33% Scale Schweizer TG-3A ~ Design and Kit by Peter Goldsmith

Build Manual by Jim Dolly

The prototype (built by Peter Goldsmith) and first production kit (built by Jim Dolly) were constructed using a combination of products from ZAP and Deluxe Materials (available at your local hobby shop and from Horizon Hobby). The primary adhesive used was Deluxe Materials Aliphatic Resin. Deluxe Materials Speed Bond was used for application of 1/32" sheeting (using hot iron technique). ZAP CA products were used where instant bonds were needed to assist with construction.

Wings

- Peter recommends that the wings NOT be built over the plan, but rather the plan be used as a reference while you build. Let the laser cut parts set the spacing of ribs.

- Wings are built as right and left panels. Each panel is approximately 8'8" long. Wing panels can be built on an 8' long bench allowing the tip end to extend off one end of the work surface.

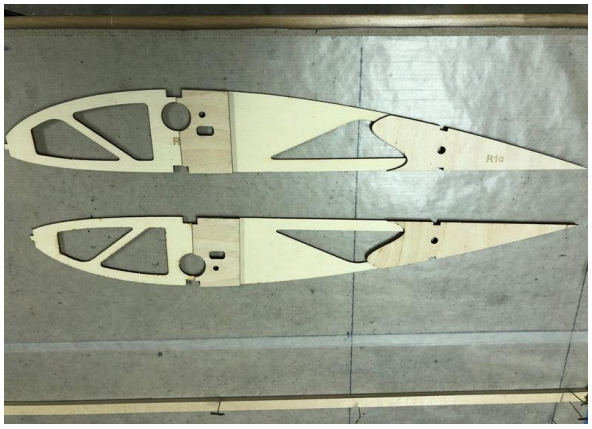
- Start by locating the 1/4"x1/2"x48" basswood spar material. Make the bottom main spar by joining two 48" pieces plus an additional section approximately 10" long to complete the full span.

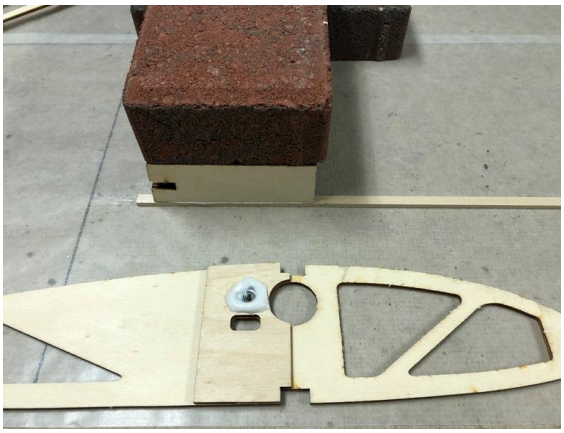
- We used scarf joints to join these three sections and placed the bottom spar so that the laminated R9 & R10 ribs were centered on the joint between the two 48" sections. This joint is 43-3/4" from the root side of R1 and 56" from the tip side of R24.

- Draw a straight reference line the length of your workbench and align the bottom main spar along this line. We use Homasote Sound Board on top of our bench as a replaceable surface that is easy to pin into, and we use Cut Rite Wax Paper as a cover over the building surface.

- Next, locate all the wing ribs, shear webs, and other parts. Draw a perpendicular line at the root end of the spar reference line. Align R1 on this line. All ribs align at 90 degrees to the main spar.

- Prepare R1 ribs by first laminating parts R1c and wing attachment reinforcement. Then add the wing bolt blind nut. Prepare the bottom rear 1/4”x1/8”x48” spar by gluing the plywood Sh1b shear web to it. Note orientation of slanted edge and slot for steel anti-rotation pin.

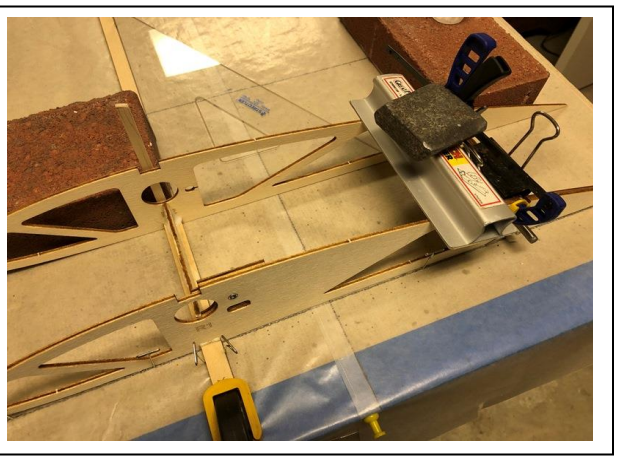


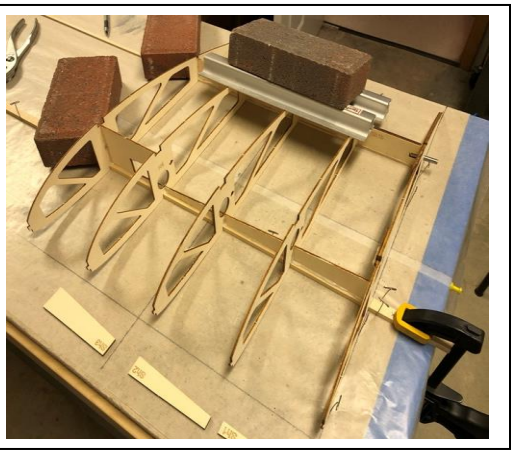


- Locate ribs R1-R5, shear web parts Sh1-Sh6, Sh7b, and three R7b. Dry fit these parts to identify correct orientation of all pieces.

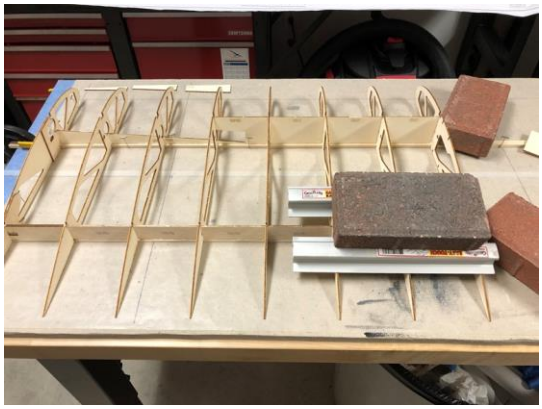
- Use Sh1b and Sh6 to set slant of rib W1. Inserting the 1/4” steel anti-rotation pin through rib W1 and into Sh1b helps stabilize these parts. The notch in the bottom of ribs R1 and R2 set the position of the rear bottom spar. Align the outside bottom edge of W1 with the reference line on the workbench and let it tilt so that it touches Sh1b and Sh6. Use Sh1b and Sh6 to set the spacing of rib W2. Check that W2 is square with the main spar and glue everything in place.

