Radio Controlled Soaring Digest

August 2015

Vol. 32, No. 08

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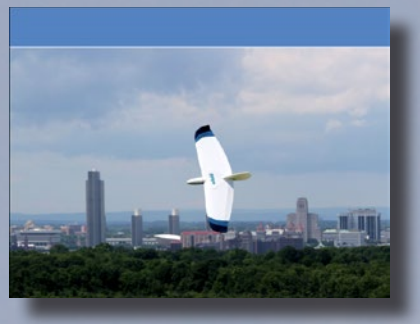

Front cover: Alula Trek with Empire State Plaza, Albany NY, in the background. Flown from a small roadside hill in Rensselaer NY about seven miles away. Dave Garwood's review of the Alula Trek begins on page 28 of this issue.
Photograph by Jim Harrigan.
Canon EOS Rebel SL1, ISO 400, 1/1000 sec., f411, 113.0 mm

Back cover: Kevin Farr's vermilion red scale P-38J-20 "Yipee" does a close pass near Cape Town, South Africa. For more information about this unique aircraft, see <http://www.armyairforces.com/P38-Yippee-m168870.aspx>
Nikon D90, ISO 400, 1/400 sec., f16, 170mm

R/C Soaring Digest

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In the Air

As long-time readers of *RC Soaring Digest* know, we have always been enthusiastic about building our own sailplanes. Whether of wood, foam, fiberglass, Kevlar or carbon, constructing an airframe from scratch has always been a thrilling experience for us.

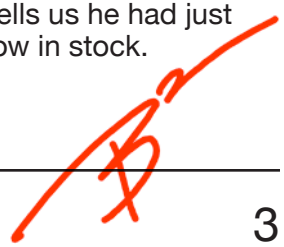
As a result of this drive, our major projects workroom, in a separate building, is filled with tools. Our "collection" includes the usual major power tools - 10" radial arm and table saws, drill press, 36" wood lathe, and a belt/disk sander - plus the usual plethora of hand tools such as pliers of various types, screwdrivers, wood planes, etc. And there's a Gast vacuum pump as well.

Our in-house building room is filled with smaller tools and projects, both finished and in progress, and a drafting table purchased at the now defunct Boeing Surplus. We have several hand drills, various saws and knives, clamps of several types, plus, of course, a number of Dremel roto-tools and accompanying accessories, etc., etc.

In looking over this vast collection, there are several items which get a lot of use. These tremendously helpful implements include machinist blocks we use to align wing ribs and fuselage sides, a selection of X-Acto blades and razor planes (see Pic 74 in Al Clark's Cherokee RM build, page 24) are used to shape balsa to a very fine degree, and heavy duty straightedges in 2', 4', 5' and 6' lengths.

We found a Dremel 580-2 table saw at a garage sale a while back and our search for a new drive belt led us to Bob Beecroft's aerosmith.com web site and from there to Bill Wilson's accessories for the saw. Bill's equipment is first rate, and it's sure to make our Dremel table saw one of our favourite power tools. If you have 580 series Dremel table saw, make sure you check out the reviews of Bill Wilson's miter gauge, cross-cut sled, dust plate/wobble lock and rip fence in this issue. As we're writing this, Bill tells us he had just finished making 45 miter gauges and they are now in stock.

Time to build another sailplane!



Construction log

1:3 Cherokee RM, Part 3

Edited from <http://www.rcgroups.com/forums/showthread.php?t=2127351>

Al Clark, hotdogx@knology.net

Fuselage construction continues

Turtledeck

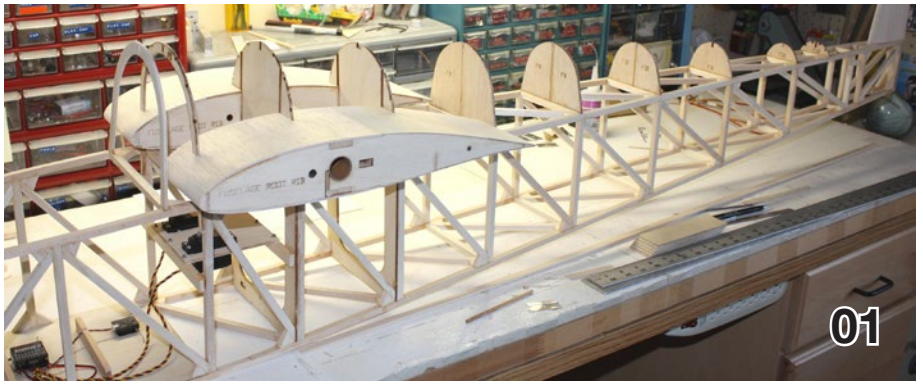
First step is to glue the T-deck former halves together. Then install all of the formers. They align flush with the back edge of the cross pieces. Make sure they are perpendicular to the longerons. See pix 1 & 2.

Notch out the main 1/8 X 3/8 basswood stringer between F4 and F5 to clear the 1/32" ply sheeting that will be added later.

Fit check the stringer with a long straightedge and make sure the top is straight before you glue it. Usually the former notches need a little tweaking to get it straight. See pic 3 & 4.

Total Energy Probe

Total Energy (TE) probes are generally located on the upper part of the vertical fin, or on top of the fuselage between the wings. On a model I believe the fin location is more subject to damage so I am using the location between the wings. For the vario, the TE probe is used in place of static air, but just using standard static ports in their usual location on the fuselage does not work well - thus the TE probe. I will be making my probe per the attached picture. I am sure I will have to do a lot of experimenting with it to get it to work properly, but that is part of the fun.



If you have a vario and plan to use a total energy (TE) probe, now is the time to install the TE tubing.

Cut a 5/32" notch in the main T-deck stringer just in front of former F7. Cut two 1 inch long pieces of 1/8" X 3/8" basswood and file a 1/64" notch into the center of each, then glue them to each side of the main stringer.

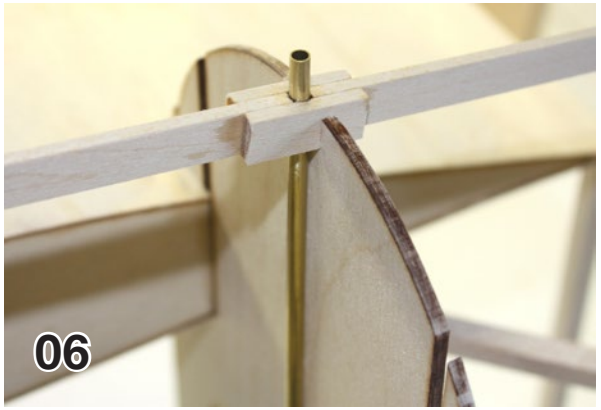
Get a 36 inch length of 5/32" O.D. brass tube and shape it with bends referring to the plans.

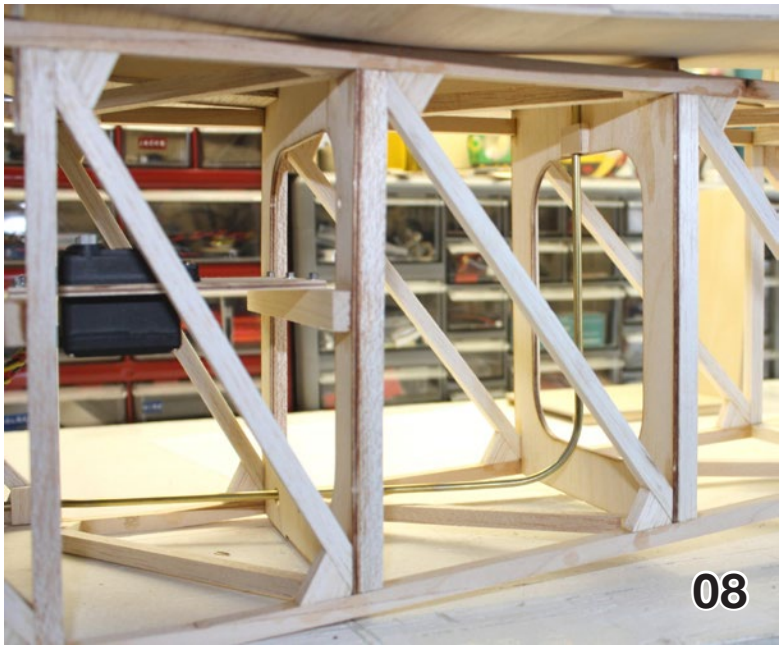
The easy way to bend the tubing is to anneal it first. Just be careful to do this in a safe place and use protective gear. You don't want to burn yourself or set the shop or house on fire!

