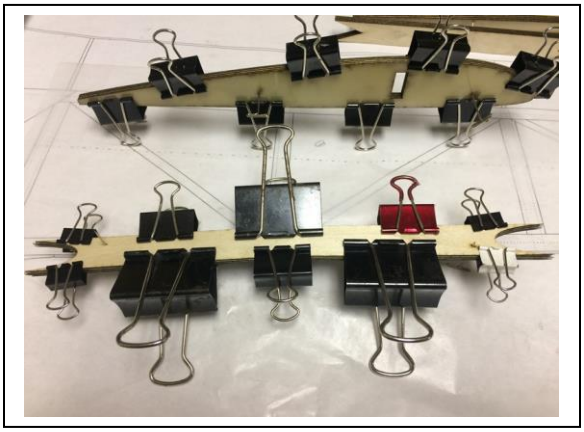
1/3-Scale Slingsby T-37 Skylark ~ by Peter Goldsmith Designs

Wings

- Wings are constructed in four panels. Panels are joined by laminated plywood joiners with the inner two panels permanently joined around a center laminated rib.

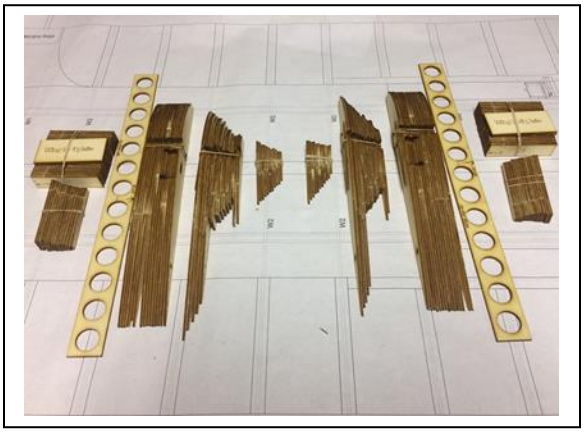


- Locate the plywood center wing joiner parts and the center rib plywood and G10 parts. Stick T-pins through alignment holes and epoxy parts together.

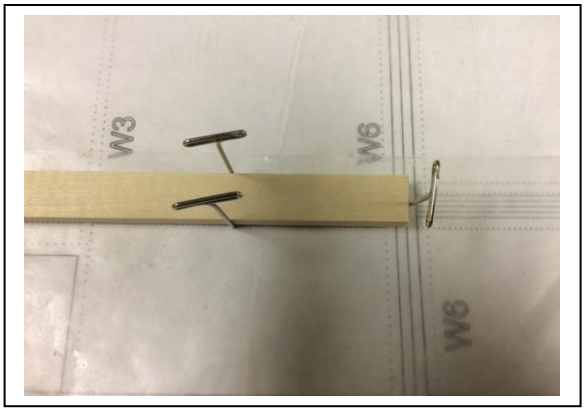
- The center and outboard wing joiners are three pieces of plywood laminated together. The center rib is three pieces of plywood and two pieces of G10 laminated together with the G10 added to the outsides of the lamination.

- Locate all the wing ribs and shear web parts, break them out of the laser cut sheets, lightly sand off the nubs, and group them in order. This helps ensure that you have all the necessary parts identified and speeds the build process.

- Peter recommends NOT build the wing panels over the plans, but rather to use the plan as a reference. The reason is the paper plans can change dimension with time and humidity causing a mismatch between the parts and the plan. Establish and straight reference line on your building surface and scribe a perpendicular reference line at one end. Align the lower spar with the reference line running down the worksurface and the first wing rib with the perpendicular reference line.

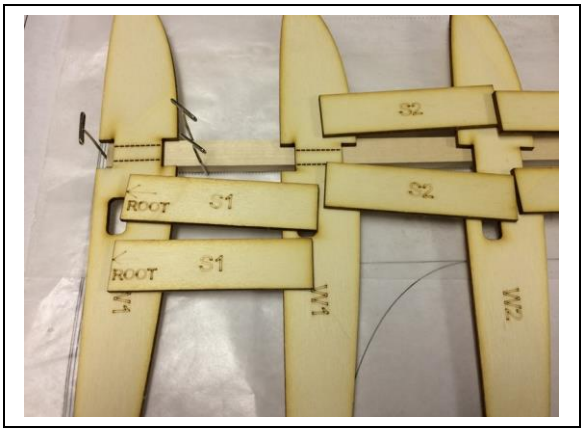


- For many kit builders, building over the plan is preferred…so we used the plan just to see how well things would go. First step is to get the lower spar pinned into place.



- Locate all the ribs and shear webbing for each wing. Study the plan and arrange the pieces in order. Note that the shear webs have a top and bottom as well as a left and right. Make sure you have these properly oriented as you glue them in place.

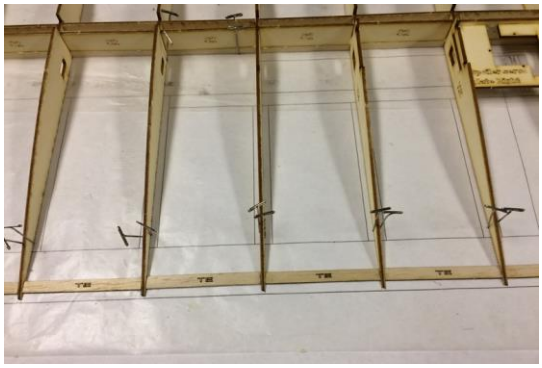
- Note the laser cut dotted lines between the top and bottom spars on W1 ribs. This area will get removed at a later step. Note also the dihedral angle on the root side of shear web S1. This sets the angle the root ribs of the center sections.



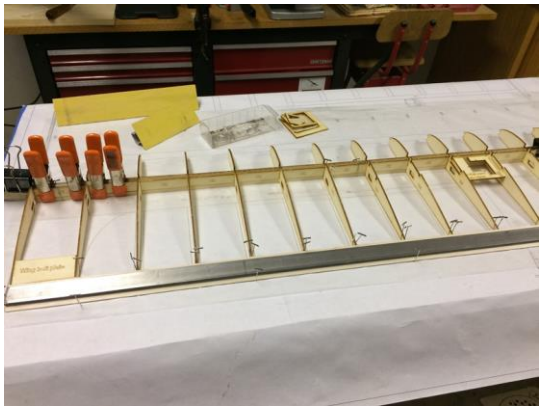
- The S1 and S2 shear webs set the spacing between the W1 and W2 ribs. They also form the “box” that the spar joiner blade will fit into. You can cover one of the plywood spar joiners with wax paper and use it as a spacer when gluing in S1 and S2 parts.

- This same “box” will be created at the outboard end of the center panels and on the inboard end of the tip panels. Add the stack of wing bolt plates (note that it is easier to laminate these parts together and sand the top taper before gluing them between the ribs). These form a hard point for the wing bolts and need to fill the space between the top and bottom balsa wing sheeting.

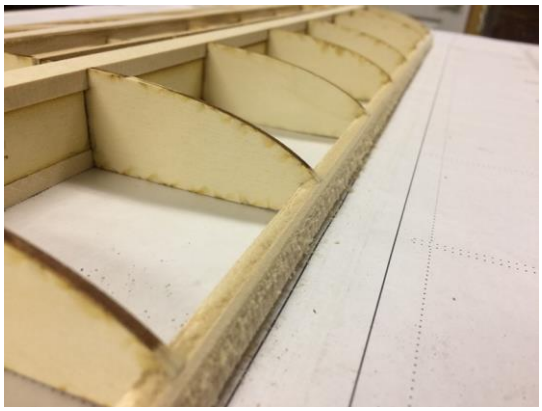
- Continue out board adding a shear web and then a rib, another shear web and then another rib. Add the spoiler servo mount plate being very careful to get the correct orientation. Add the TE parts along the trailing edge (they are like mini shear webs). The servo mounts are made to exactly fit the Spektrum A7020 or A7050 thin wing servos.



- Glue on the top trailing edge balsa sheeting strip. We used a piece of steel as a weight to hold the trailing edge flat on the workbench. (Various pieces of steel are available at Lowe's or Home Depot and make handy tools for model building.)

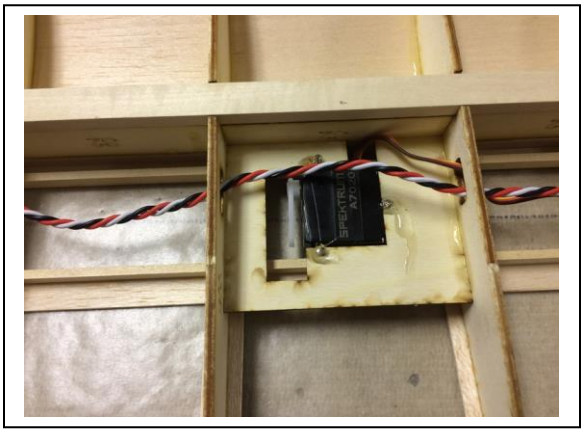


- Glue the 3/8" x 3/8" balsa leading edge in place and sand the top edge so it follows the contour of the ribs. Top wing sheeting will be glued down over this edge. One method of applying the balsa wing sheeting is to use Deluxe Materials Speed Bond glue and a hot iron. Glue is applied to both surfaces to be joined and allowed to dry. Start by ironing along the spar and work forward over the ribs and then on to the leading edge.



- Add the 1/8" x 1/4" basswood strips to front and back edges of spoiler pocket. Balsa wing sheeting and cap strips can now be added. Study the plan to see where the sheeting fits relative to the spoiler pocket, spar line, and wing root area. Once the glue has set, the wing panel can be removed from the workbench and turned over. Fit the spoiler servo in place and string the servo extensions through the ribs before going on to complete the bottom sheeting and cap strips.