- Add Sh5 and first piece of R7b, then set rib W3 in place. Continue by adding Sh4 and second piece of R7b in place and adding rib W4. Then add Sh7b and the third piece of R7b and set rib W5 in place. You can now see how the wing rod tube will fit through ribs W1-W4.

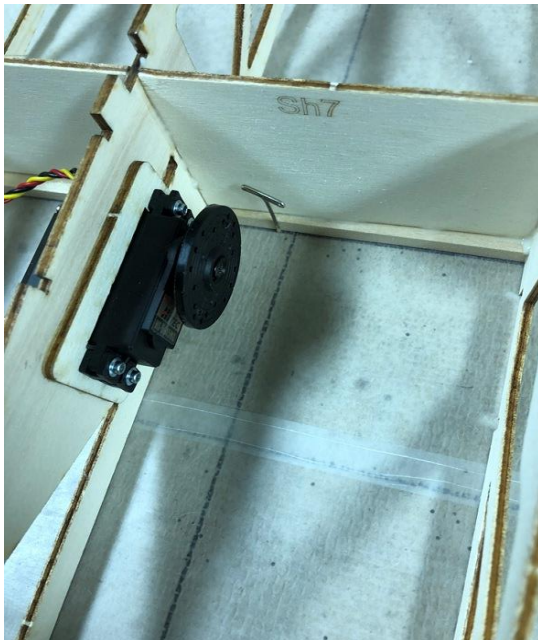




- The inboard wing section has a constant chord while the outboard section tapers. The bottom of the outboard section continues flat on the building surface. The top of the outboard section tapers downward toward the tip and gives the wing a sort of gullwing appearance.



- Continue by adding Sh7 & R7b shear web pieces and R5 ribs for two more bays. Note the location of the spoiler pocket and the ribs that form it. Also note rib R7 that holds the spoiler servo and laminate the reinforcement part W27 to it for the servo mount. Add another section of shear web and place rib W6, repeat for rib R7, then R8, and then another R6 rib to complete the spoiler pocket area.



- Cut two pieces of 1/8”x1/4” basswood to fit between the two R6 ribs extending across ribs R7 and R8 forming the front and rear edges of the spoiler pocket.

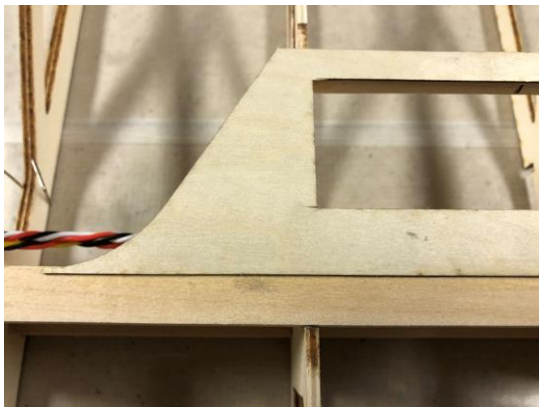
- Locate sheer web Sh8. It is twice the length of Sh7 and extends from the outboard R6 rib to the R11 rib. Note that the bottom edge is flat and the top edge tapers from center toward the tip. Ribs R9 and R10 are laminated together and are split into front and rear sections. Mark a center line on Sh8 to align R9 & R10 ribs. Cut a piece of 1/4”x1/2” basswood spar stock to the same length as the Sh8 shear web. Glue this piece on top of the bottom spar spanning the joint in the bottom spar. Glue Sh8 on top of this piece. Add rib R11 to the outboard edge.

- Cut cardboard wing rod socket tube about 1/8” longer than the depth of the slot it fits into. Glue in and add top shear web parts.

- Continue adding the laser cut shear webs and ribs out to the tip. Note the orientation of the tapered shear web pieces, they are not symmetrical. There is a top and bottom. Spar, leading and trailing edges will keep the tip aligned even though it extends off the edge of the work surface. Add leading and trailing edge laser cut caps. Note tabs on ribs fit into slots in these strips.

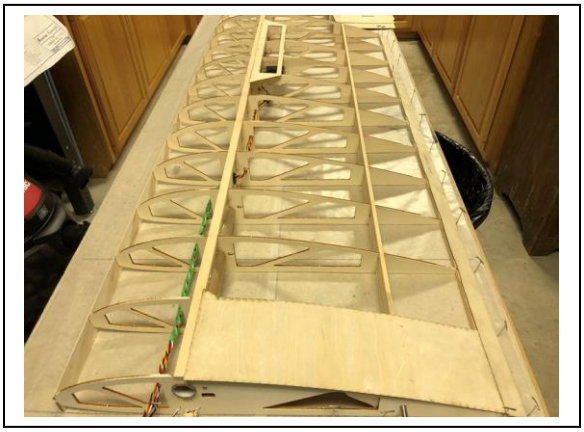
- Locate 1/4 “x1/2”x48” basswood spar stock and join two of the 48” lengths plus an additional approximately 15” piece. Glue this top spar in place allowing the tip end to extend beyond rib R24 at least 4” (this will support the tip sheeting).
- Use the 1/8”x3/8” balsa stick to make the inboard trailing edge shear webs. Cut them the same length as the R7b parts. Use the top trailing edge 1/32” plywood laser cut sheeting to mark the ribs at the front edge of this 1/32” strip of plywood. Use these marks to glue the shear webs is place so that they support the front edge of this strip. Next, glue the plywood top trailing edge sheeting in place.

- Locate the 1/32” plywood mask for the spoiler bay area and glue it in place. Note that the front edge overlaps onto the main spar by a little bit. Add the laser cut 1/32” rib cap strips between the spoiler bay mask and the trailing edge top sheeting. Add the laser cut 1/32” plywood top sheeting panel between W1 and W2. Note that this piece needs to overlap onto the main spar by the same amount as the spoiler bay mask.



- The balsa leading edge can now be contoured to the curve of the ribs. A razor plane makes this an easy task, only requires a minimal amount of final sanding to get prepped for sheeting. The 1/32” plywood wing sheeting is pre-cut to length and width. Note that there are four rectangular pieces and four tapered pieces. Two of the rectangular pieces and tow of the tapered pieces have slightly less width than the other two. The wider pieces of each are for the top of the wing. We used Deluxe Materials Speed Bond glue to adhere the wing skins. Glue is applied to both surfaces to be joined, allowed to dry to clear, then a hot iron is used to press the parts together activating the bond between the skins and the underlying structure.

- Add the remaining laser cut 1/32” cap strips to the inboard panel and then proceed to the outboard section. Note that the cap strips are unique for both top & bottom and left & right. Each is labelled accordingly. The top sheeting requires all the tapered 48” long 1/32” skin plus a smaller section to reach the tip.



- Add the laser cut cap strips to the outboard section and then add the tip 1/32” sheeting. The top spar that extends out beyond rib R24 supports the tip and the triangular W25 and W26 parts add support in front and back of the spar line. (Building tip: Temporarily clamping a piece of basswood to the top of the structure helps hold things in place while gluing.)