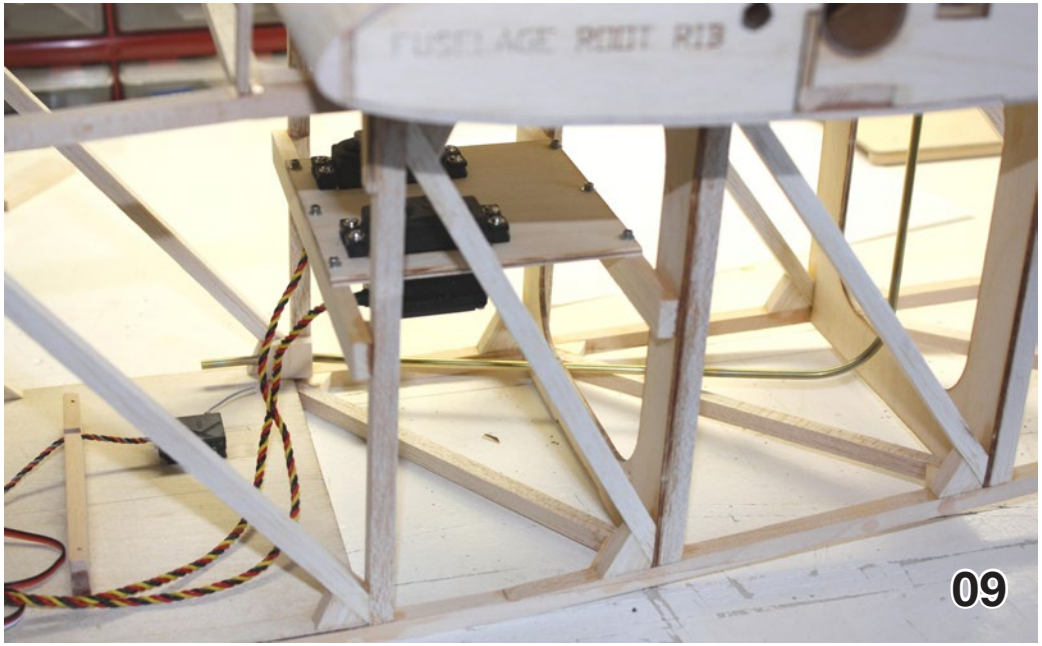
Get a propane torch, some small vise grips, and some gloves.

Figure out where you will make the two bends and mark the tube. Grip the tube

05 - 07. The total energy probe is mounted on the top of the fuselage on the front of F7.







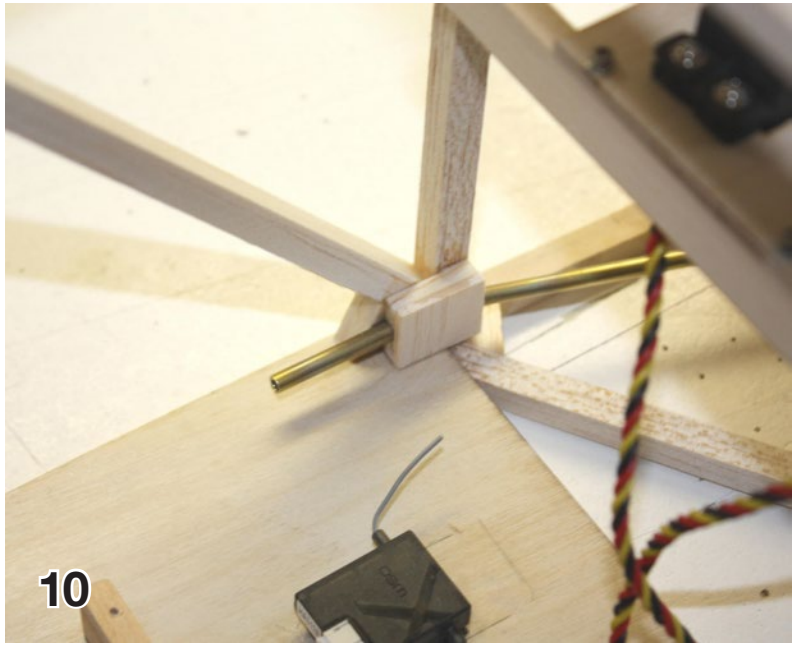
with the vise grips lightly to hold it for heating. You only need to heat the areas where the tube will be bent. Get in a dimly lit area and heat the brass tube until it is a dull red color. Then run it under some water to cool it off. The tubing can now be bent easily.

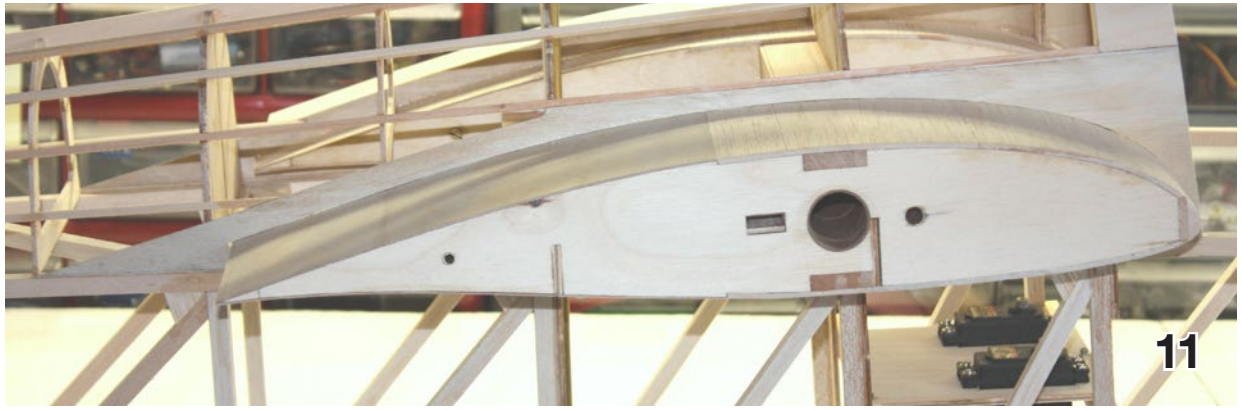
For the 1 inch radius bend I just used a small spray can that was 2 inch diameter to bend the tube around - the radius isn't critical.

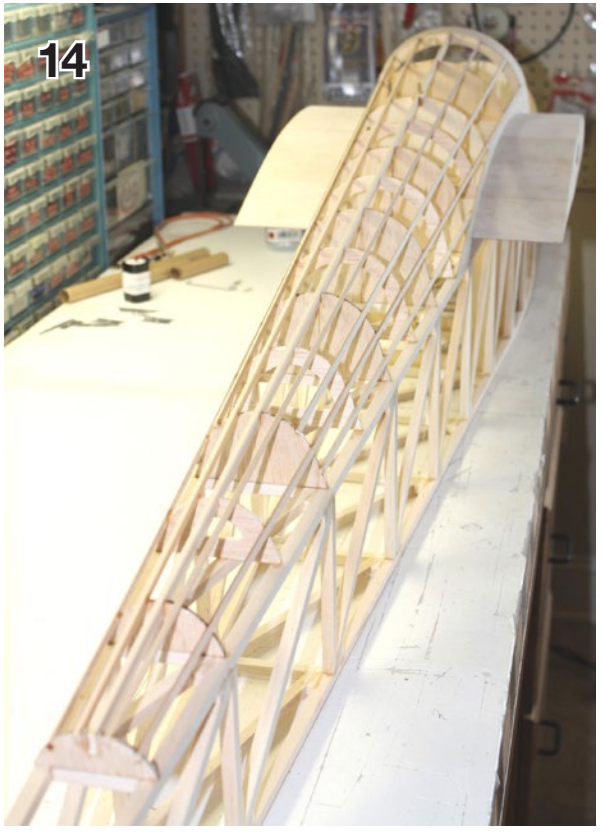
The bend in the cockpit area is just eye-balled. It's a bit fiddly, but the tube will go through the fuse structure, the hole in the bottom of F6, and on up through the main stringer if you flex it a bit while sliding it in.

Once you get it positioned correctly with the bends adjusted you can glue it in place. Sand the tube with 220 grit where it will be glued. I made a couple of clamps from scrap balsa and ply to hold the tubing to F7 and in the cockpit. A piece of silicone tubing will go from the TE brass tube up to the vario unit. See pix 5 - 10.