- Do not use the rubber grommets on the servo mounts. Servos are hard mounted directly to the servo mounting plates. Best to program your radio, attach the servo arm, and adjust for the correct travel of the spoiler servo. Also make sure there is enough clearance around the servo arm for the spoiler door stirrup to retract down into the wing. We applied a dot of Zap Goo to the points of the servo mounting screws.

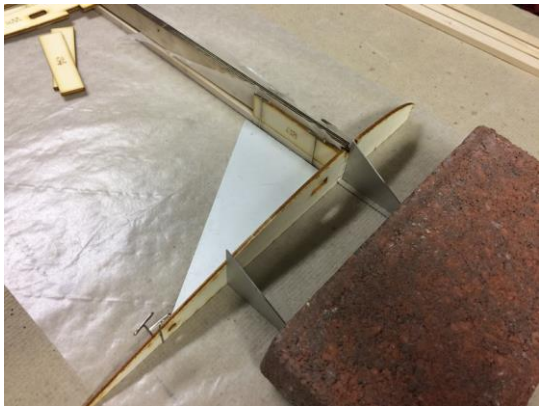


- Servo arm needs to be in line with the midline of the servo case in the retracted position and at about 70 degrees to the midline in the fully deployed position. Make an exit hole for the servo extension in the bottom wing sheeting at the root end. Add part W6b to reinforce the alignment pin hole.

- Once both center panels are completed, fit them together over the center wing joiner with the laminated center rib in place. The center rib may need to be sanded to fit flush with the top and bottom wing skins. Much easier to do this before the panels are joined! Prop up both wing tips an equal amount, align the trailing edges of the two panels along a reference line, and once satisfied epoxy wing joiner, center rib, and two panels together.

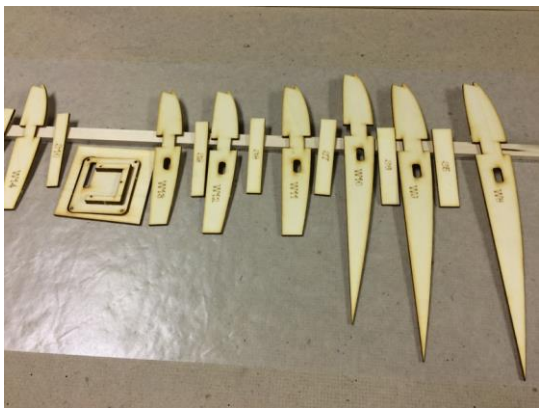
- Reinforce the center joint with a wrap of fiberglass top and bottom. This hardens the balsa surface and helps prevent crushing of the balsa sheeting when tightening the wing bolts.

- We did not build the wing tips over the plan. Instead, we use the reference lines on our workbench. Take time to get the spar, first rib, and shear webs properly aligned. The wing tip joiner was wrapped in wax paper and used as a spacer. Building squares were held in place with weights while glue dried.

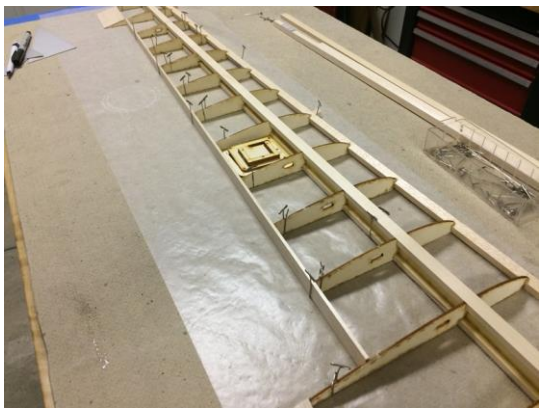


- Add the next rib checking that it is square with the spar.
- Continue out the spar adding a shear web and then a rib checking that each rib is square with the spar. Pin the rib trailing edge of each rib to hold it squarely in place.

- Add the aileron door support between ribs W13 & W14
- Note that there are no shear webs after rib W17. Keep the spacing of ribs W18 – W21 uniform with the rib spacing between W6 & W17.



- The door to the aileron bay is also the servo mount. Laminate the servo mount parts to the door being careful to set the correct orientation.
- Add the 1/8” thick balsa trailing edge to the back of the ribs in the aileron cut out. Cut this piece to follow the taper of the wing before gluing in place. Once secured in place, sand to top edge to the contour of the ribs.



- Add top spar, top trailing edge sheeting, and 3/8” square leading edge. Shape the top of the leading edge to follow the contour of the ribs. Using a razor plane speeds this process.

- Lay the top wing sheeting over the wing and mark the root and tip overhang. Cut off this excess sheeting and save it for the next section to be covered.

- Glue the top front section of sheeting in place. Add top trailing edge sheeting as shown on the plans.

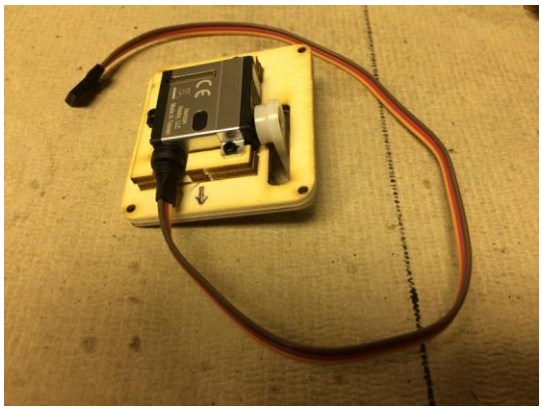
- Using the excess piece cut off in the last step, fit it in place between the top front section of sheeting and the trailing edge of the aileron cutout. Scribe a curve on the root end (as per the plan) and glue in place.

- Cut a curve on another small piece to complete the top sheeting on rib W10. Add cap strips to ribs W6 – W9.

- Add part W6b to the inside of rib W6 to reinforce the alignment pin hole.

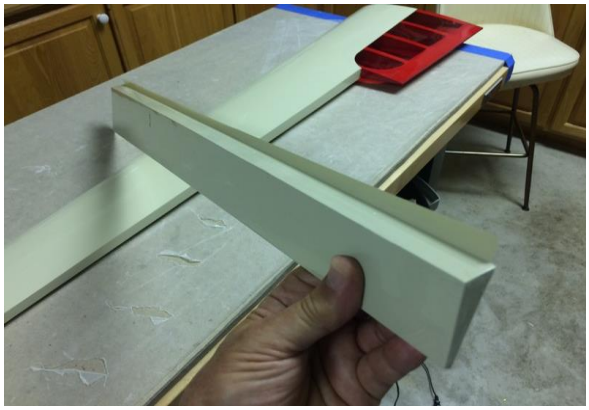
- Flip the wing over, install the aileron servo extension cable and then add sheeting as was done on the top side. The plywood end cap rib is added, and the leading edge is sanded round. After a final sanding to level out any uneven joins, the wing is now ready to cover.

- Laminate all the parts together for the servo doors/mounts. This is a good time to program your radio and set up the servo travel. Install the servo arm and mount the servo on the door/mount.



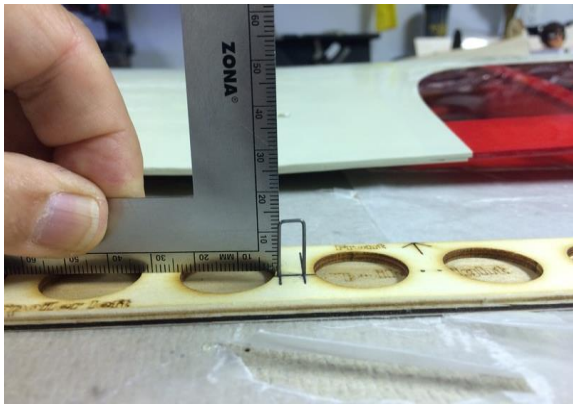
- Aileron ribs are added to the bottom pre-cut sheeting using the laser etched lines as a guide. Add the 1/8” balsa leading edge piece and sand it to the taper of the ribs. Add the top sheeting and final sand the ailrons.

- The ailerons are top hinged using two strips of covering material (one on top side and one on the under side) to make the hinge.



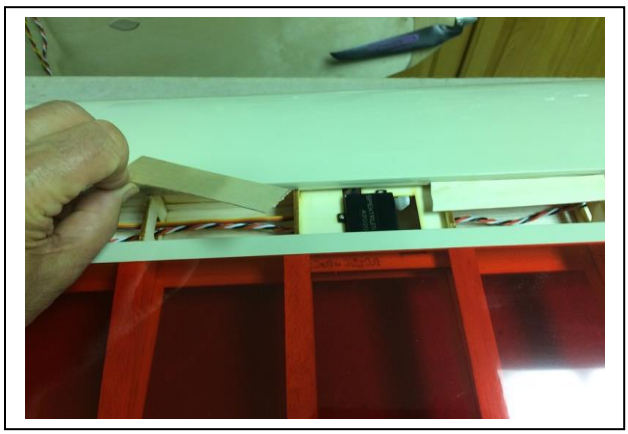
- First, add a strip of covering about 3/4" wide to the top edge of the aileron. Then, holding it place against the wing in the down position, seal the strip to the wing. Then flip the aileron over onto the top of the wing and apply a second strip of covering over the bottom side of the hinge line. Move the aileron back to the neutral position and go over the hinge line with your iron to seal the top and bottom pieces together. Add the G10 aileron horn in the precut slot and make an aileron pushrod using 2-56 threaded rod and clevis.