- Wing can now be turned over to finish out the bottom. This is also a good time to run the servo extension wires for the spoilers and ailerons. Start with the 1/32” trailing edge, then the spoiler pocket mask, then the root section sheeting between W1 and W2, then the leading-edge sheeting. Since the bottom of the wing is flat from root to tip, the joint between the inboard and outboard sheeting can be made at rib R11 instead of R10.

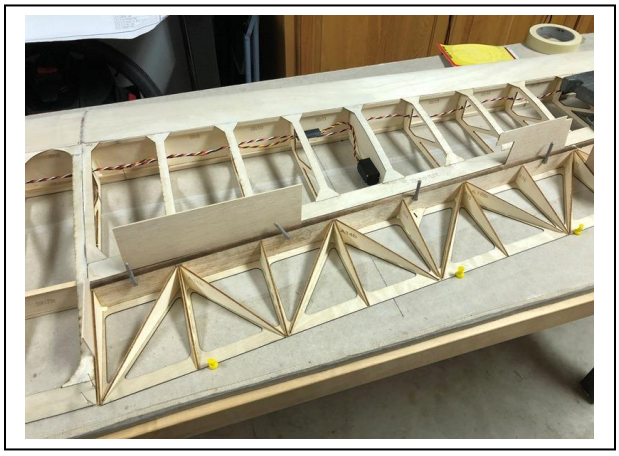
- Aileron servo access panels replace the 1/32” cap strips between ribs R14 & R15 and ribs R19 & R20. There are left & right and inboard & outboard 1/32” plywood for these. The hatch support plate needs to be properly oriented between the ribs and has a notch in one side that keys into the W27 servo support piece. Use the laser etched lines to position the 1/8” plywood reinforcement which also forms the access door frame and support.

- The bottom tip sheeting is cut well oversize to allow a custom cut and fit to the contour of the tip upper sheeting.

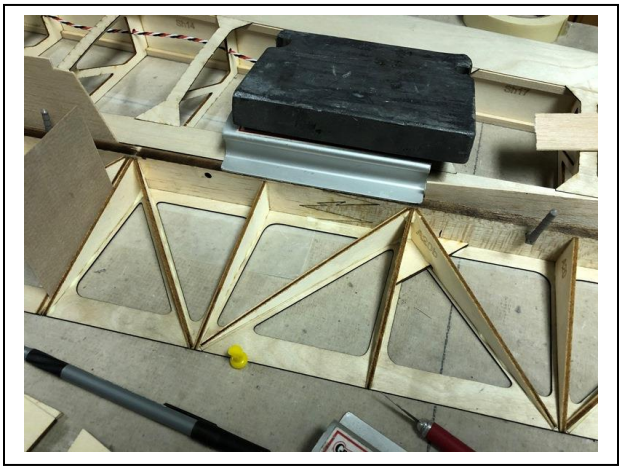
- 1/32” sheeting gets trimmed flush with the leading edge (actually sub-leading edge) and the balsa leading edge cap is added and sanded to contour to finish the wing LE.

Ailerons

- Once all of the 1/32” skins are added to the bottom of the wing. the wing can be turned back over and held flat on the workbench. Locate the 1/32” bottom skins for the ailerons (they have laser etching for rib locations) and the balsa aileron leading edge pieces. Fit these parts into the aileron cut out in the wing and temporarily insert hinge pins to hold them in place. Use strips of wax paper between the aileron and wing to avoid accidentally gluing them together.

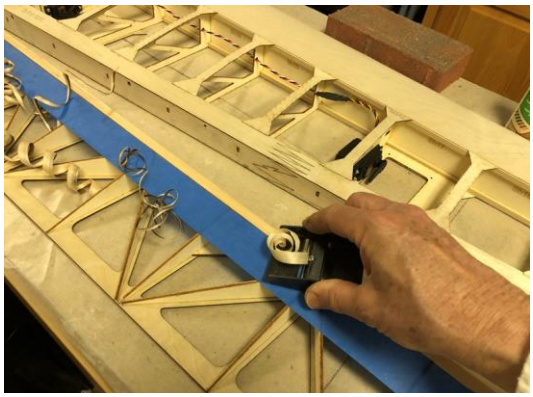


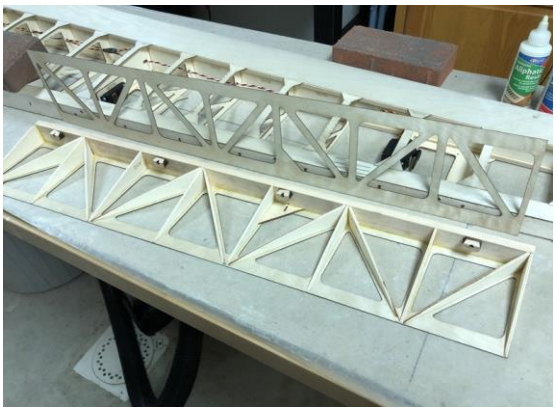
- Scrap pieces of sheeting can be used to set spacing between the wing cut out and the ailerons.



- Glue in all the ribs and aileron horn supports. Note that the aileron gets cut into two parts, inboard and outboard at double rib A17 when finished.

- The aileron leading edge gets sanded to the taper of the ribs, the hinge pin “donuts” are added, and then the top sheeting is applied.

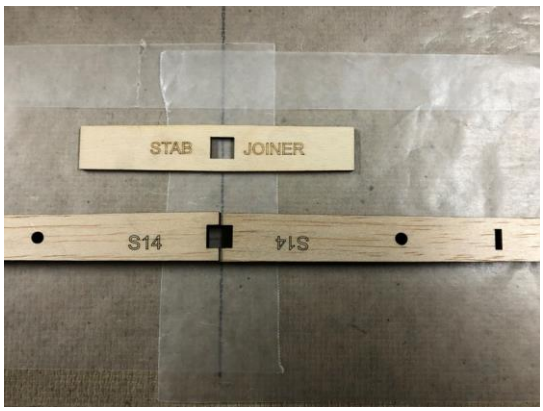




- We used Deluxe Materials Speed Bond glue (using the hot iron technique) to apply the top aileron skins. Once top sheeting is applied, the ailerons can be cut apart into the inboard and outboard sections. Then the leading edges are sanded to a taper above and below the hinge line. (See cross section on the plan for reference.)

Stab

- Locate, sort, and organize all the parts for the stab, elevators, and rudder.
- With the tab and slot design, these assemblies can be built standing up with the flat side of the leading or trailing edge against the work surface.
- Stab trailing edge S14 is in two parts. The stab tapers from the middle to the tip. Draw a straight reference line on your worksurface and align the centerline of the S14 parts with this reference line. The plywood STAB JOINER is used to lock the S14 parts together.



- Glue the four S1 ribs together and stick the read tab into the hole in the center of the stab joiner. Check to see that this rib assembly is perpendicular to the worksurface. Add the S11 ribs to each end. Again, make sure that they are perpendicular to the work surface. Next, cut 3/16” dowel rod to fit into the rounded fronts of the ribs spanning from S1 to S11. Now add in S3, S5, S7, and S9 followed by the diagonal ribs S2, S4, S6, S8, and S10.