Before the rest of the T-deck stringers are installed, the 1/32" ply has to be installed around the wing center section on each side. These pieces have been cut slightly oversize on the top and bottom so they can be







sanded down for a good fit. The center section airfoil profile will never be an exact fit after it's sheeted, so there is always a bit of sanding required to get a good fit. Any gaps of 1/64" or less are OK - they can be filled later before covering. Once the fit is good glue the pieces into place. Make sure the ply pieces have a smooth contour, looking from front to back over the center section, before you glue them into place. At former F8, 3/32" balsa spacers are needed between the 1/32" ply and the former. See pic 11.

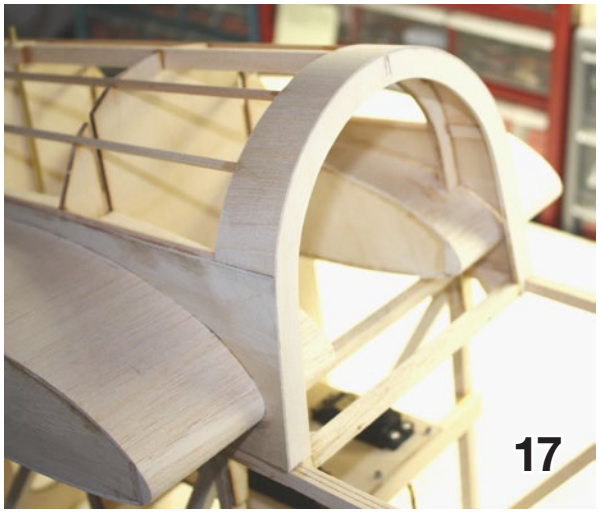
On former F7, fill the slots near the top with balsa scrap so there will be a continuous surface to glue the stringers to. Now you can add the rest of the stringers. Note all of the stringers must be notched at the front to clear the 1/32" ply covering over F4 and F5 (see pic 12).

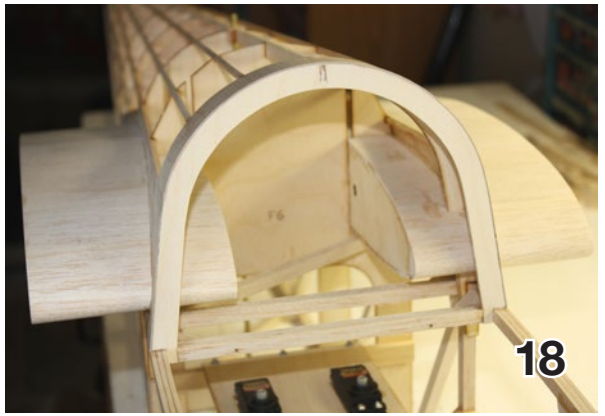
I like to start with the stringers that are glued to the edge of the 1/32" ply center section fairing pieces. Use a straightedge and sight along the stringers from the end to make sure they are straight.

Adjust notches and the edges of formers if necessary. On the prototype a small amount of tweaking was required in a few areas.

After I got all the left side stringers installed, I decided the distance between the aft formers was a bit long for these 1/8 sq. stringers - I was concerned that the covering would pull them in and sag. So I made up a set of light weight 3/32" balsa intermediate formers and installed them between formers F7 and F12. This added a lot of stiffness to the stringers.

These formers will be included on the plans and in the kits. See pix 13 - 15.





The area over formers F4 and F5 is covered with 1/32" ply. Make a paper template from manilla folder or similar material, and cut the 1/32" ply a bit oversize, then fit it to the formers. Once you have a good fit, add some 1/4" wide ply tabs on each end on the inside - these will reinforce the glue joints at the ends. Glue the ply on and sand the front edge flush with F4. See pix 16 - 18.

That completes the turtledeck. The horizontal tail mount will be next.

Horizontal Stabilizer Mounting

Grab some 1" X 3" balsa and cut it to length for the stab mounting block.

Mark the center and edge lines. Make the width about 1/16" wider on each side to allow for the center cut and some sanding. Cut the two pieces and sand the edges smooth.

Make two templates from the stab plan using some manila folder stock or similar.

Draw lines on the center edge and outer edge of each block using the templates.

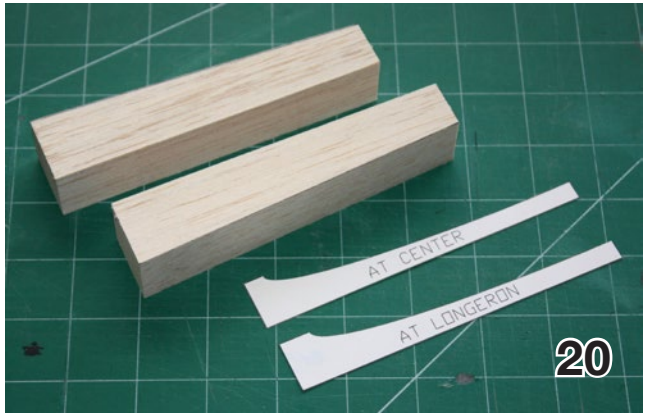
Now cut the wood out on your scroll saw using the longeron side as a guide (this is the shorter cut out), and leave a little wood beyond the line. See pix 19 - 21.

Pin the two templates to one of the blocks and sand the wood down to the templates. I use a sanding block and several sizes of brass tube with 100 grit paper glued to the brass tube.

Once you get the two blocks sanded, place each of them onto the bottom of the stab and check the fit.

Touch up a bit with the sanding tools if needed – just don't get carried away. A close fit is all you need; later I'll show how to easily get a perfect fit.

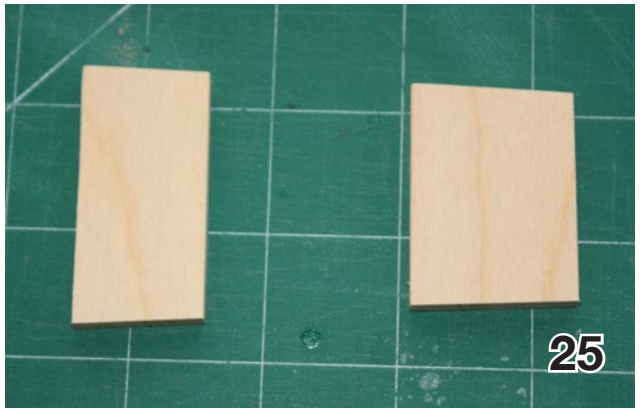
You should end up with two mirror image blocks. See pix 22 & 23.



20. Rough-cut blocks and templates.

22. Finished right side stabilizer mount.

23. L and R sides glued together.



24. Stabilizer mount in place.

25. Fore and aft nut plates.

Glue the blocks together and then glue them to the fuselage longerons up against former F13, making sure they are centered on the fuse. See pic 24.

Cut out the two 3/16" ply nut plates. (See pic 25.) and glue into place on the bottom of the longerons. Make sure the front one is located properly fore/aft.

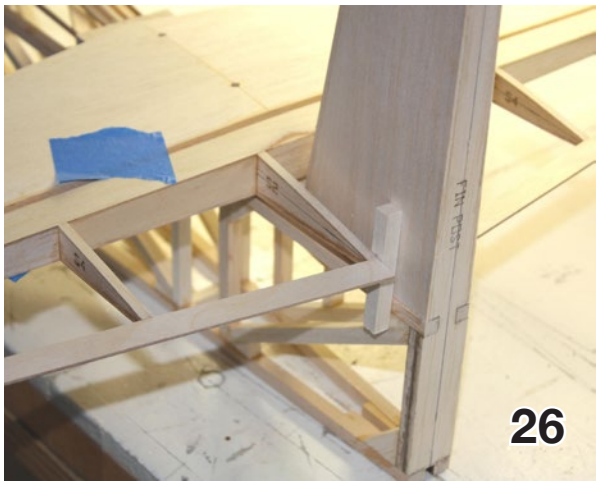
Place the stab and elevator (hinges not yet glued in) in place and put some scraps of balsa between the elevator and fin to make sure it's centered at the elevator. See pic 26.

Use a piece of non-stretch string (I like Kevlar or Spiderwire fishing line) to check the distance from each end of the stab to make sure they are equal. The total energy probe brass tube on top of the turtledeck makes a good place to measure from.