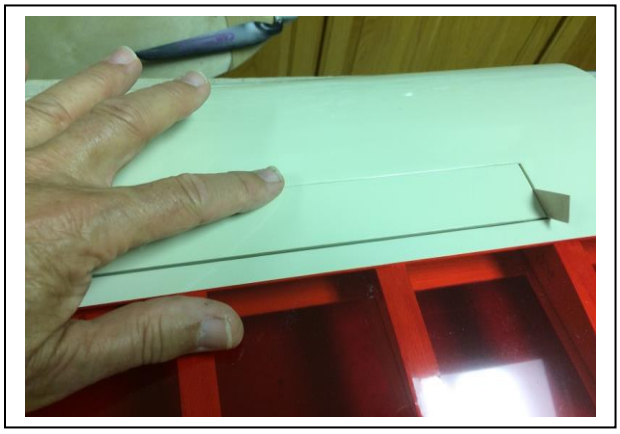
- Bend 1/32” music wire to make the spoiler door stirrup (note sketch of this on the plans). Stirrup needs to be about 5mm wide and extend down into the wing about 12mm (wire should be about 17mm tall). Wire is pushed through holes in the spoiler blade, glued in place with thin CA, and cut off flush with the outside surface.

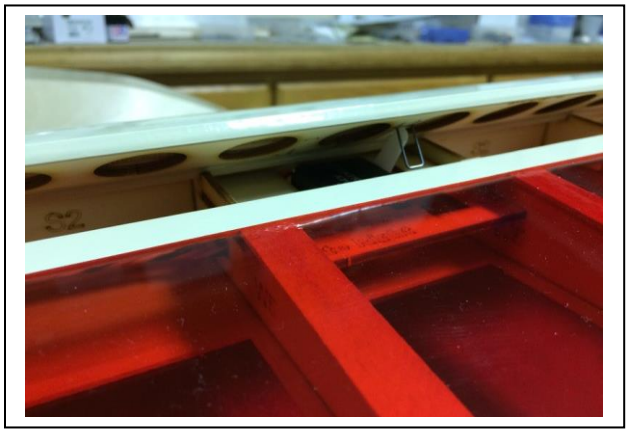


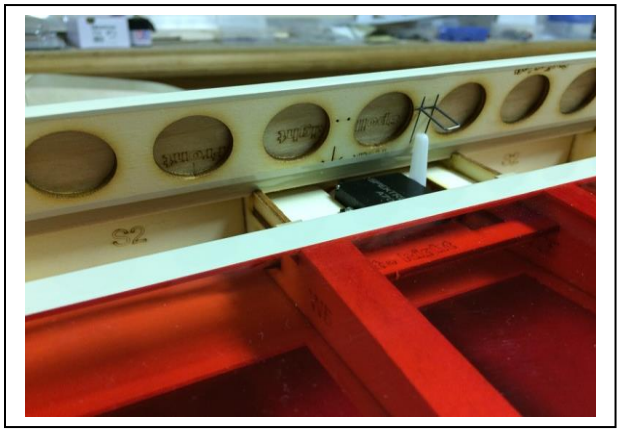
- Place shims in the spoiler bay to raise the outside of spoiler flush with the top of the wing. Use shims to hold the spoiler in the center of the opening to allow for friction free opening and closing. Now you can apply a 3/4” wide strip of covering to form the hinge line. Spoiler does not require a second strip on the underside. Servo arm pushes the spoiler open and

engages the music wire stirrup to hold the spoiler closed. Springiness of the covering hinge naturally wants to close the spoiler as will the air pressure against it in flight. There is no direct connection between the servo arm and the spoiler blade.





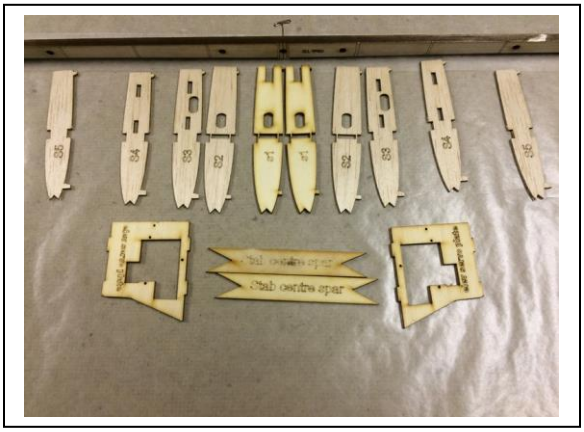




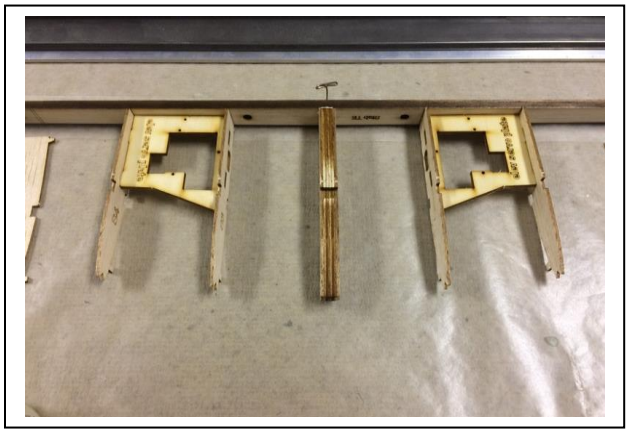
Stab/Elevators

- The horizontal stabilizer and elevator halves are tapered structures. Peter's design provides building tabs on the ribs that allow these structures to be built on a flat surface. As the ribs are removed from the carrier sheets, be cautious to not break off these tabs.

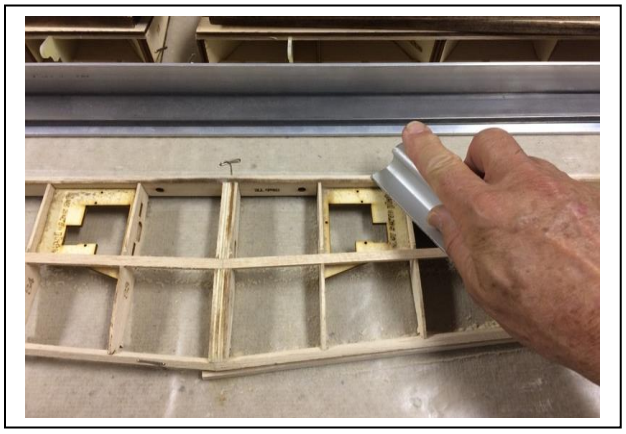
- Locate all the stab parts and arrange them in order to start the build.

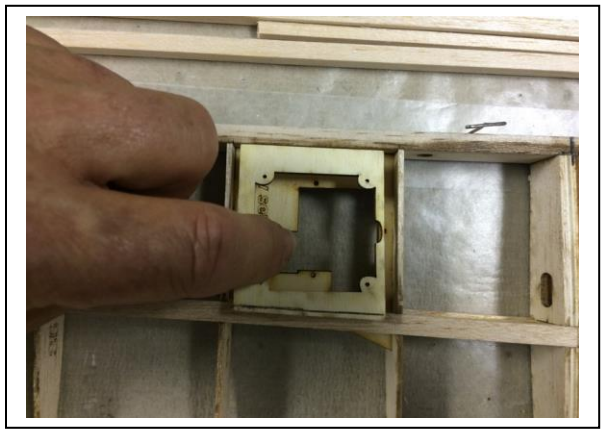


- Pin the stab TE to a straight reference line on your workbench. Note the predrilled holes for the hinge points. Also note the tabs that hold the hinge line level with the workbench surface. Laminate the center S1 & S2 ribs together and glue the elevator servo mounting plates between ribs S3 & S4. Glue all the ribs to the TE. Next, add the spar and the leading edge. To orient yourself, the bottom of the stab facing up here.

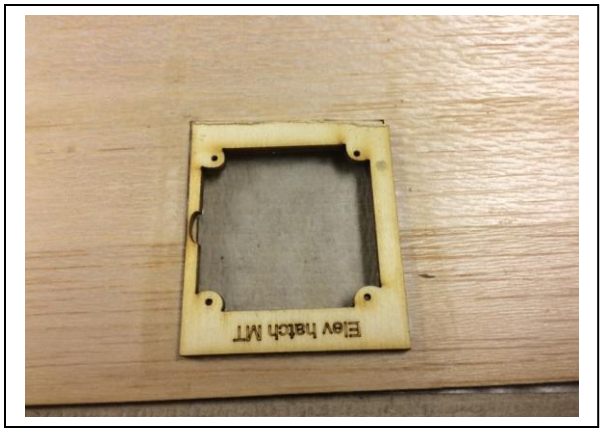


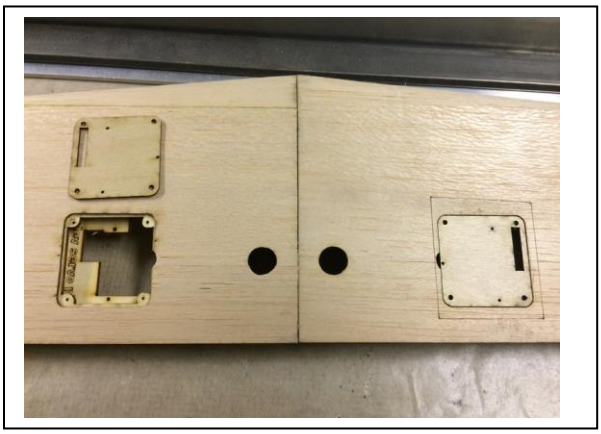
- Sand the TE to follow the contour of the ribs (be careful about pressing down too hard on the structure so you don't break off the leveling tabs on the ribs). Test fit the Elevator Hatch Mount between ribs S3 and S4. It needs to fit tight against the TE and rib S3. Trim the front side as needed to achieve this fit.