- Locate the center section top sheeting and glue it in place. We used Speed Bond and a hot iron for this step.

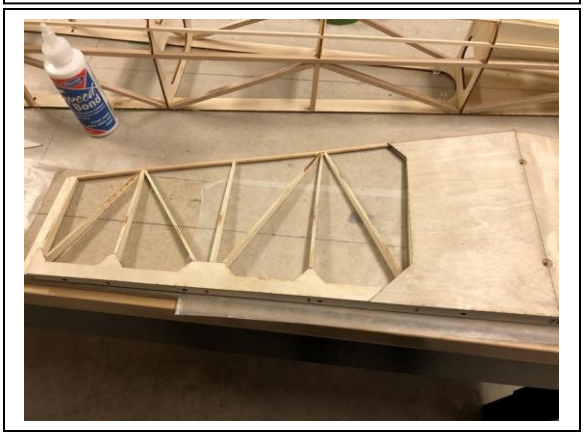
- Prepare the bottom center sheeting by assembling the servo door frames and attaching them to the inside of the sheeting.

- The bottom sheeting can be added along with the top and bottom trailing edge 1/32” plywood skin. Over the trailing edge.

- Add the balsa S15 tip blocks, sand the ends rounded, and blend into the leading edge dowel.

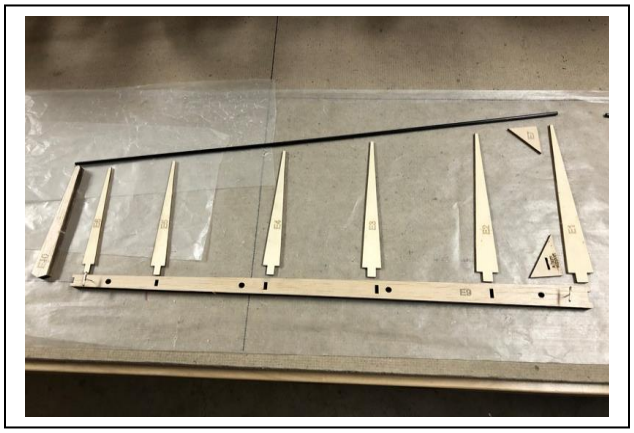
- Add the hinge pin hole “donuts to the inside of the stab trailing edge.

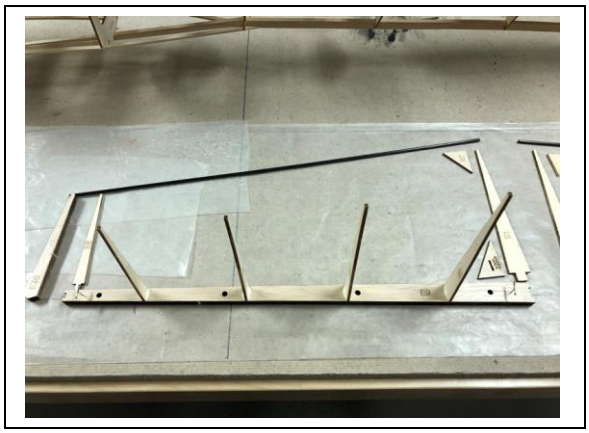
- Smooth sand structure and it is ready to cover; however, it is best to hold off on covering until the stab is mounted onto the fuselage.

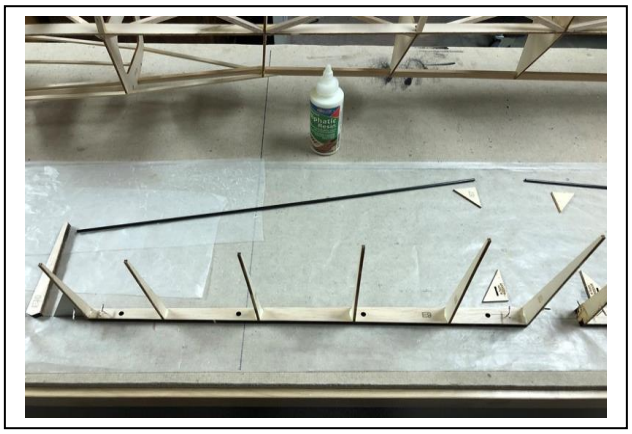


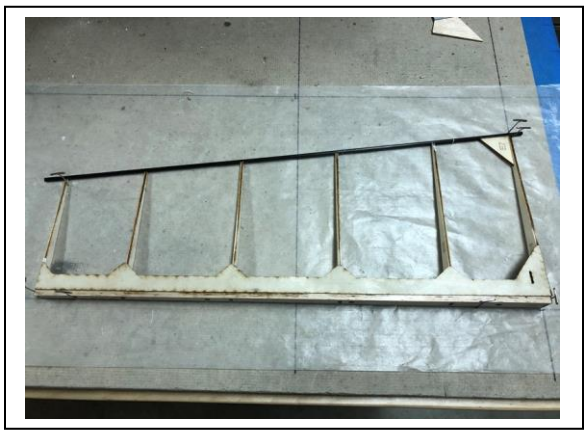
Elevators

- Elevator halves are built in a similar way.

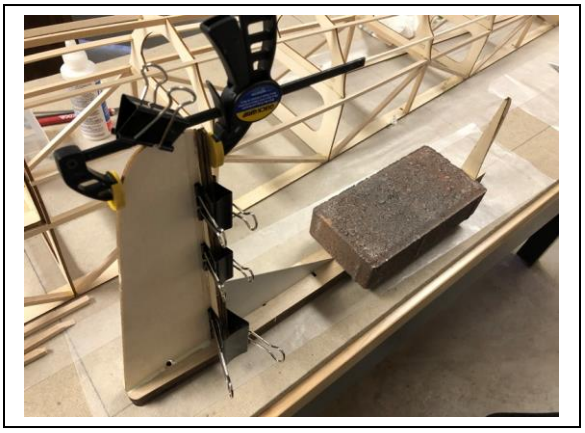








Rudder



- Place the rudder leading edge piece (that has hinge point holes and slots) flat on the work surface. Assemble r2, r2b, and r3 into one unit. The balsa r2b acts as a spacer to make a slot for the rudder horns to fit into. Glue parts r7 and r10 together and add them to the top of the leading edge. Use the 4mm carbon rod to span the trailing edge from r2 to r7. Next, fit r4, r5, and r6 into the slots in the leading edge. Make sure they are perpendicular to the leading edge. Then add the diagonal parts r8 and r9. Balsa filler blocks are added to either side of r10 at the top of the rudder.

