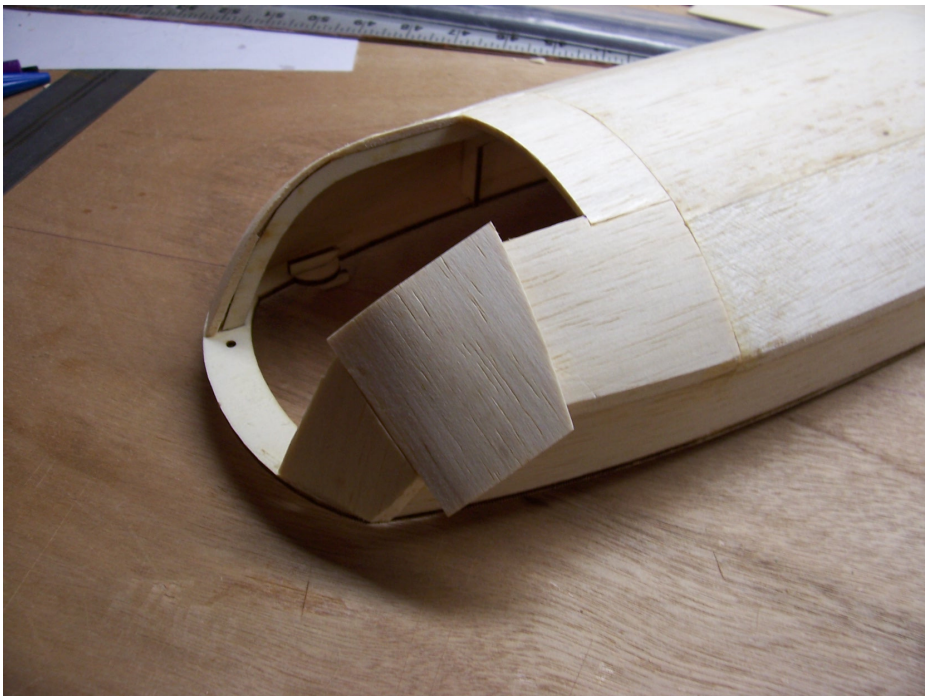
***Notice the laser cut holes in the rear former of the chin cowl. If you cheat a bit and frame the pipe tunnel on the fuse, you can align these holes properly before sheeting the chin cowl.



Sheeting the chin cowl frame can be a bit tricky. It is important to simpy take your time in applying each section of sheeting to the frame.



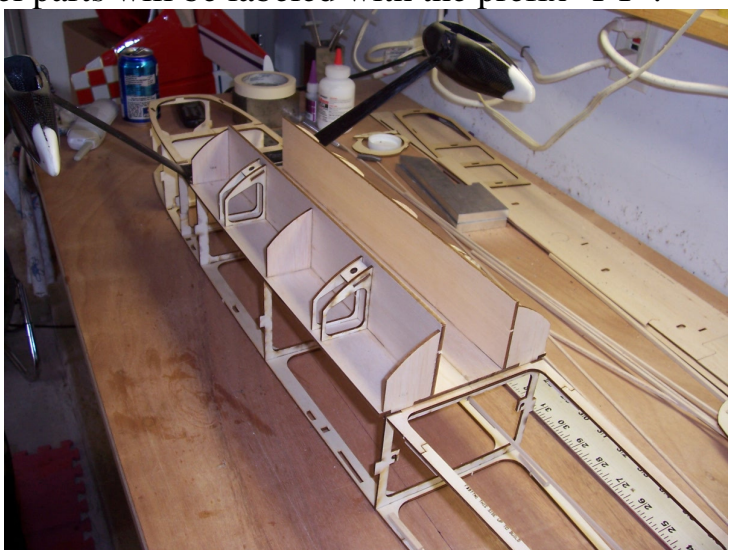
Start by gently sanding the lite ply stringers slightly so that the sheeting will lay properly against the formers.