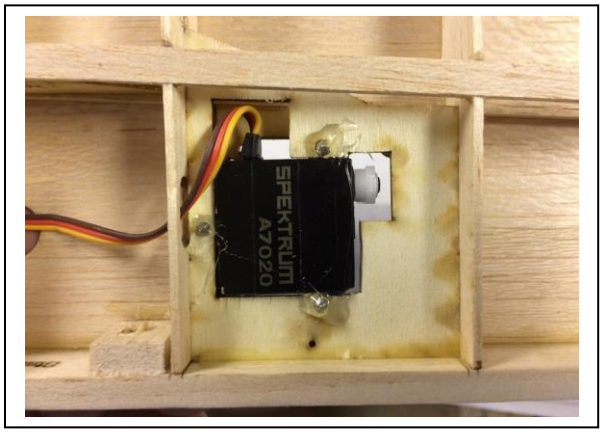
- Glue the Elevator Hatch Mount to the bottom stab skin using the laser etched outline as a reference.
- The bottom stab skins are slightly oversize on purpose, so pay attention to this next step!
- Test fit the skin to the stab keeping the Elevator Hatch MT frame tight against rib S3 and the TE. The center line edge where the two skins meet will need to be trimmed on each half to make a clean center line joint.

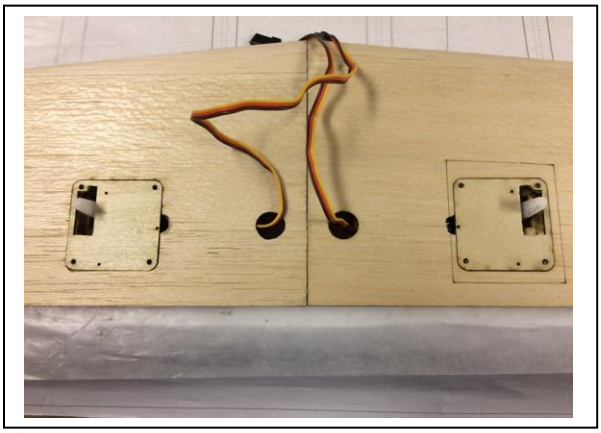




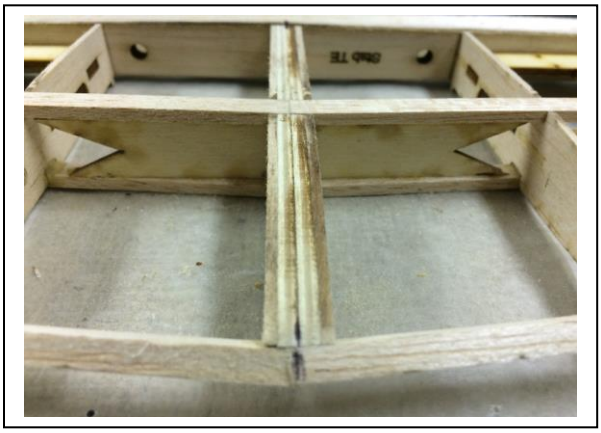
- Install the elevator servo arm and screw it to the servo mount plate. (again, this is a good time to program your transmitter and to set the servo travel for the elevator servos). Do not use the rubber grommets, hard mount the servo directly to the plywood plate.

- Recommended elevator servo is Spektrum A7020 thin wing servo. Use the supplied long double arm with one side removed. Pull the servo leads through the ribs and out through the holes in the bottom skins. No extension is needed.



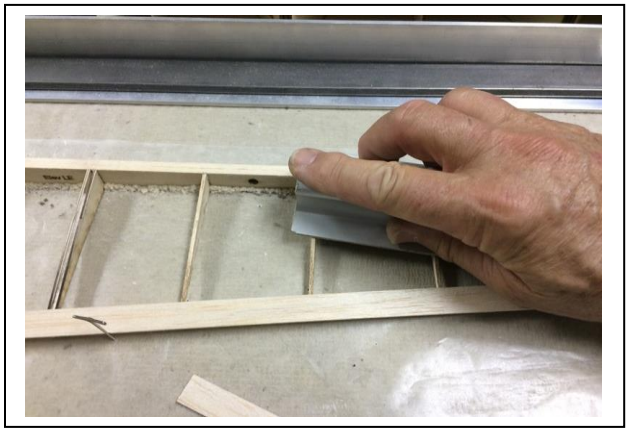


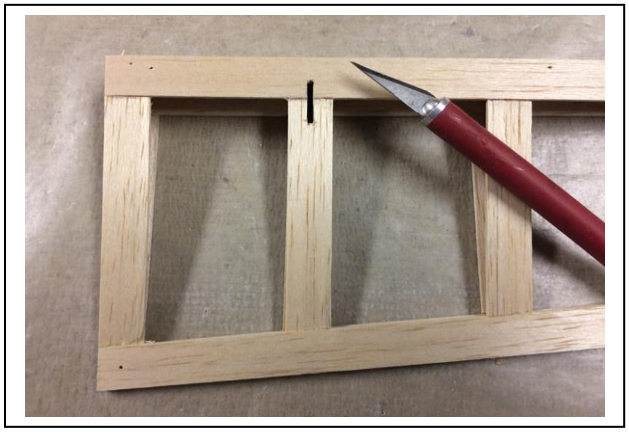
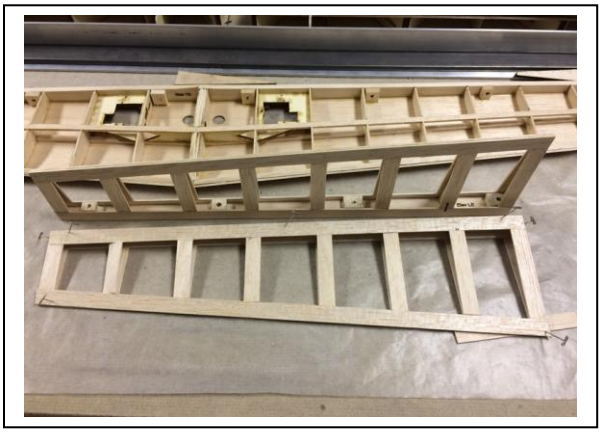
- Add the balsa “donut” pieces to the inside of the TE to extend the holes for the hinge points. Sand the stab spar joiner to fit between the top and bottom spars. Then, add the top spar. Break off the build leveling tabs and sand the TE and ribs to contour. Add the top skins, trim off excess, and sand leading edge round. Add Stab tips and final sand the stab.



- Elevators are constructed in a similar manner. Use a scrap piece of 1/16” balsa to make a spacer between the E2 ribs. This forms the slot for the G10 elevator control horns. Once constructed, add the balsa donuts to the inside of hinge point holes.



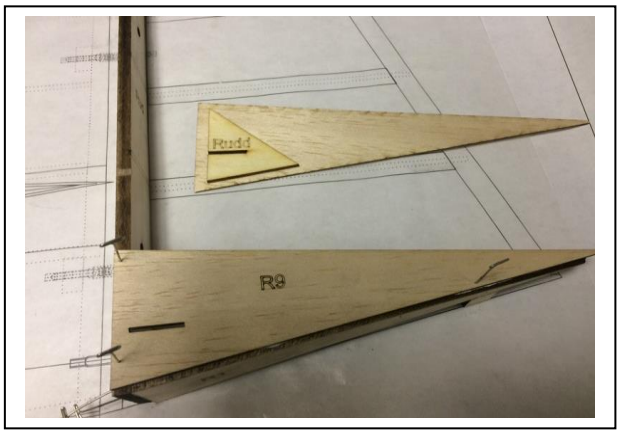


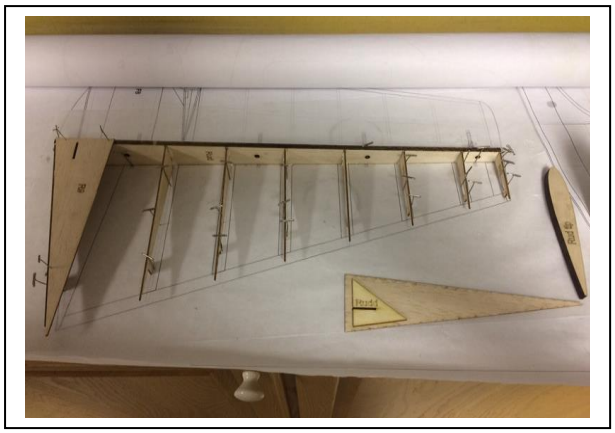



Add the LE to the elevator halves and sand it to a V along the center hinge line. Add the tips and sand to final shape along with the stab.

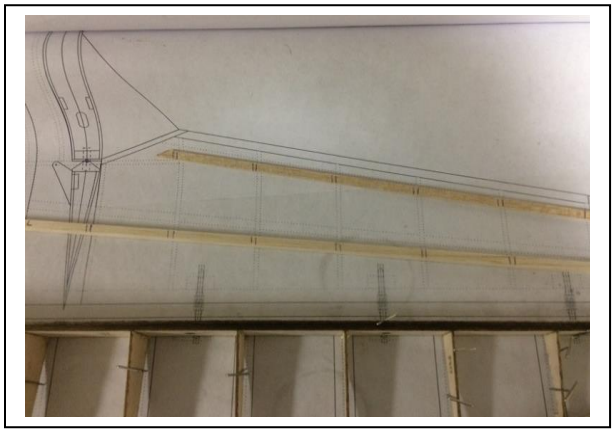
Fin/Rudder

- Locate all the parts to complete this section. The ribs have build tabs that allow the structure to be assembled on a flat surface without the need for special shims. The leading edge of the rudder is like the elevators. There are two pieces with pre-drilled hinge point holes. One is used in the initial construction of the rudder and the second is added later and sanded to a V along the hinge line. We used dowel pins to align parts.