Once you have the stab square with the fuse centerline, check to see that it is parallel with the wing rod — see pic 27 — adjust with some sanding on the stab mount if needed.

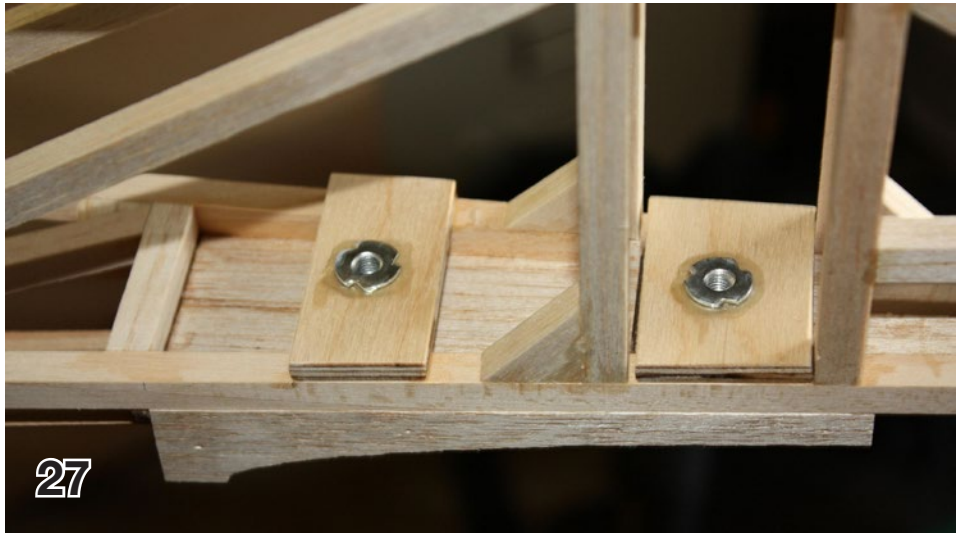
Check again for square and tape the LE of the stab to the turtledeck. Drill through the stab mount holes, and through the 3/16" ply nut plates, with a #21 drill bit.

Remove the stab, turn the fuselage on its side and drill out the holes in the 3/16" ply nut plates to 1/4" diameter.



26. Stabilizer and elevator in place on the stabilzer mounting block.

27. Making sure the stab is parallel to the wing rod.



I taped a piece of brass tube onto my drill bit for an extension to drill the 1/4 holes.

Use a Dremel to cut off the teeth on two 10-32 blind nuts, and glue them to the nut plates using CA+. See pic 28.

Drill out the holes in the stab using a #9 drill bit, and countersink them to fit the nylon 10-32 X 2" flat head screws.

Use some CA to harden the countersunk areas.

Put the stab back into place on the fuse and run a 10-32 tap through the holes and blind nuts – this will make sure the nylon screws will go in freely.

Install the 10-32 X 2" nylon screws and check the fit. See pix 29 & 30.

My source for the nylon screws is McMaster-Carr. They carry a wide variety of items useful to modelers.

Next will be making the elevator pushrod and linkages, and getting a perfect fit on the stab mount.

29. View of mounted stabilizer from below.

Elevator Pushrod and Final Fit of Stab Mount

Attach the 4-40 ball from the Sullivan 4-40 aluminum ball connector (S591) to the elevator horn so the ball is on the right side. Use Locktite. See pic 30.

The stab mounting block needs to have a hole cut to clear the ball on the elevator horn when the stab is put on each time. You can see this in pic 42 (p. 11).

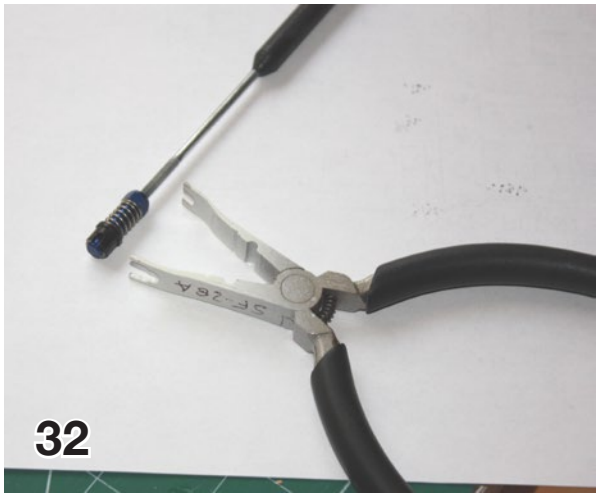
Also remember to file the slot into the stab mounting block and aft 3/16" ply nut plate to clear the elevator horn at the full down elevator position.

For the elevator pushrod I used Dave Brown fiberglass rod PRDS-5400 and fittings. (Arrow shafts will also work, both fiberglass and carbon.)

One pushrod isn't long enough so two need to be joined and cut to length. For a joiner I used a 3 inch length of 1/4" dia. dowel epoxied into place, and also drilled two holes (one on each side of the joint) and installed two 2-56 screws and nuts.

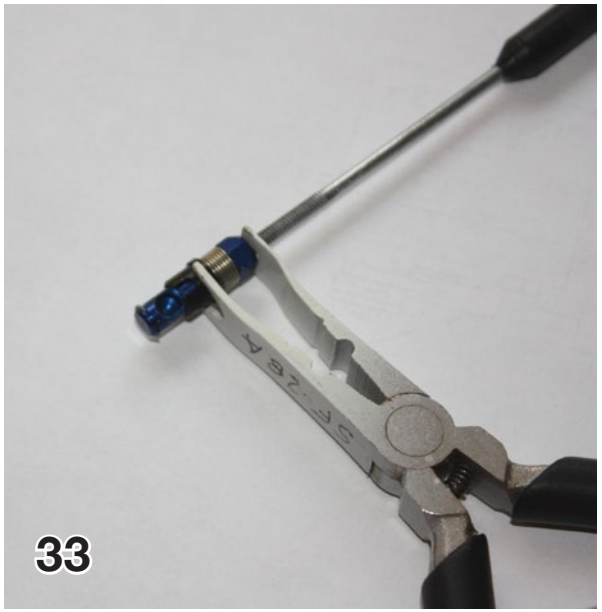
I used threaded 4-40 rods on each end. At the elevator install I used the Sullivan S591 4-40 aluminum ball connector. See pic 31. This has a sleeve which you slide back to release the connector from the ball.

I modified some helicopter ball link pliers by enlarging the opening on one jaw



to fit around the sleeve on the Sullivan connector. You simply squeeze the pliers to compress the connector sleeve and release it from the ball. This makes it quick and easy to use inside a fuselage. See pix 32 - 33.

31. The Sullivan S591 4-40 aluminum ball connector at the elevator end.



32 & 33. Modified helicopter ball link pliers are used to retract the sleeve and release the ball.

The opposite end of the pushrod also uses a 4-40 threaded rod, and uses a Du-Bro 4-40 ball link to attach to the extended servo arm.

The Hitec heavy duty servo arm is cut down per the plan and an extension made from G-10 (also detailed on the plan) is added to the servo arm with #2 screws. See pix 34 & 35.

As mentioned in Part 2, I found I wasn't happy with the original ball connector access hole location on the fuselage, so I made a small change to the fuse structure on the right side in this area. See pic 36.

Pic 37 shows the ball end connector on the push rod, and pic 38 shows the servo end of the pushrod.

The pushrod needs to have a guide installed near the center at station F10. I made this from scrap 5/16" square balsa pieces. See pic 39. Glue the pieces so there is a small clearance (about like 2-3 thicknesses of printer paper) all around.

This guide serves two purposes:

One is to keep the pushrod from bowing under high loads, such as doing loops.