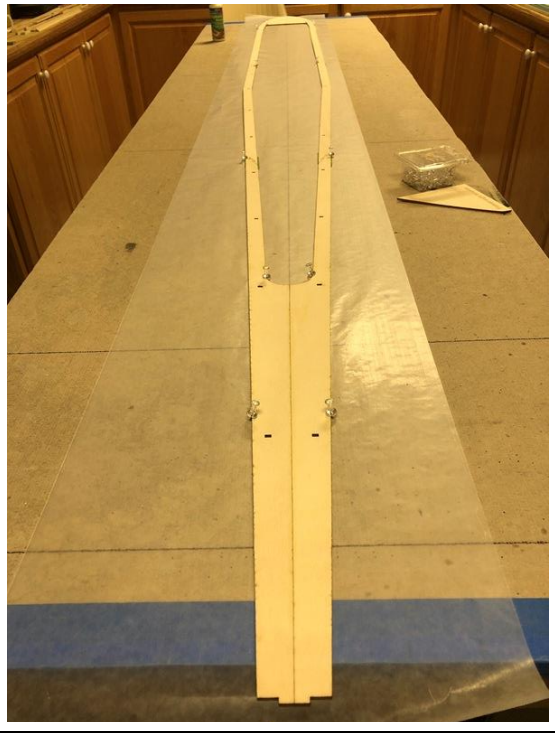
- The second section of the rudder trailing edge (has hinge point holes but no slots) is added to the front of the rudder assembly and is sanded to a “V” cross section along the hinge line. When the fuselage and fin are finished, the rudder is mated to the fin and the top of the fin is sanded to a rounded cross section.

- If you plan to use the red and white stripes with blue bar on the rudder, the stripes need to be 1-9/16” wide in order to get the total of 13 stripes with equal size. We covered our model with UltraCote. Rudder was first covered in White, then the True Red stripes were added, and finally the Corsair Blue vertical bar was added. The top and bottom True Red strips need to be cut wider than the 1-9/16” in order to visually look the right width and to cover the top and bottom rounded edges. The Corsair Blue bar is 1-9/16” wide not counting the tapered front.

Fuselage

- The fuselage is split top from bottom along its midline by a “crutch” plate. This allows the top half of the fuselage to be built flat on your work surface thus ensuring a nice straight and true assembly. Once the entire top half is constructed, including add on the fin, the fuselage can be flipped upside down and supported by cross member hardwood sticks supported on blocks. No special jig or fixtures are needed.

- Start by locating all the fuselage parts. We rolled out the fuselage plan and used it as a reference. As parts were separated from the carrier wood, they were place on the plan at their approximate location. This allowed us to become familiar with the parts and their placement, and it helped to organize the parts into groups for the top half of the fuselage build versus the bottom half.

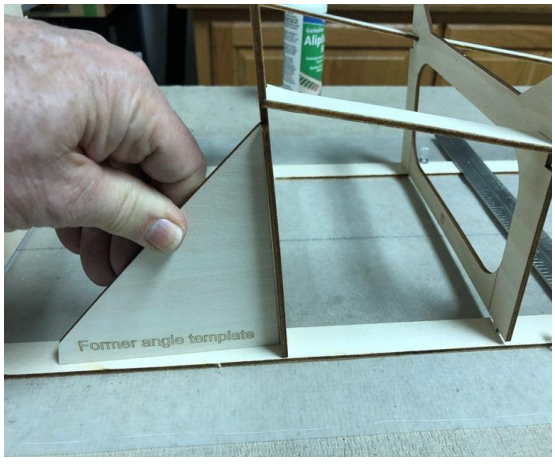


- As with the wing, the fuselage crutch assembly is slightly longer than my 8’ long workbench. This works to your advantage when it comes time to build on the fin.

- Draw a straight line down the work surface and center the crutch assembly over it with the aft end extending a little beyond the edge of the bench. Make sure the middle section is centered by measuring out from the center to each side. Bulletin board push pins work well for holding structure in place.

- Locate the “Former Angle Template” as this helps set the correct angle of each former as they are added to the crutch. Note that formers are NOT perpendicular to the work surface.

- Place the formers over the crutch in their approximate location to familiarize yourself with how the structure will come together. We elected to start wit former f6 and work forward adding formers f5, f4, and f1 plus both f19’s that form the front canopy base. Note the tabs on the bottom of the formers that fit into the slots in the crutch.



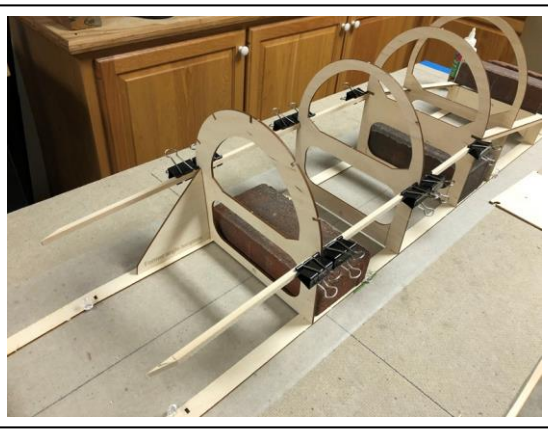
- Select a stick of 1/4”x1/4” basswood and, using the plan, fabricate the support pieces that fit under the f19’s between formers f4 and f6. Note the tapered cuts on each end of these pieces.

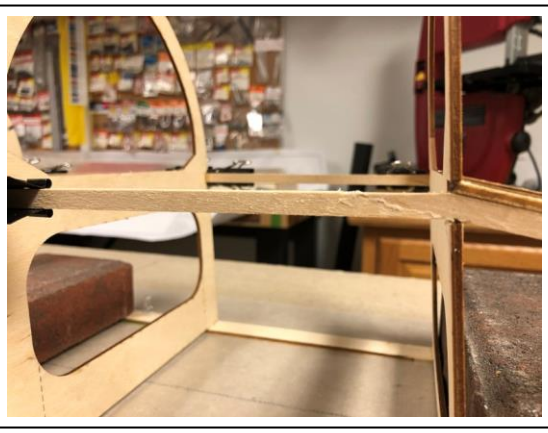
- We used Deluxe Materials Aliphatic Resin for all our general construction. It has a quick “grab” almost like working with thick CA, but makes a much stronger and less brittle joint.

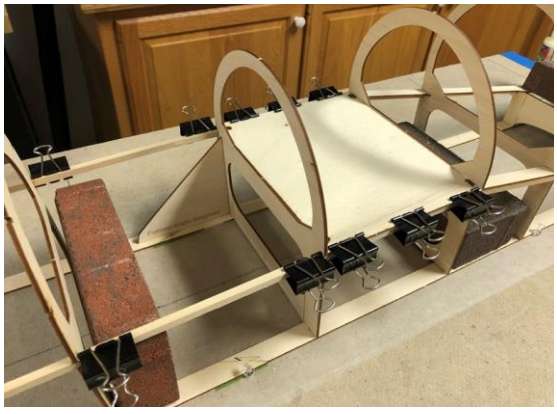
- Next, f7 and f8 were set in place using the angle template and another section of 1/4”x1/4” basswood was added to each side. This 1/4”x1/4” basswood continues all the way back the fuselage to the tail fin post. This distance is greater than the 48” length of the 1/4”x1/4” basswood stick, so several splices will be required to reach to the tail. We elected to make one of our scarf joints at the location of former f9.