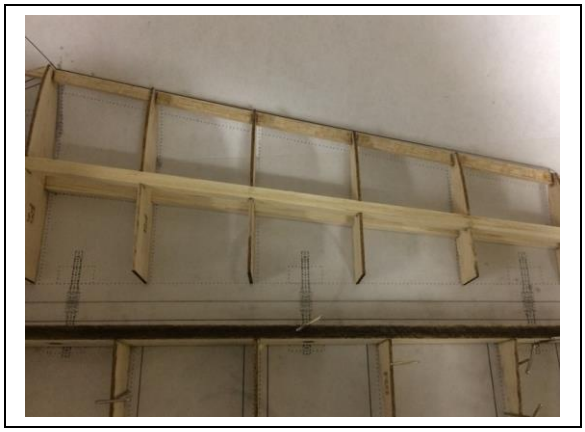




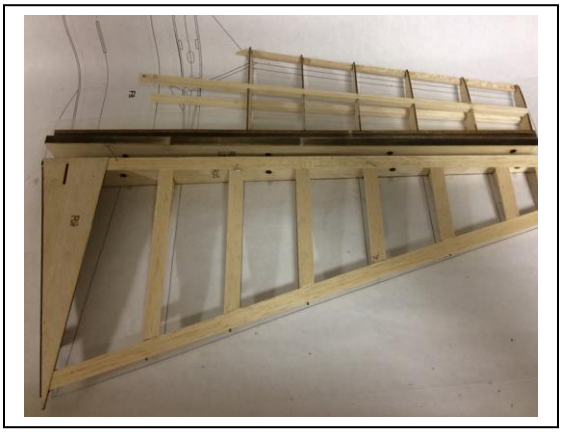
- Using the plan as a reference, cut the fin spars and leading edge to length and mark the location of the ribs.



- Dry fit the parts together and make sure the slant of the ribs is correct according to the plan. Once you are sure, tack together with thin CA.



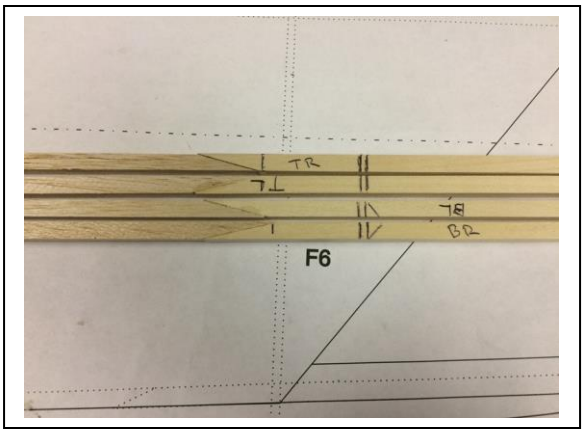
- Stand this structure on the fin tail post using the etch lines to place the ribs and make sure the ribs are centered over the centerline of the hinge point holes. Once you are sure everything is aligned, glue in place.



- Bring the fin and rudder together to check the alignment of the hinge point holes. Add the donuts to the inside of the fin hinge point holes.

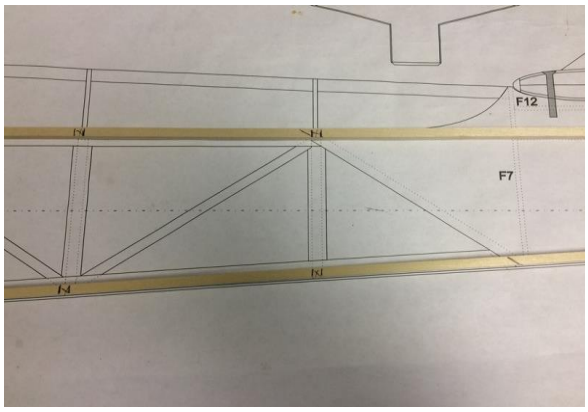
- Leading Pre-cut fin sheeting is added to both sides. Excess sheeting along the leading edge is trimmed away, leading edge is flat sanded, and leading-edge balsa is glued on. Finally, sand the leading edge to a rounded shape.

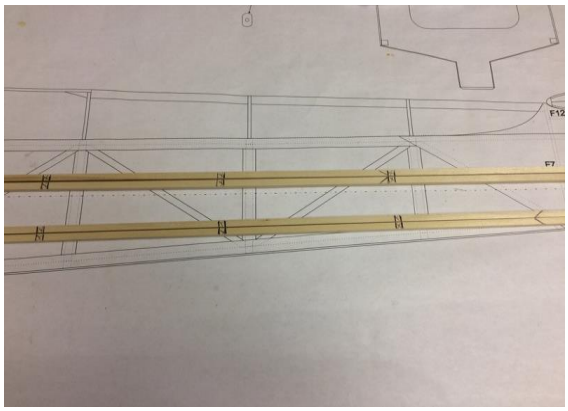
Fuselage

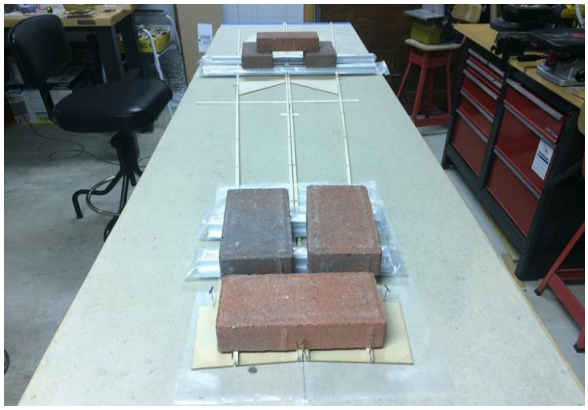


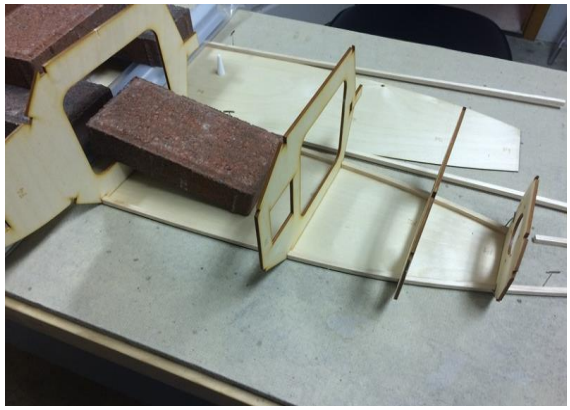
- Fuselage has a top and bottom 1/4" square longerons that run its length. These are constructed by scarfing together 48” balsa and basswood sticks.

- Using the plan as a reference, transfer the position of the formers onto a pair of the longerons. Next, copy these marks to the other pair of longerons. Note that the balsa half is the front and the basswood half is the rear of the longerons. Since nearly the entire length of fuselage is flat on the bottom, the left and right fuselage sides were aligned along a straight reference line on the workbench bottom to bottom. This is an easy way to make the left and right mirror image fuselage sides. The longerons need to be supported with 1/8” shims between the front and rear plywood fuselage side panels. We used paver bricks as weights to keep parts flat on the bench while the glue dries. The front balsa longerons get bent to follow along the outside edge of the side panels. The formers can be used to set the spacing (but don’t glue them in place).

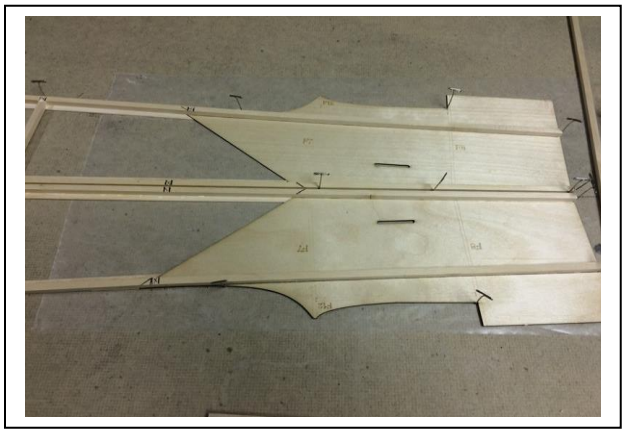
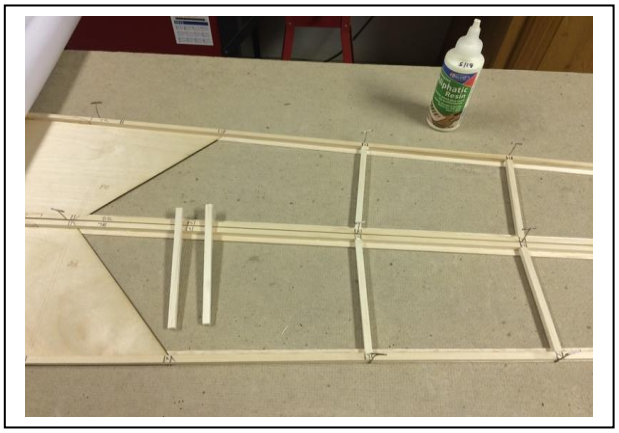
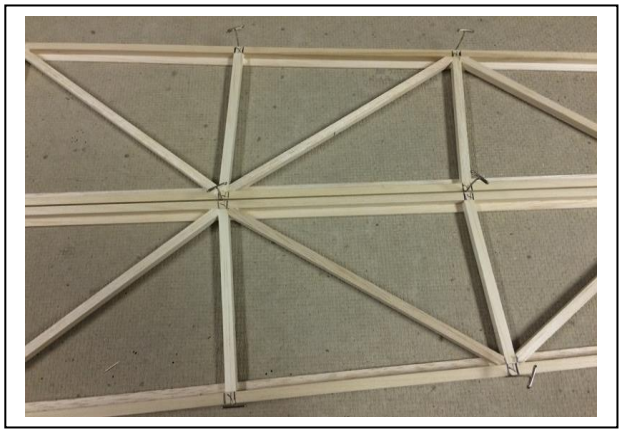
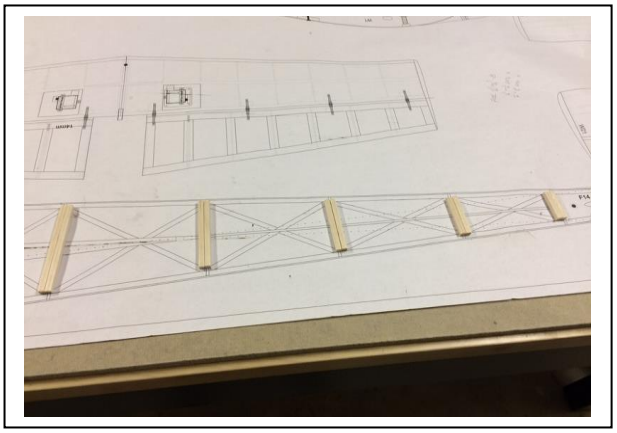