The other is to prevent the aft end of the pushrod from falling down into the fuselage and being inaccessible when you want to attach it to the elevator horn.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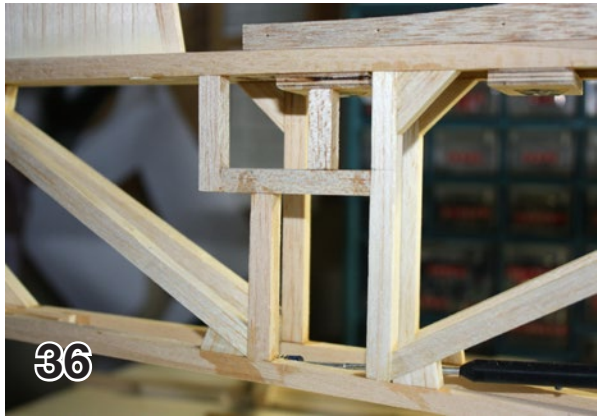
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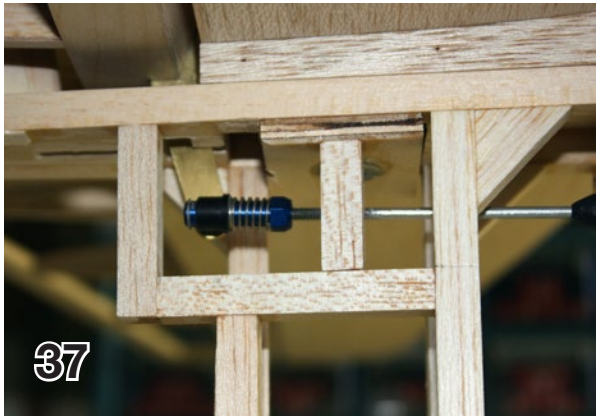
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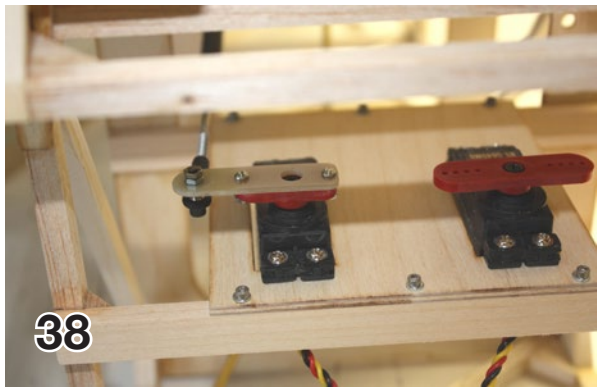
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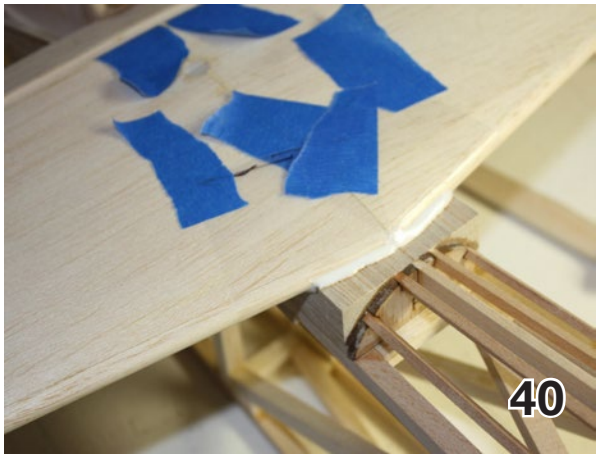

Although the balsa stab mount is a fairly close fit to the stab, there is an easy way to get it nearly perfect.

Find a piece of Monokote backing material (the stuff you peel off before covering), cut two small openings to clear the nylon bolts, and tape a piece to the bottom of the stab so that it comes up around the LE and around the aft edge. Make it about an inch wider than the fuse. Tape it on so it is pulled tight and smooth. It works better at the LE if you cut it in the middle above the centerline of the LE.

Mix some epoxy finishing resin and micro balloons together and apply it in about a 3/8" inch wide strip on each side of the stab mount block, and across the LE of the stab mount block. Just a thin layer will do on the sides and a little more at the LE.

Put the stab and elevator into place, center the elevator with balsa scraps, and check the stab for square using the string again.

Tighten the nylon screws down well and let cure overnight.

Next morning remove the stab and pull the Monokote backing off the stab. The Monokote backing easily breaks loose from the finishing resin and you now have an excellent fit.

Sand the stab mounting block down flush with the fuse sides and then to the shape of former F13, so that the taper goes half way back on the edges of the stab mounting block. See pix 40 – 43.

40 - 43. Using a Monokote separator, a micture of epoxy and microballoons is used to get the stabilzer mount to exactly fit the stabilizer.

Fuselage Bottom

I decided to build the fuse bottom before putting on the side stringers.

Start by gluing on the keel with CA+. You should have marked where the keel is located when you made the cockpit floor, but if not, mark it now so you will know where to position it. Make sure it's square with the cockpit floor.

Install formers B1 – B5 on one side, then on the other side. Locate these per the plan – B1, B3, and B5 are located flush with the aft edge of the keel cutouts for the skid blocks. See pix 44 & 45.

Make the tail skid from 3/16" ply. Round the LE and taper the aft portion. Glue the tail skid into place between the blocks at the aft end of the fuse bottom. See pix 46 & 47.

Install formers B6 – B11, making sure they are centered.

Cut the 1/8" X 3/8" basswood stringer to length and cut the 1/8" notch at the front for the wheel well plate.

At the B12 position on the fuse you will need to make a shallow notch on the fuse crosspiece to clear the stringer.

Dry fit the stringer and check with a straightedge – adjust any notches in the formers as required – then glue into place.

Glue on the two small F12 former pieces. The aft end of the stringer glues to the


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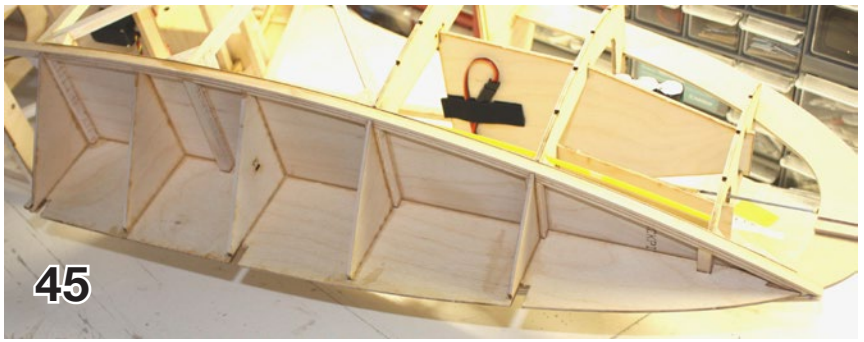
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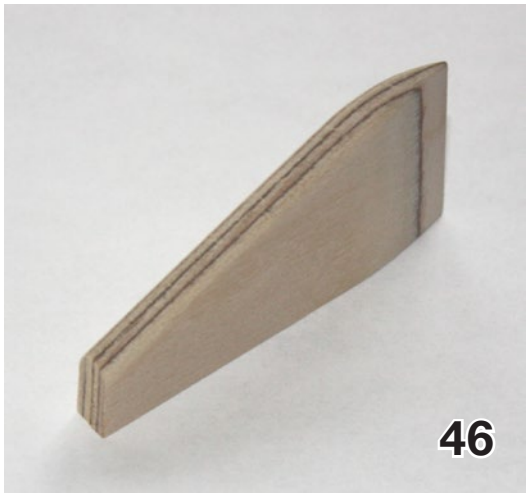
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47

front of the tail skid with CA+. See pix 48 & 49.

Cut the stringer doublers to length and make the 1/8" notches, then glue one on each side of the stringer. See pic 50.

The reason for the doublers is to strengthen the stringer behind the wheel, as this is where the glider usually gets picked up when it's carried.

Cut the three 1/4" X 1/2" basswood blocks to length and glue into the keel, and to the formers, with CA+.

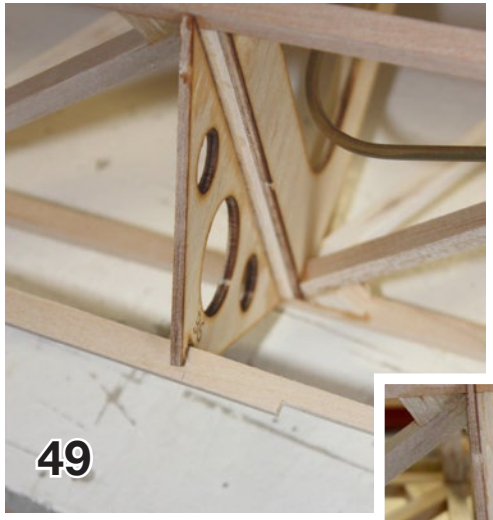
Before the 3/16" square basswood can be installed along the keel bottom edge, it must be cut into two pieces (lengthwise) with a razor blade so it is more easily bent to the shape of the keel.

Once this has been done, cut the 3/16" square to fit and glue along the bottom of the keel on both sides. Don't forget to apply CA to the lamination joint. See pix 51 & 52.