- Scarf joint in 1/4”x1/4” basswood stringer at former f6 pictured here.

- Binder clips make great clamps to hold formers at the correct position on the 1/4”x1/4” basswood stringers.



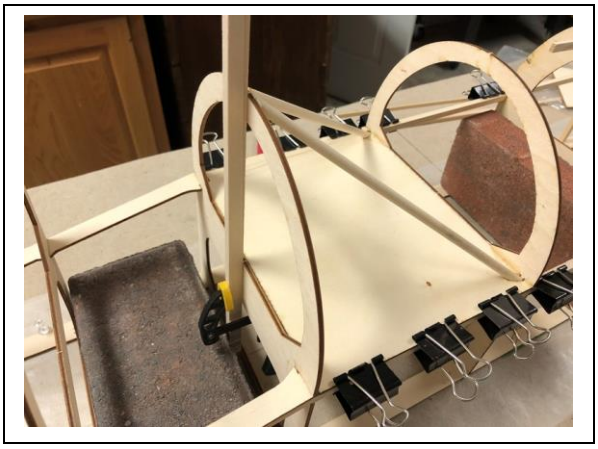




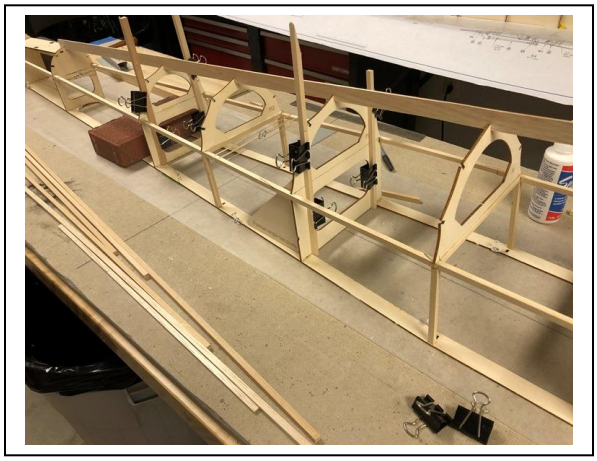
F26 is added to the top of the stringers between formers f6 and f7. Note the binder clips. We also like to use landscape paving bricks to help hold things in place.

- Using a piece of basswood stick helps keep former f6 from bending as the dowel rod detail is added.

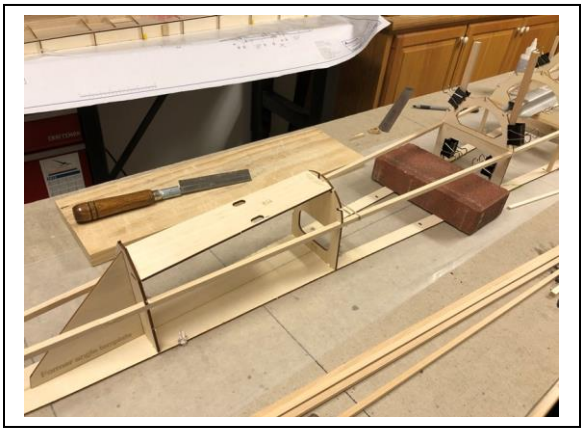
- We used additional pieces of basswood stick to help align and hold the formers in place in the aft section of the fuselage. We also used a piece of 1/8” x 1” sheeting scrap to align and hold the tops of the formers.



- Continuing rearward, formers f11, f14, and f16 are added to the crutch at the correct angle and the 1/4”x1/4” basswood stringer is extended back to the tail. Note that formers f12 and f15 do not extend down to the crutch, but rather sit atop the 1/4”x1/4” basswood stringer. Use 1/4”x1/4” balsawood stick to fabricate supports between the crutch and bottom of the 1/4”x1/4” basswood stringer under formers f12 and f15.



- Add f19 and f20 between formers f16 and f18. Now 1/8”x1/4” basswood stringers can be added between formers f8 and f16.



- Use 1/4”x1/4” balsa stick to fabricate the diagonal braces between the formers between Former f7 and all the way back to the tail.

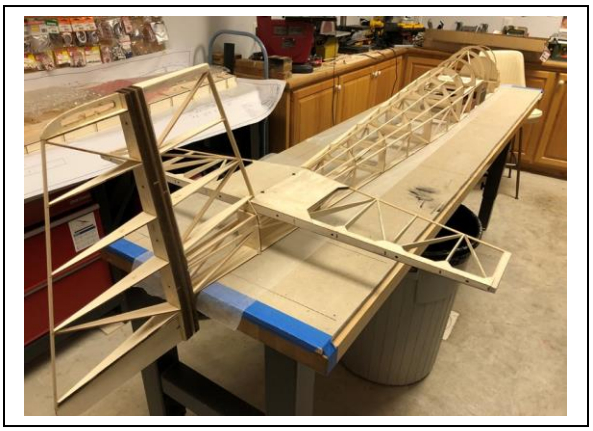
Fin

- The plywood fin post can be added. Note that the bottom of the fin post will extend down below the work surface. There is a slot in the fin post that the tab on the end of the crutch fits into.
- Laminate fin ribs fin1 and fin2 together. Insert the aft end of these ribs into the slot in the fin post. At the front of these ribs, fin2 rest on top of former f18 while fin1 stops against the backside of former f18.
- Test fit the stab onto the top of f19 and check to see that the trailing edge of the stab will fit under the front extension of rib fin2.
- Add fin ribs fin3, fin4, fin5 using 3/8" dowel to form the fin leading edge.
- Use 1/8"x3/8" basswood to make the diagonals and cap the fin with fin6 balsa parts.
- MAKE SURE THAT THE FIN POST REMAINS STRAIGHT.

With the fuselage flat on the work surface and the fin plumb, set the stab on the fuselage and check alignment. When satisfied, drill a 1/16" pilot hole. Remove stab and check location of the pilot hole in f19. If satisfied, place the stab back on the fuselage and hold in place with a piece of 1/16" music wire or drill bit. Check alignment again and when satisfied, drill a second pilot hold as per the plan location.

If satisfied with the alignment and the pilot hole locations, drill out the front hole for the steel wing bolt included in the parts bag. Install the blind nut to the bottom of f19 (use a piece of scrap 1/8” plywood to add thickness). Install stab using the steel bolt and check alignment again for rear bolt hole. Then repeat what you did for the front.

- With both bolts and blind nuts installed, use a countersink bit to drill into the top of the stab. Drill deep enough so top of bolts are level with the surface of the skin.