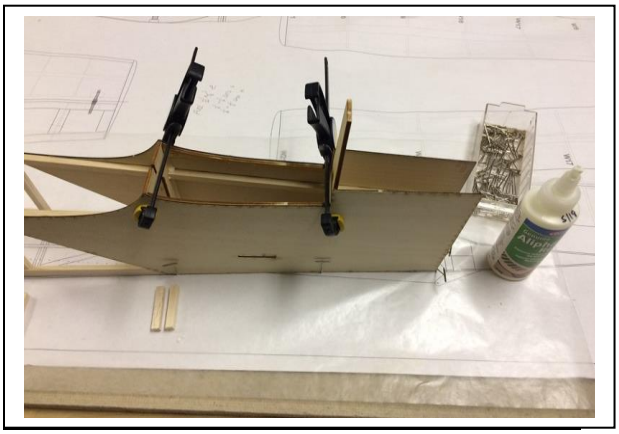
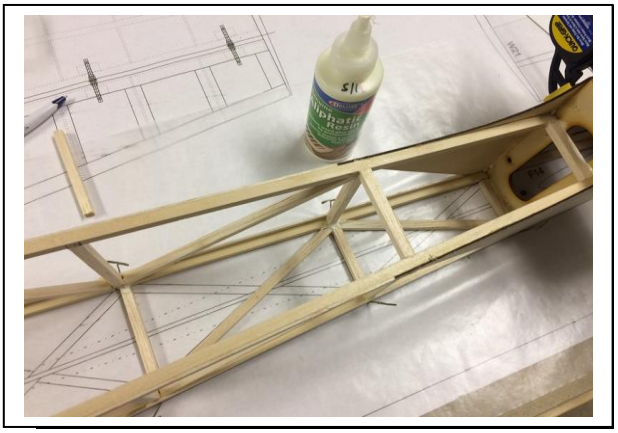




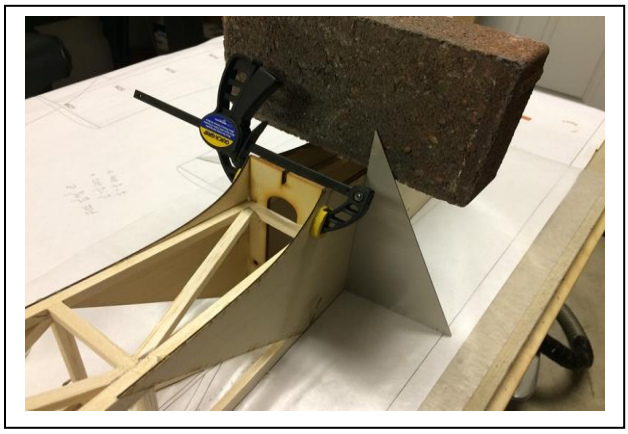
- Once the longerons are set, pins are used to lock the fuselage sides in place on the workbench surface and 1/16” x 1/2" balsa strips are added to the outside of the 1/4” square longerons. This creates a lip for the 1/4" square sticks that make the aft fuselage formers. Add the vertical parts and then the diagonal parts to each side. Make pairs of cross pieces (that complete the aft fuselage formers) using the plan as a reference.

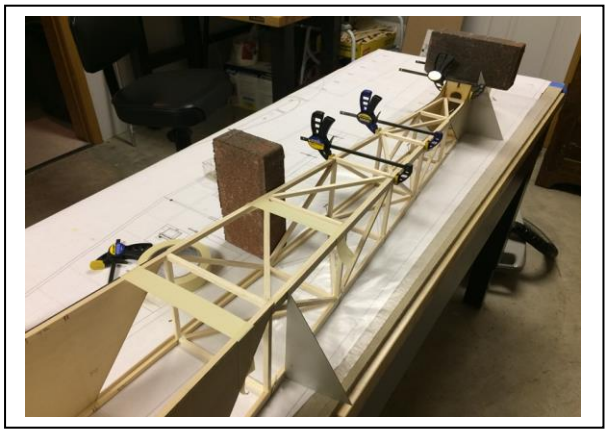





- Stand the fuselage sides up over the plan. Starting at the rear, add cross pieces and work forward pinning and clamping while keeping sides flat on the workbench.

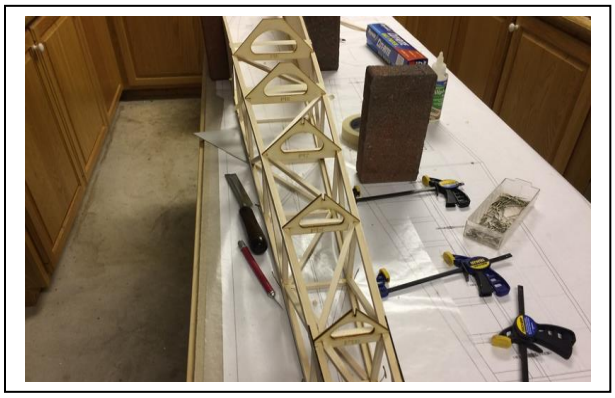



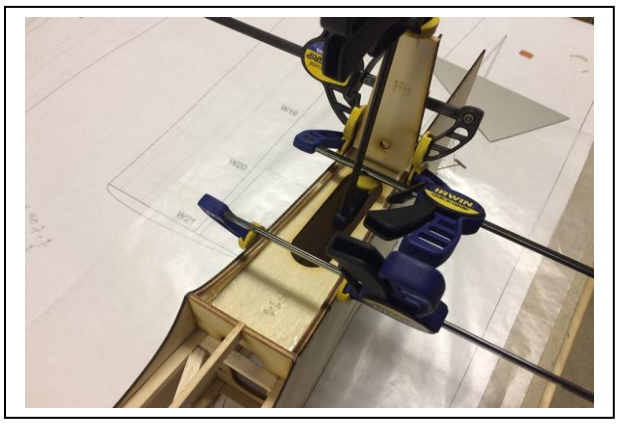
- Continue working forward adding the cross pieces and then the diagonals to form the fuselage truss work. Use weights and builder's triangles to keep fuselage sides perpendicular to workbench surface.



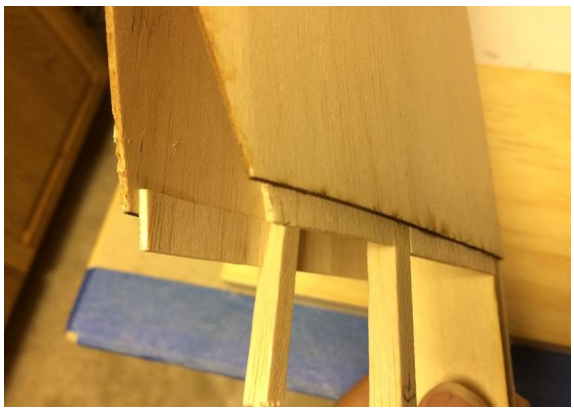


- Add the top fuselage formers F15 – F19 and then top 1/8" x 3/8" basswood spine between F15 and F7. Add F14 and F8. Clamp in place and check that fuselage sides remain aligned over the plan and perpendicular to the workbench surface. Install the fin structure into the aft fuselage section and check for fit and alignment, but don't glue parts together yet.

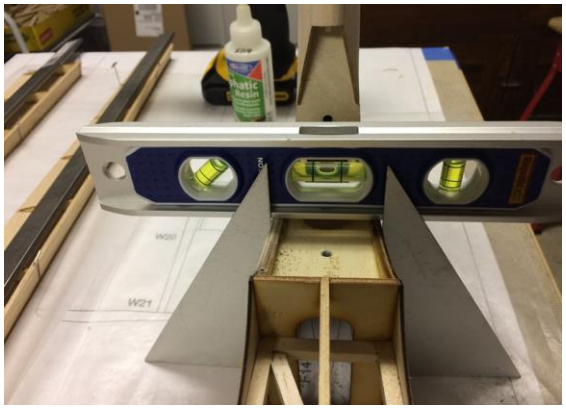




- Separate the fin from the fuselage and add pieces of 1/16” scrap balsa to the lower edge of the fin sheeting. When the fin assembly is reinserted into the fuselage, the lip created by adding the scrap balsa makes the joint between the plywood fuselage sides and the fin sheeting sides blend together with a smooth joint.



- Check the stab mount for level and the fuselage sides for square. Position the stab on the fuselage, drill hole for hold-down bolt, and install blind nut on the underside of F14.



- So far, everything has been done with the fuselage bottom flat on the workbench surface. Because of the keel tabs on the bottom of formers F2 – F6, the fuselage will need to be elevated to give them clearance.