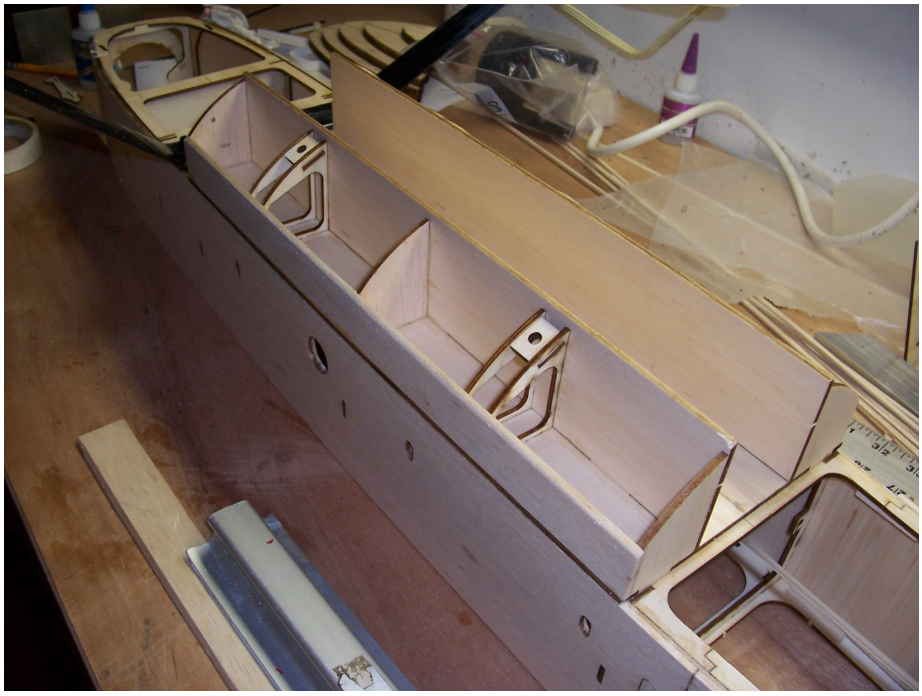
I found that near the nose I had to sheet small sections (Use 1/8", very light, sheeting) separately in order to run the grain in a good direction for the bending required. Some minor (gentle) sanding will be required to give the cowl a nice, smooth surface finish.

Pipe Tunnel Assembly

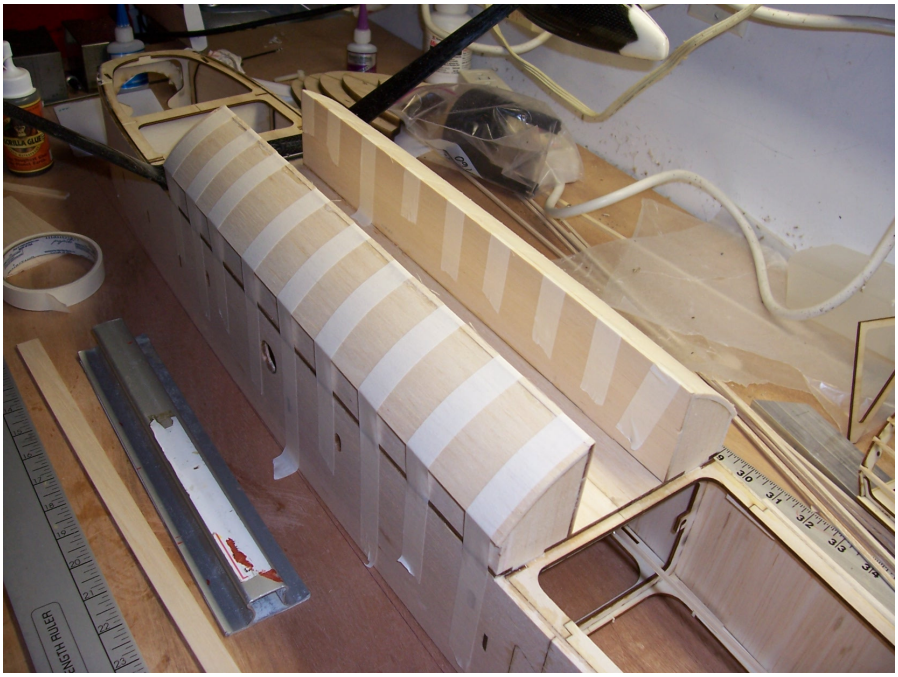
All of the pipe tunnel parts will be labeled with the prefix "PT".



Pipe Tunnel halves, assembled and ready to go on the fusebox bottom. Notice the lite ply plates for mounting the bottom FSD later.



Sheet the side of the pipe tunnel frame first, sanding the top edge of the sheeting flush with the round section of the formers.