The wheel well is made from four pieces. Glue the two WW sides to the bottom plate using CA+. Use a square to position them. See pic 53.

Cut a piece of 1/32" ply (cross grain) to width and length and glue onto the two WW sides and the bottom plate. See pic 54.

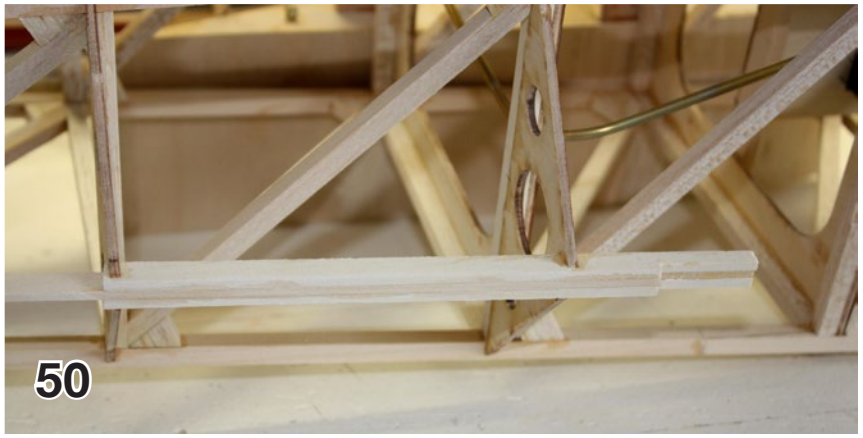
Apply three coats of Poly-U to the inside to protect from dirt and dew.

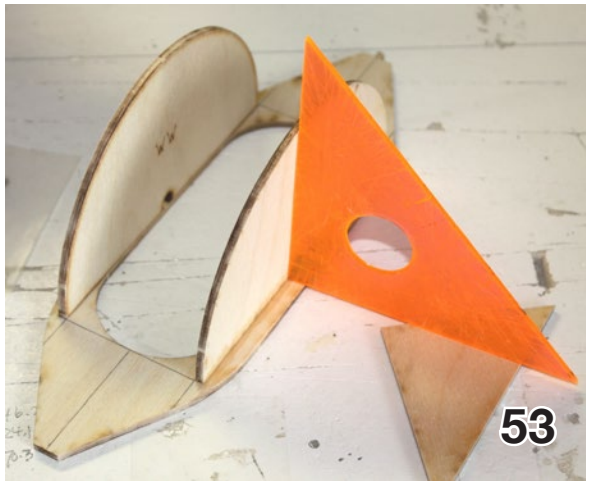


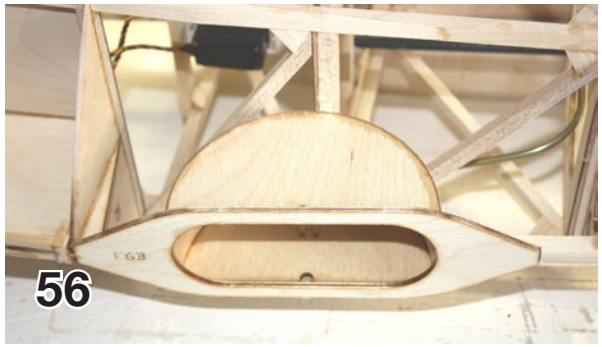
48. Bottom formers B6 - B11 installed and bottom 1/8" x 3/8" basswood stringer installed.

49. Notch at front of stringer for the wheel well bottom plate.

50. Two 1/8" thick basswood doublers installed on bottom stringer to strengthen the lifting point.







If you haven't already done so, notch out the balsa cross piece at the bottom of fuse former F6 to match the notch in F6. Fit check the wheel well, make any adjustments, and glue to the keel, bottom stringer, and F6 with CA+. See pix 55 & 56.

53 - 56. Construction of the wheel well. Make sure to apply three coats of Poly-U to the inside of the well to seal it from dirt and moisture.

Add the F6A formers to both sides of the wheel well, paying attention to where they are positioned relative to the holes through the WW sides.

Add the axle doubler on each side.

Check the hole clearance by running a piece of 7/32" brass tube through both sides of the wheel well holes. If necessary, run a 7/32" drill through the holes.

Cut two 3/8" long pieces of 7/32" O.D. brass tube and sand the outside with 100 grit.

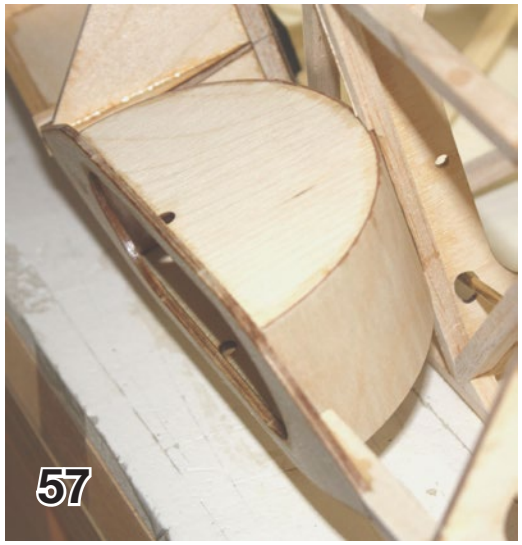
Place the two pieces of brass tube into position on the WW sides, and slide the 3/16" music wire axle into them to make sure they are parallel, then glue the brass tubes with a bit of CA. Be careful not the glue the axle to the brass tubes!

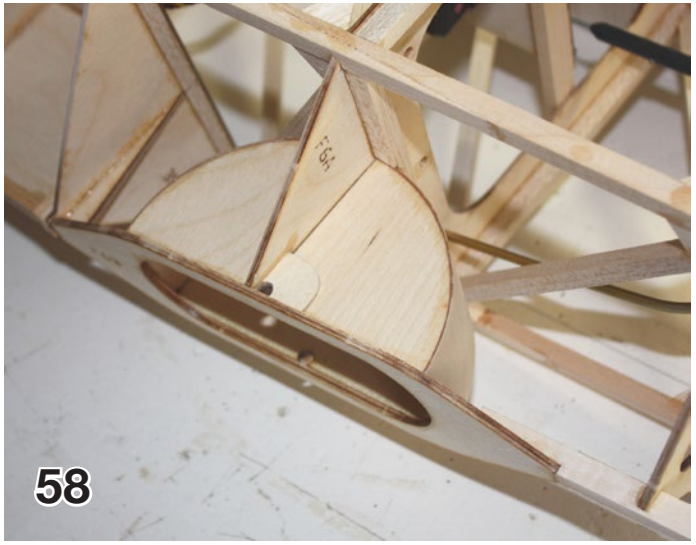
Slide the axle out and finish gluing the brass tubes with CA and CA+.

The wheel is centered inside the wheel well using two brass tube spacers about 1/4" inch long each.

A 3/16" wheel collar goes on each side of the wheel hub, and a brass tube spacer goes between the wheel collar and the side of the wheel well on each side.

Adjust the length of the brass tube spacers to give a very small amount of side play to the wheel.





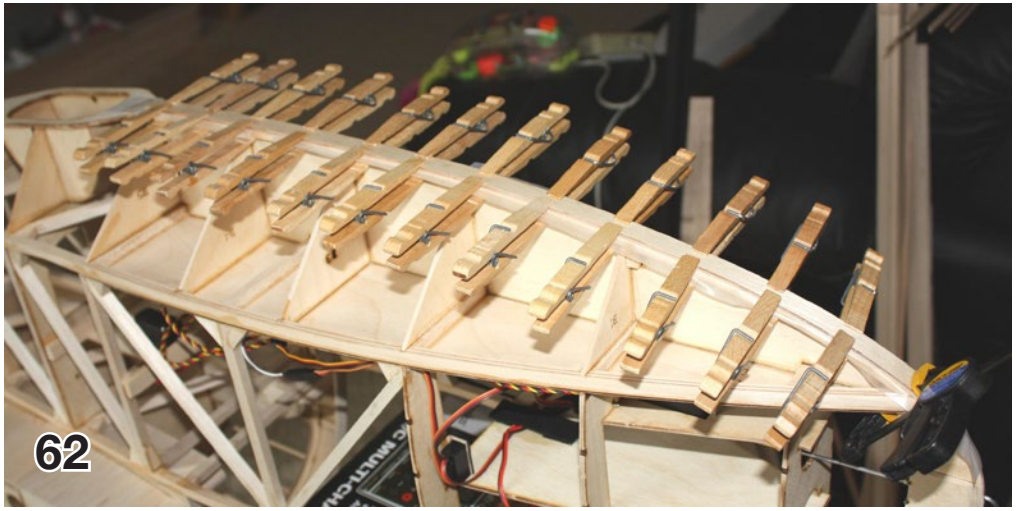
57. View of top of wheel well glued to fuselage former F6.