- To begin, Use F1 and masking tape to pull the front fuselage sides together. Do not glue F1 in place. Use enough masking tape that fuselage sides will not separate from F1 as formers F2 – F6 are friction fit into place. With the fuselage elevated over a straight reference line, sight down through the fuselage to see if the sides align. Because of the different density and bending resistance, one side might want to be straighter than the

other and cause the nose to be offset to one side. If this happens, use a razor saw to make partial cuts through the 1/4" longerons on the side resistant to bended. Make enough cuts to gain symmetry between the sides.

- Note the lack of symmetry between the right and left fuselage sides and the angle of F1 to the centerline.

- Cuts were made in the right side longerons and the sides were brought into symmetry and F1 is now square with the centerline.

- Block the fuselage in place over a straight reference line and check for alignment and level before gluing in any of the formers F1 – F6.

- Sight down the fuselage and check for symmetry of the sides and that fin is perpendicular. Once satisfied, use thin CA to tack the formers in place. Use a good quality wood glue, like Deluxe Materials Aliphatic Resin, to reinforce all joints between the formers and fuselage sides.

- Add the battery box panels, the tow hook mount plate, and the rudder servo mount. Make sure servos fit properly in these mounts before gluing them in place.

- Motor battery is an E-flite 4S 30C 14.8V 4000mAh LiPo pack.

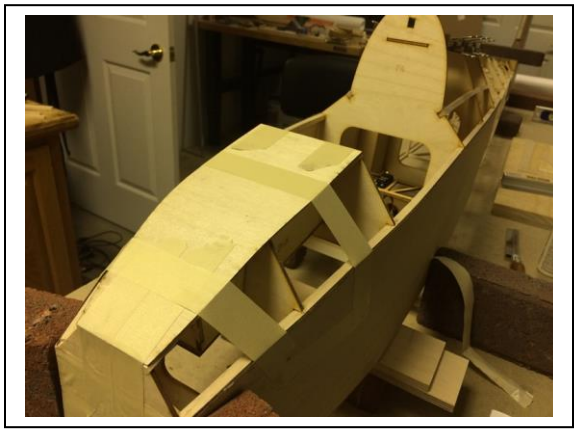
- Tow release servo is a Spektrum A6320.

- Rudder servo is a Spektrum A5060.

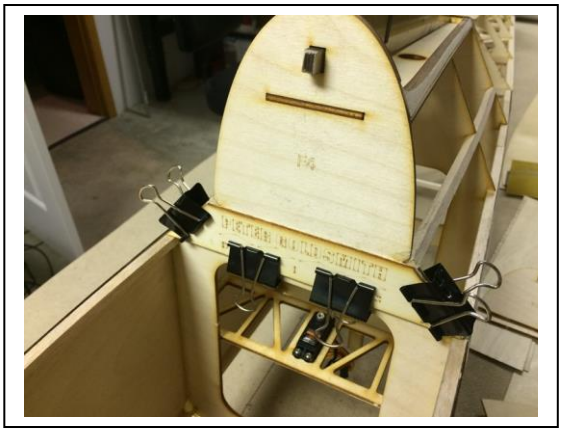
- Add bent wire for the tow release and the blind nuts for the motor mount (note that they go on the front side of F1).

- Add F10 and F11 parts to the top of the fuselage. Set completed wing center section in place and check for fit in wing saddle. Once satisfied, drill through wing into F10 to make wing bolt attachment. F15 is laminated to the bottom of F10 and blind nuts are added to the bottom side of F15 for the wing bolt attachments.

- Add the stringers between F1 and F3. Sand the top side of them flat with the tops of formers F1 – F3. Glue on precut 1/32” plywood skin.

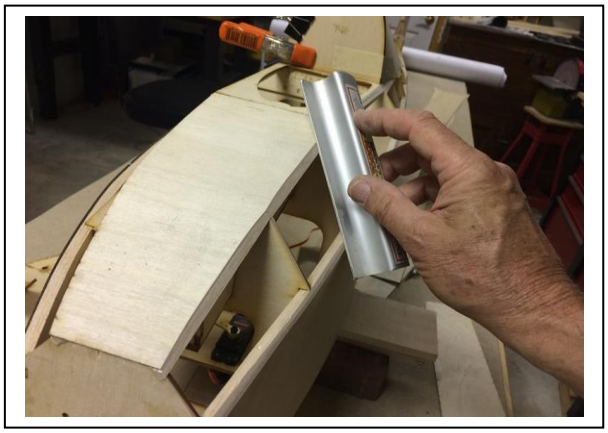


- Locate part F13 and glue in place.



- Add the canopy base and then F4b.

- A blind nut will be added to the underside of the canopy base to secure the front of the canopy.

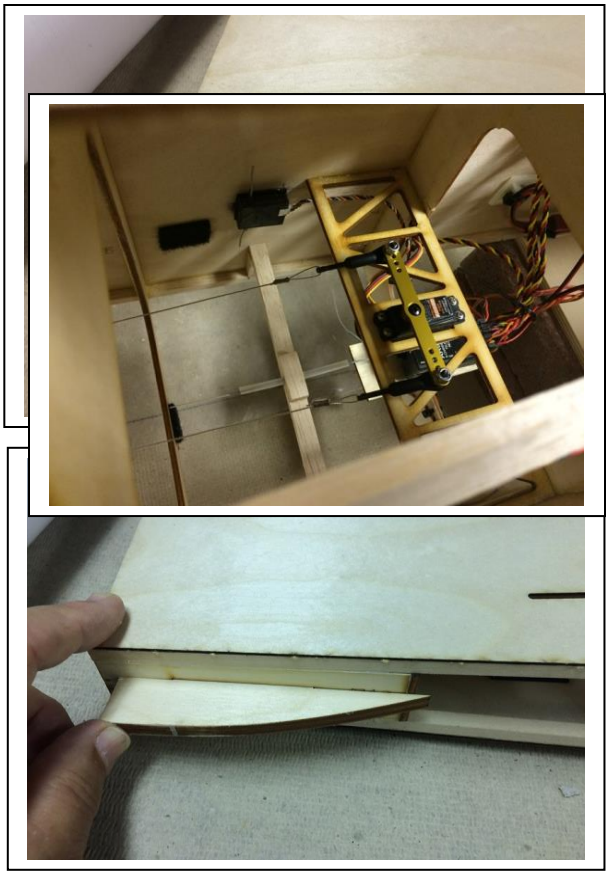


Flat sand the space between the top stringer and fuselage side and add another section of the pre-cut 1/32” plywood sheeting. Continue on back with the next section of 1/32” plywood sheeting and then up between the wing mount and angled side.

- Lightly sand off the sharp corners.

- Remember to secure the wing hold down blind nuts with epoxy before you cover the other side of the upper fuselage.

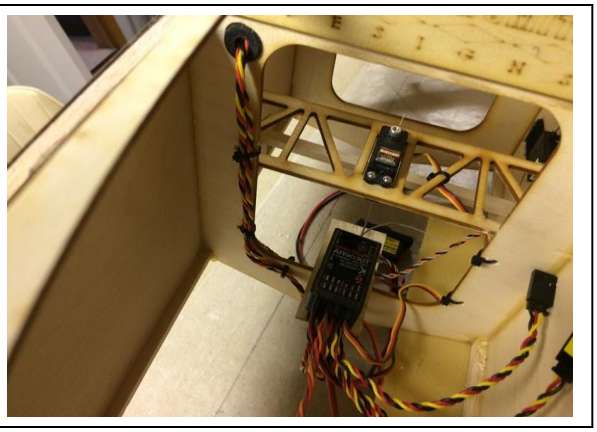
- Add the tail skid parts.

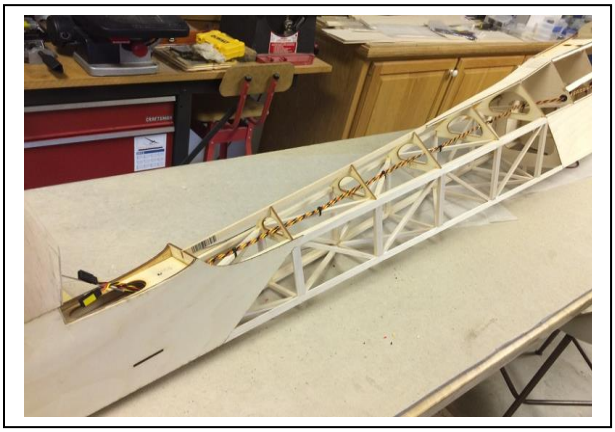


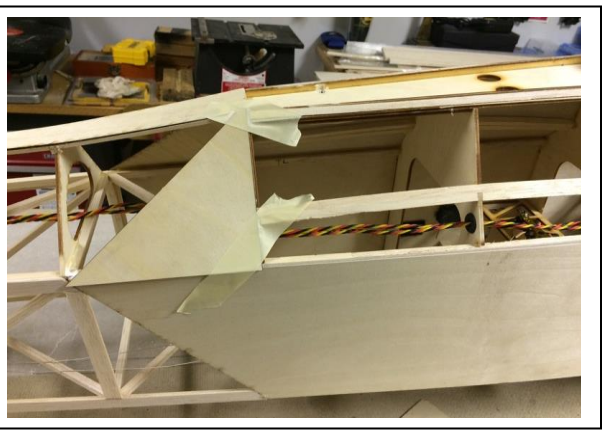
- Glue Install the G10 control horns into the slots on both sides of the rudder. Install double arm on rudder servo and run cable for the rudder pull-pull system.

- This is also a good time to decide where and how you will mount your receiver, receiver battery, switch, and Electronic Speed Control for the motor.