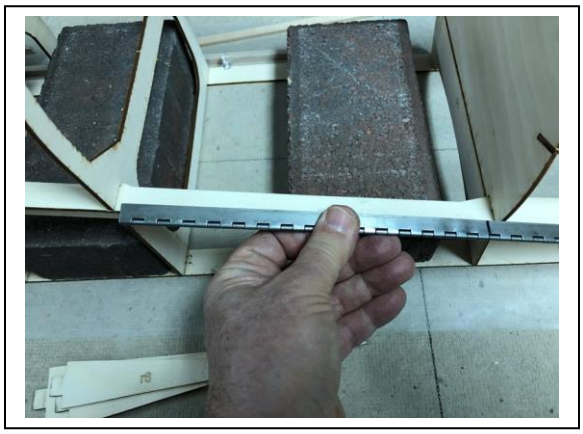


- The f17 side panels can now be added. The f17’s sit on top of part f20 and glue to the sides of f19. The f17’s extend slightly above the surface of f19 on purpose. This supports the stab as each side tapers upward slightly from the centerline.
- Add an extension to the side stringers back to f18 along the sides of the f17 panels and add 1/4”x1/4” balsa stick between former f18 and the fin post.

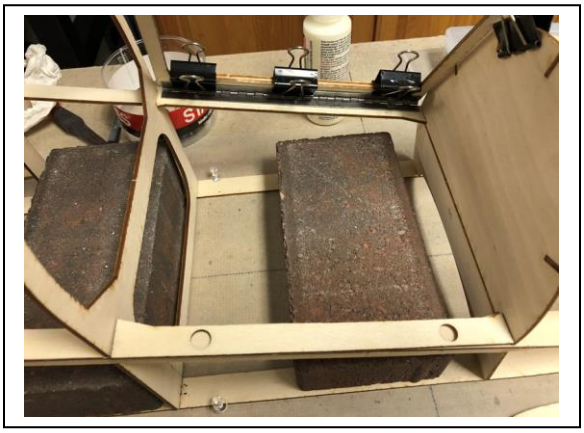
- Now we can move back to the front of the fuselage.
- Add f2 and f3 along with f20, and the pairs of f21 and f22 stringers.

Canopy Frames

- Cut the piano hinge to proper length and attach the c2 canopy frame base.

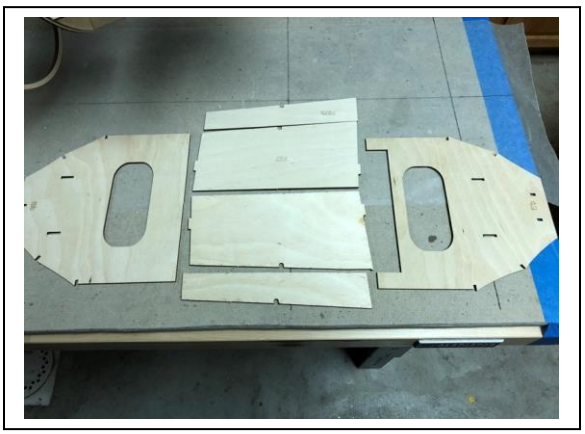


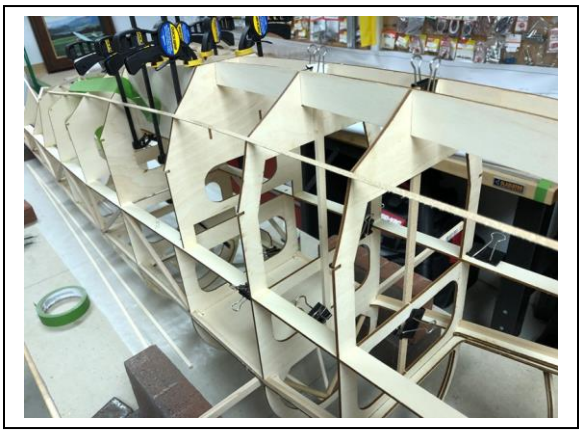
- Glue c2a (the part that holds the canopy latch magnets) to the fuselage. The hinged c2 canopy frame has matching holes for a second set of magnets. With c2 canopy base in the closed position, place c1 at the front and c4 at the rear. Add the c2b parts to each side and then glue the pair of c3 canopy support hoops together and insert their tabs into the slots in c2b and c2. Make sure the c3 hoops are perpendicular to the c2b base. We made spacers from scrap wood and clamped the parts together while glue set.



The rear canopy frame is less complex.
It attaches by using a single through bolt on the right side and a hold down tab on the left side. Study the plan carefully to understand how to build the tab and add the hold down bolt assembly.

- The fuselage can now be turned upside down and the bottom structure added.
- The wheel well “box” assembly is constructed from formers f7b and f8b plus side panel parts f27, f27b, and F30.
- This assembly is added to the bottom of the crutch and then additional formers are added going forward and rearward from it along with stringers.

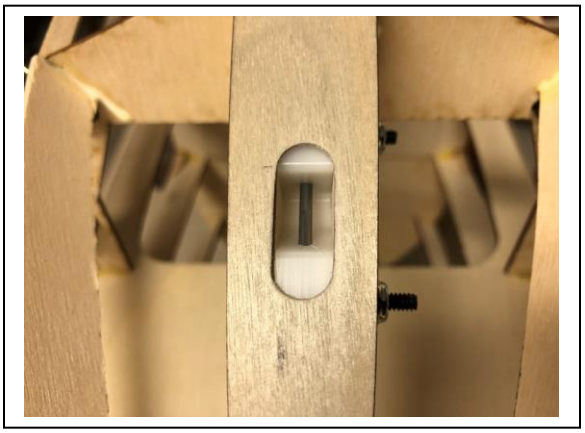




- The kit includes a simple tow release system. The nylon block that forms the pull pin system is mounted between the f22 keel pieces and the drive servo is mounted behind this block in a tray between the same f22 parts. The f22b

parts fit between the nylon block and the f22 keel parts. Sand them as needed for best fit.

- Add 1/32” plywood sheeting from wheel well forward. Mark location of the tow release and cut an opening.

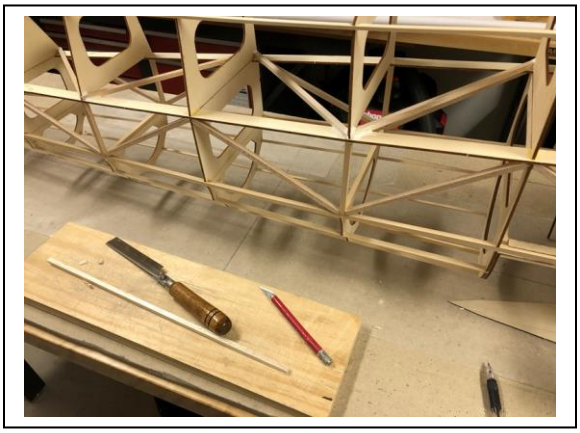


- Add formers and stringers between the wheel well and the tail post.