58. Former F6A and axle doubler shown on left side of the wheel well.

59. The 7/32 O.D. brass tube axle carriers installed.

60. Wheel in place with wheel collars and brass tube spacers to maintain centering of the wheel in the well.

Once the wheel collars are tightened (use Locktite), the wheel will stay centered inside the wheel well. See pix 15 - 17.



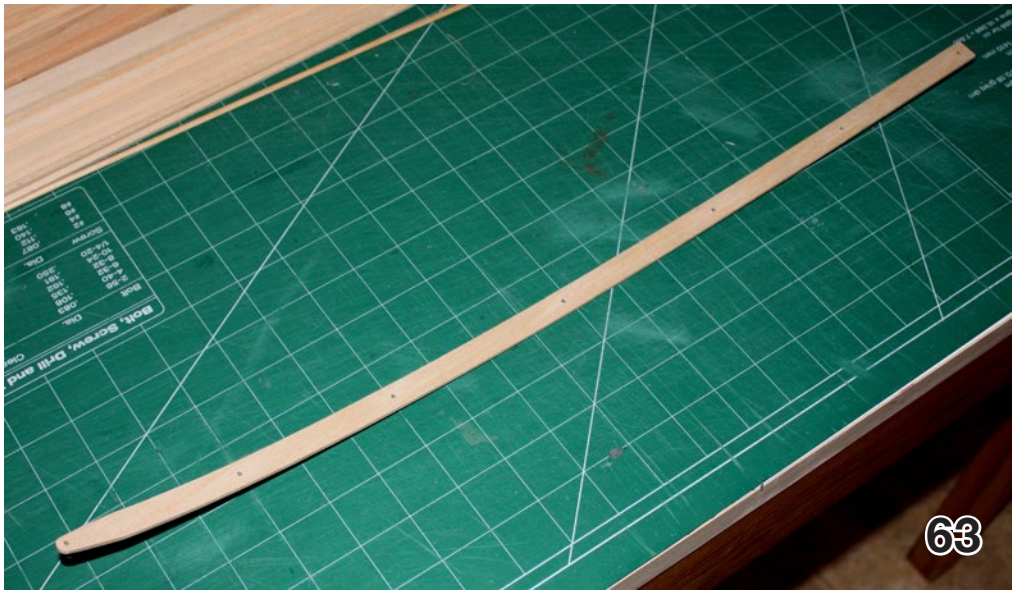
Skid

The skid is made from three layers of 1/32" plywood laminated with 15 minute epoxy.

Cut the three layers about 1/64 inch wider than the 1/2 inch width required to allow for sanding down smooth after the lamination. Cut them slightly long so you can trim to length later.

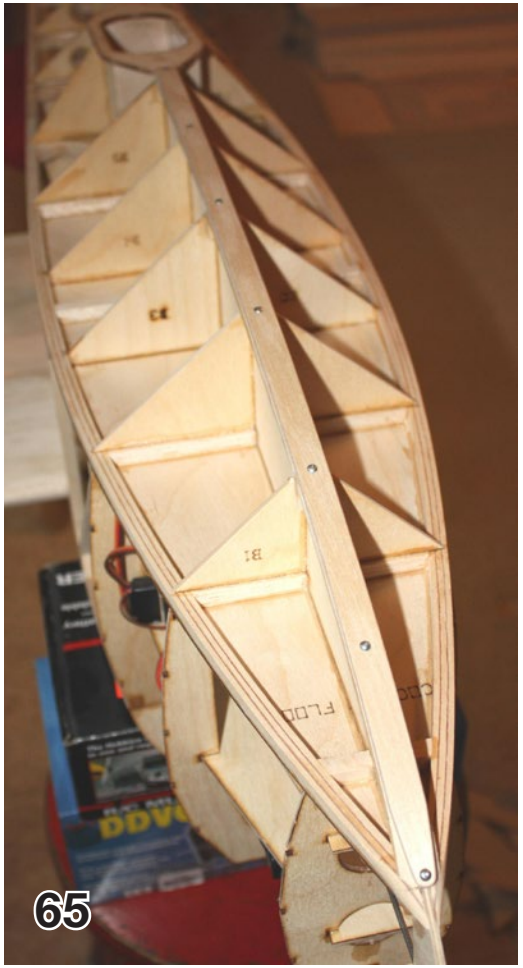
Tape some wax paper over the keel. Apply a very thin layer of 15 minute epoxy to each of two 1/32" ply pieces and lay all three pieces onto the keel. Clamp the pieces to the keel using clothespin clamps, and a regular clamp at the front. See pix 61 & 62.

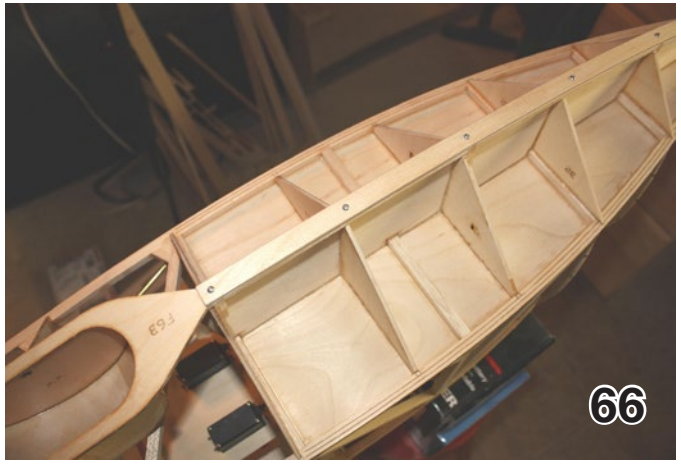
After the epoxy has cured, remove the skid and sand the edges smooth. Sand the aft end square and tape the skid onto the keel to mark where to cut it off on the front end. Taper the front end to match the fuse and round it off. See pic 63.



61 & 62. Three layers of 1/32" plywood laminated with 15 minute epoxy and clamped to keel for shaping. Note regular clamp at nose.

63. Finished skid.



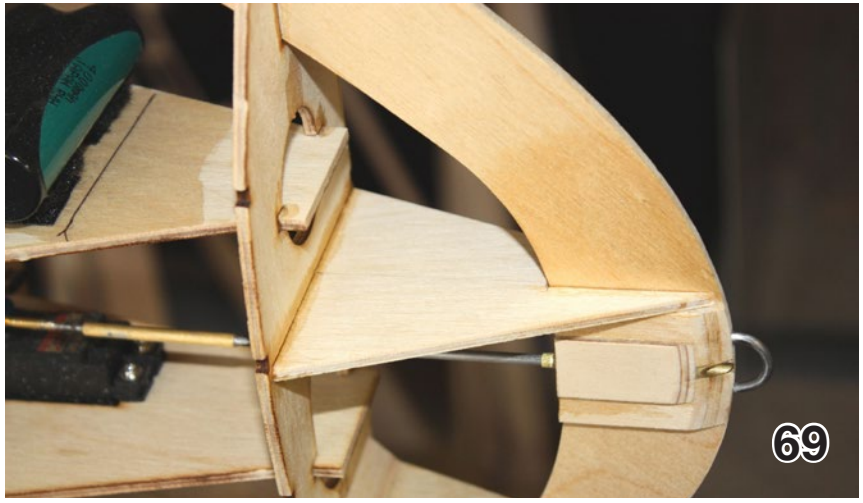


Mark the skid where the holes will be drilled. There should be one screw at each of the three blocks on the keel, one screw between each block, and one screw at the nose for a total of seven holes.

Tape or clamp the skid in place, making sure it is centered, then drill the seven holes with a 1/16" drill bit to a depth of about 5/8 inch.

Remove the skid, drill the holes in the skid out to 3/32" diameter, and install the skid onto the keel using #2 X 1/2" button head screws. See pix 64 & 65.

Remove the skid and apply 4 or 5 coats of Poly-U. The skid and the drilled keel are shown in pix 66 & 67.



On the screw holes in the basswood blocks, I hardened the threads by applying CA into the screw holes after removing the screws.