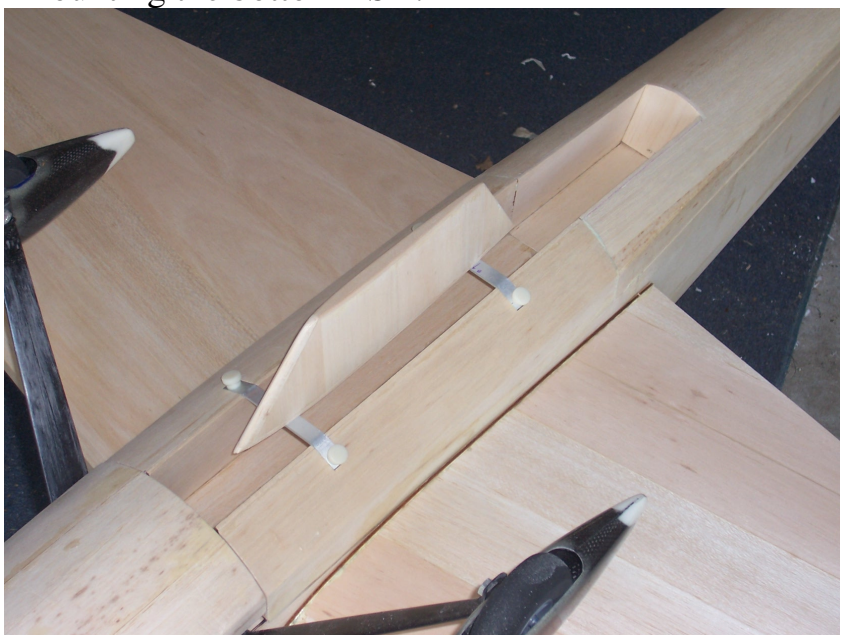
Then sheet over the formers (mark the approximate hole locations on the sheeting to make finding them later easier) with 1/8” sheeting. I push a straight edge of the sheeting up against the pipe tunnel wall and wrap the sheeting down over the outside edge of the fuse side. Let dry and sand flush to the fuse side.

Bottom Rear Fuselage Deck

The sheeted rear deck will have to be cut to fit around the aft end of the pipe tunnel assembly. Trial fit to the fuse and glue in place with a very light amount of polyurethane glue. Use plenty of masking tape to hold the deck in place overnight.

Bottom Fuse Fin (FSD)

The bottom fin, or FSD, can be mounted using the aluminum brackets supplied. You will have to open holes in the sheeting on either side of the pipe tunnel to expose the lite ply plates for mounting the bottom FSD.

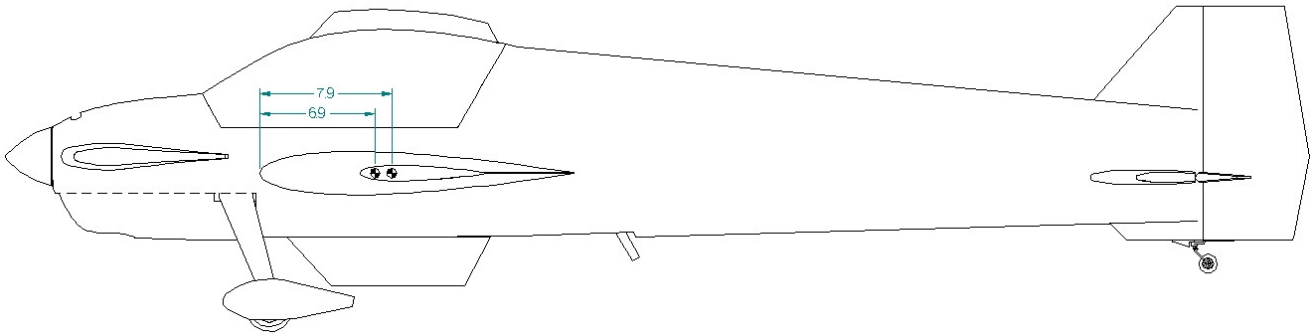


Are We Done Yet?

It's time to start filling and sanding your completed airframe. Quality time spent at this stage will yield a terrific finish later. The prototype fuselage was glassed with 3/4oz. Fiberglass cloth, then painted. The wings and stabs were completed with Monokote.

Ready to Fly

The throws and CG location are as follows:
CG range is from the back surface of the wing tube up to 1" behind the rear surface of the wing tube. This equates to 6.9" back from the LE at the root up to 7.9" back from the LE of the root. My Pentathlon is flying at 7.65", or ¾" behind the rear surface of the wing tube.



Elevator:
Low Rate ±13°
High Rate ±18°

Aileron:
Low Rate ±12°
High Rate ±16°

Rudder:
Low Rate: approx. ±35°(I use all I can stand with 60+% expo in my LOW rate flying. This assures a crisp hammerhead even in windy conditions.)
High Rate (snaps only): (20-30% LESS than my low rate position. This keeps my snaps from turning into blenders.)