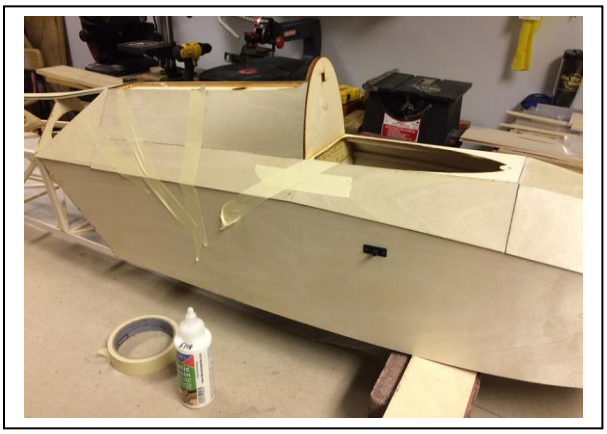
- We added a receiver mounting plate to the F4 former below the rudder servo mount. You will also need to run the servo extension wires for the elevator servos. We used rubber grommets in the holes we made for the wiring to pass through.



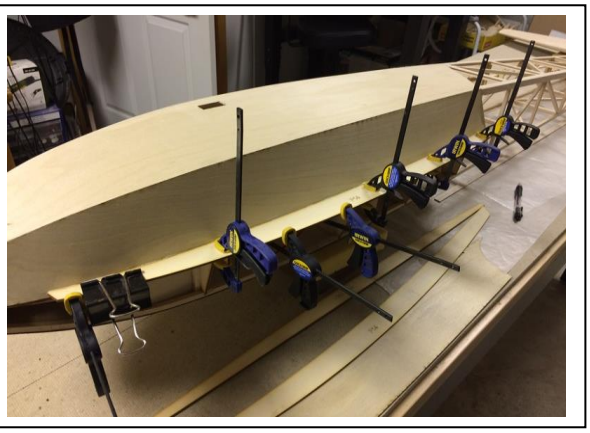


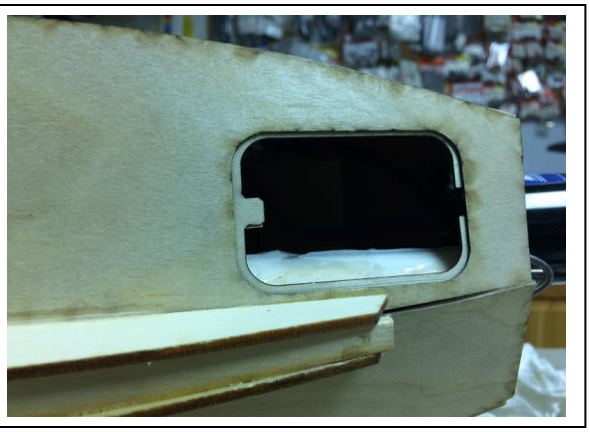


- Add the 1/32” plywood sheeting to the right upper side and sand off sharp corners.

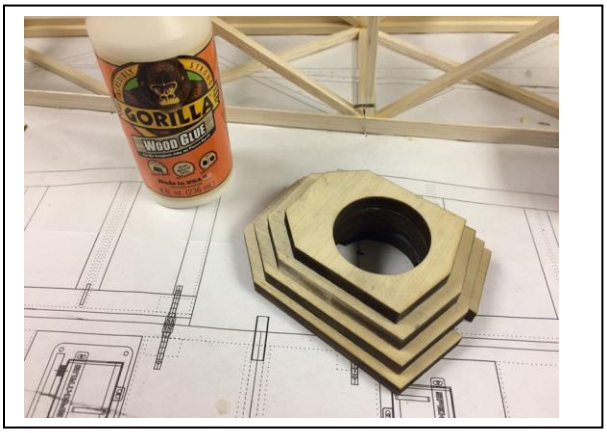


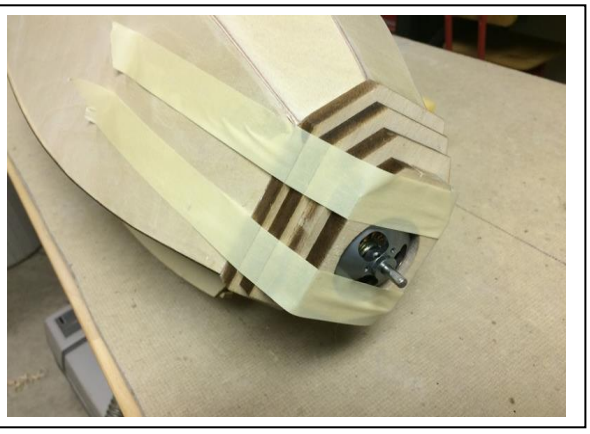
- Add the bottom 1/32” plywood sheeting and the plywood keel sides and bottom to finish out the fuselage.





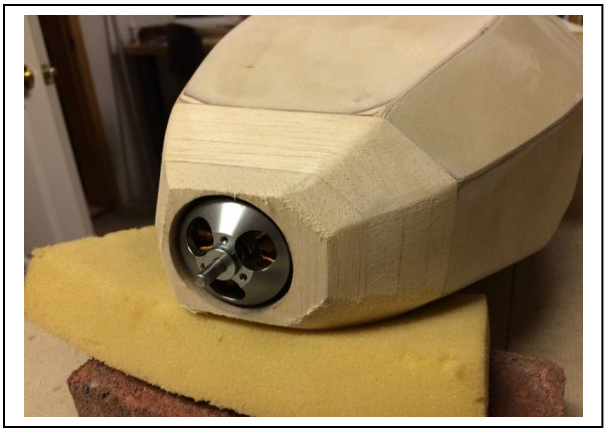
- Fit access door to fuselage bottom and use a screw to hold the door shut. Use scrap pieces to box in both ends of the keel and sand off the sharp corners.
- Laminate the balsa nose blocks together and then add them to the front of the fuselage making sure that there is clearance around the motor.





- Sand off the “steps” to contour the nose blocks into a smooth shape.

- Do this on each of the flat sides.



- Make a recess in the final nose block to fit over the front of the motor. Also make an air inlet to allow cooling air to be drawn through the motor.

- Glue the nose block to the front and sand to blend it into the curved lines of the nose.

- We opted for a natural exposed wood finish and used four coats (sanded between coats) of Miniwax water base Polycrylic Clear Satin Protective Finish on the 1/32” plywood surfaces and the balsa nose blocks.
- Peter finished his model with Zap Epoxy Finishing Resin for a deep gloss finish.

- Canopy uses a 4-40 bolt to secure it in place. A small hole needs to be drilled in the front of the canopy to access this bolt.
- We balanced our model in the center of the range shown on the plan (100-110mm) and used about a pound and a half of ballast.
- Finished model, including receiver and motor batteries, weighs 12lbs 11oz.

Takeoff Dolly

- Plywood parts are included to construct the takeoff dolly. You will need a pair of 4-1/2” wheels to complete.
- Drill a hole in the bottom of the keel to locate the dolly as shown on the plan. This needs to be a very loose fit so dolly will easily fall away on takeoff!

Pilot Figure is available through www.petergoldsmithdesigns.com

Pilot bust is very lightweight and is easily painted with water based acrylic flat paints.

Completed Prototype built by Peter Goldsmith (Caroline Goldsmith holding model)

Completed Kit #1 built by Jim Dolly (view build thread on www.forum.scalesoaring.com)

Specifications:

- Wing Span: 188” (4.7m)
- Fuselage Length: 85” (2.18m)
- AUW: 12-13 pounds
- Airfoil: Modified SD3021

Items Used to Complete Model

Spektrum Servos:
- A5060 (SPMSA5060) (note: need one of these for the rudder)*
- A6320 (SPMSA6320) (note: need one of these for the tow release)
- A7020 (SPMSA7020) (note: need four of these, two for elevators and two for spoilers)
- A7050 (SPMSA7050) (note: need two of these for the ailerons)

*Hangar 9 3D XL Full Servo Arm 4-40: JR (HAN3576) (note: need one of these for the rudder pull-pull system.

Motor system:
Motor: Power 32 Brushless Outrunner Motor, 770Kv(EFLM4032A)
Speed Control: 60-Amp Pro Switch-Mode BEC Brushless ESC (V2)(EFLA1060B)
Prop: 14 x 8 Folding Prop with Aluminum 38mm Spinner(EFLP14080FA)
Motor Battery: 14.8V 4000mAh 30C 4S LiPo, 12AWG: EC3(EFLB40004S30)

Launch Dolly:
DuBro Treaded Lite Wheels 4-1/2"
(DUB450TL) (note: will need two wheels)
DuBro 3/16" Dura-Collars (4) (DUB141) (note: will need four and there are four in one pack)
3/16" Music Wire axle (note: will need piece 4-1/2" long)

Hardware:
Dubro Products
- 4-40 Pull-Pull System (DUB518) (note: comes with 4-40 Kwik Links, but substitute 4-40 Ball Links on servo end)
- 4-40 Threaded Rod 12" (6) (DUB802) (note: 6 in pack, but only need one rod for tow release mechanism)
- 4-40 Heavy Duty Ball Links (2) (DUB899) (note: 2 in pack, but will need three ball links, so get two packs)
- 2-56 Pushrod w/ Kwik Link 12" (5) (DUB185) (note: 5 in pack and will need four, two each for ailerons and elevators)

Adhesives:
- Deluxe Materials Aliphatic Resin 112g (DLMAD8) (note: will need two bottles for general construction)
- Deluxe Materials Speed Bond 4oz (DLMAD10) (note: will need one bottle for sheeting using heat method)
- Deluxe Materials Cover Grip 150ml (DLMAD22) (note: will need one bottle to cover model)