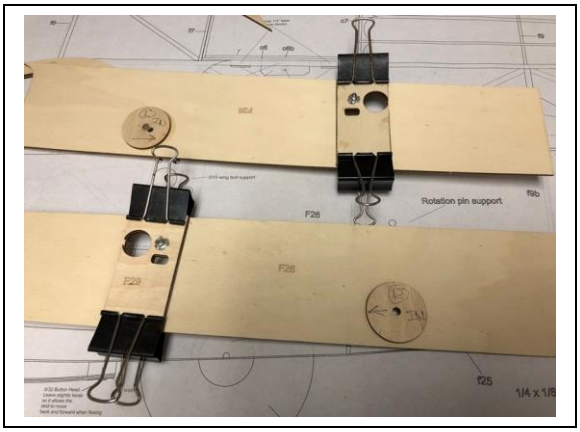
- Add the 1/32” plywood sheeting behind the wheel well

- Add the rudder cable exit guides and check the routing of the cables between the rudder servo mount and the exits. Note that the cables cross over. It is helpful to insert a piece of nylon tubing between the exit guides and forward through former f16b.

- Add the 1/4”x1/4” balsa stick diagonal truss work across the fuselage along the bottom side of the crutch plate and along the top side of the main 1/4”x1/4” basswood stringer that extends from the canopy base to the tail post. The top diagonals run opposite to the bottom ones so that they form an “X” pattern as you look down through the fuselage.

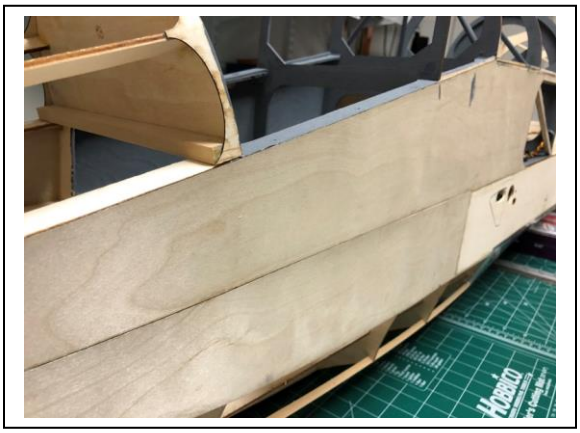


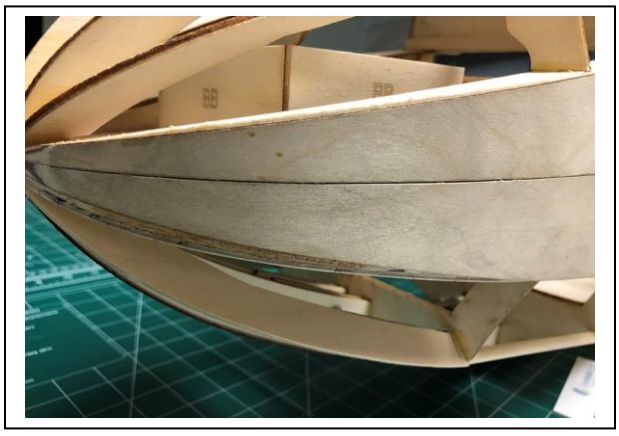
- Prepare the fuselage f26 side panels by adding the f29 plywood wing tube/wing bolt plate reinforcement. Add wing bolt hole G10 reinforcement. Add the plywood anti-rotation pin support. Be sure you have a correct left and right side.



- When these panels are added to the fuselage, you will note that they do not insert flush with the surrounding stringers and formers. They stick out about 1/32” to match with the surrounding 1/32” sheeting that gets added next.

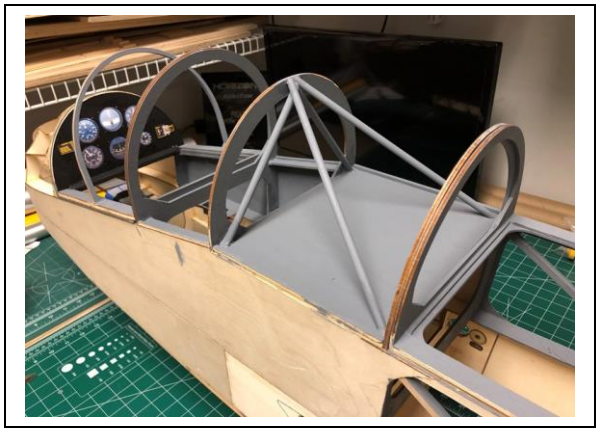
- Add the scalloped 1/32” skins over the top of the fuselage behind the rear canopy and in front of the front canopy.





- Build the Ballast box and note where it will be positioned. Once the model is finished and the correct amount of ballast is determined, the box can then be fitted into the nose and glued in place.

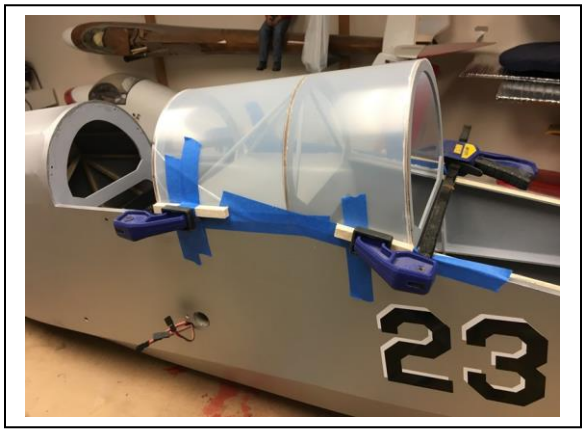
- We used Tamiya XF-53 Neutral Grey Acrylic Paint for the cockpit area and Flat Black for the dash.

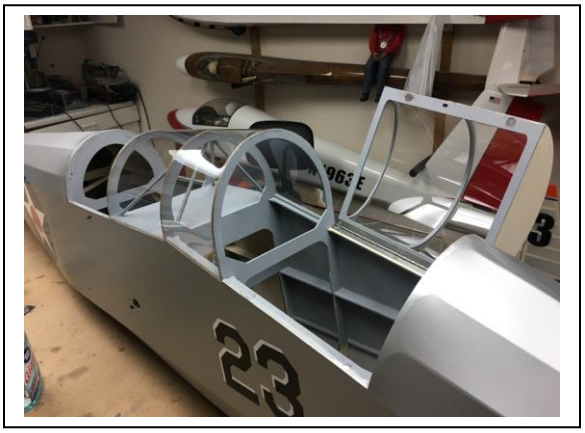


- Before adding the wing rod socket through the fuselage, install the wings with the 1/8" plywood wing root cap ribs between the wing and the fuselage. Check of fit of the wings against the fuselage and shim the wing rib caps as needed to get a good fit to the fuselage side.

- Now the wing tube can be insert through the fuselage along with the wing rod. Adjust the diameter of the holes in the fuselage sides as needed to get a good bind-free fit. Once a good fit is established, the tube can be glued in place.

- The canopy plexiglass panels are cut to a very close tolerance and should fit with minimal trimming necessary. Protective film helps keep unwanted glue and scratches from the outside surfaces during installation process.





Completed Prototype built by Peter Goldsmith

- Peter's daughter Belinda holding newly completed TG-3 prototype model

- View build thread for Jim Dolly's TG-3 on www.forum.scalesoaring.com

Recommended Servos:

(8) Spektrum A6220 HV – ailerons, spoilers, tow release, and rudder

(2) Spektrum A7020 HZ – elevators