Cut some 3/32" thick balsa pieces to fit around the tail skid, and taper these down to the outer edges of the lower longerons.

Glue them on and finish sanding them to shape. These will give the covering a place to attach to. See pic 68.

Fuselage Stringers

Before starting on the stringers I decided to add another former in front of F1 to provide more stiffness to the upper keel in the tow release area.

This is former F1A, made from 1/8" ply. See pic 69.

I also added a 5/16 basswood triangular strip at the joint underneath with F1 (not shown in pic 1), as I intend to put some lead weight on top of F1A later when it comes time to balance the model.

F1A has been added to the fuselage plan.

Unlike the turtledeck, I used spruce for the side stringers on the fuselage because it is stiffer and there are no sub-formers to help support the side stringers.

To get the required stringer lengths, some splicing of the 1/8" square spruce is required. Splice six 3' and six 4' pieces together resulting in six stringers almost 7' long.

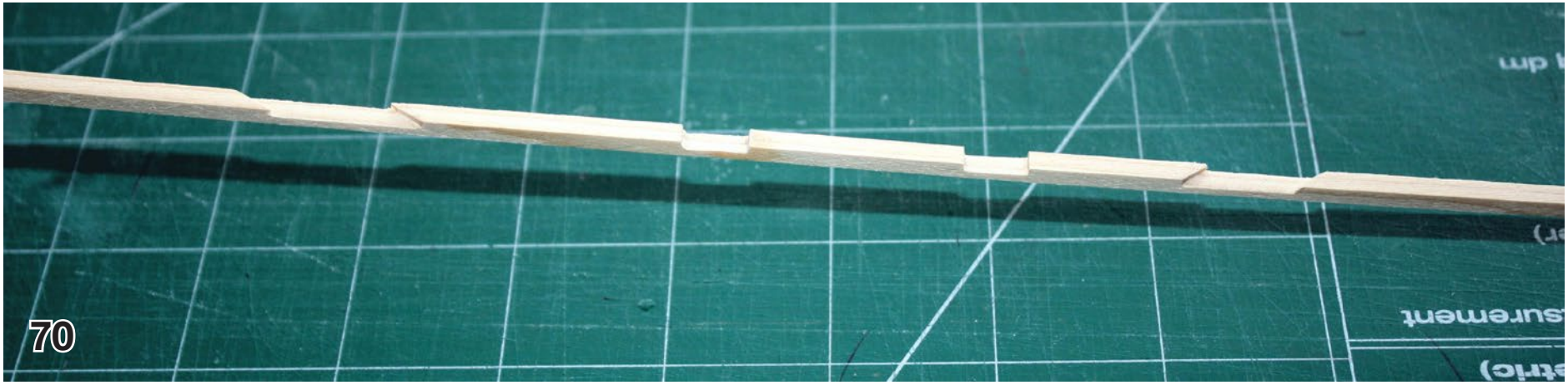
Splicing is done the same way it was done for the fuselage longerons as detailed in previously – the scarf joints are 1.5 inches long for the stringers.

4' stock will work for the other two stringers.

I like to sand the outer face and outer edges with 220 before I install the stringers – it's much harder once the stringers are glued on.

Installing the stringers is basically a matter of getting a smooth curve from front to back, and a smooth shape across the stringers once they are all installed.

The stringers are all glued directly to formers F1 – F3, but aft of that they will need small plywood or hard balsa spacers of varying sizes glued between the stringer and the fuselage vertical members, and will also have to be notched out towards the aft ends to clear the fuse structure and get a smooth curve.



I started with the second stringer down from the top longeron because it is close to being in the center of the fuse side.

I made a small gage from scrap wood that lets me set a consistent spacing below the top longeron as I glue the stringer down.

The spacers I worked out on this stringer are: 1/8" at the first four verticals aft of F3; 3/32" at the 5th vertical aft of F3; 1/32" at the sixth vertical aft of F3; glued directly to verticals 7 and 8 aft of F3; stringer notched 1/3 depth for 9th vertical aft of F3 and 9/8 diagonal; stringer notched to 1/2 depth for remaining four verticals/diagonals; end of stringer flush with tail post.

Pic 70 shows an example of notches made in a stringer to 1/2 depth. I cut these with a razor blade and #11 X-Acto, but you can file or sand them also.

The spacers used on the first stringer down from the upper fuse longeron are as follows (again all referenced aft from former F3): 1/32" on first 5 verticals; glued directly on sixth and seventh verticals; stringer notched to 1/3 depth for 8th vertical and 8/9 diagonal; stringer notched to 1/2 depth for 9th vertical and all other members aft; stringer flush with tail post.

The spacers used for the third stringer down from the upper fuse longeron are: 1/8" on verticals 1-3; 3/32" on verticals 4 & 5; 1/32" on vertical 6; glued directly to vertical 7; stringer notched to 1/3 depth at vertical 8 and the 8/7 diagonal; stringer notched to 1/2 depth at vertical 9 and the 9/8 diagonal; end of stringer flush with lower longeron.

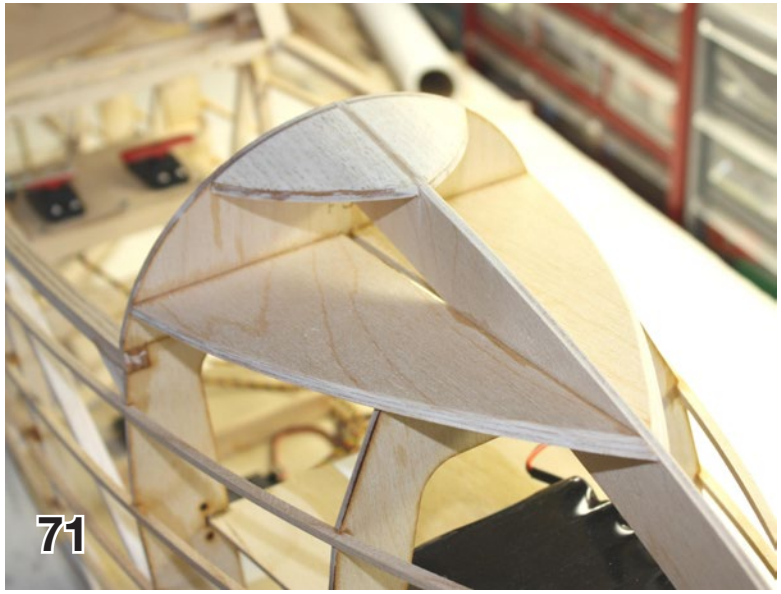
The spacers used for the lowest stringer are: 1/32" on verticals 1-4; glued directly to vertical 5; stringer notched to 1/2 depth for vertical 6 and the 6/5 diagonal; end of stringer glued flush with lower longeron.

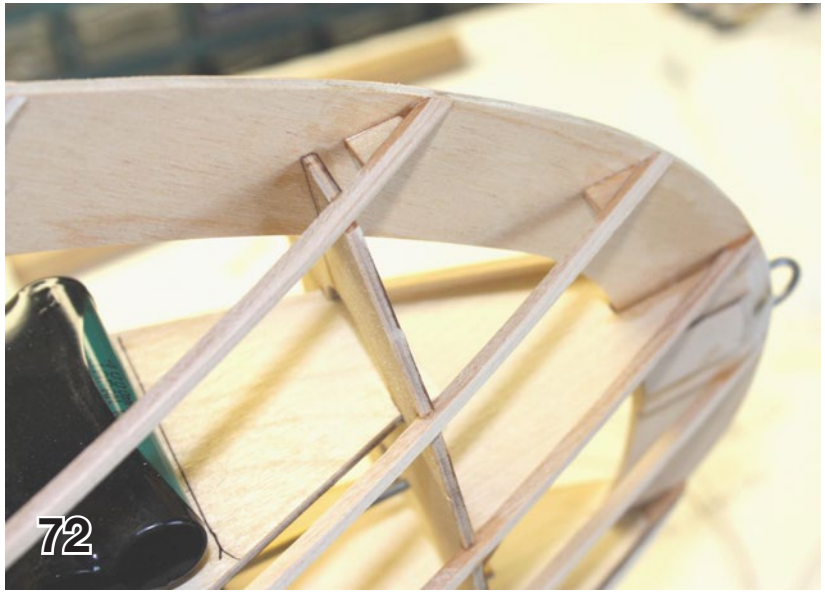
The above spacings seemed to give a fairly smooth curve fore and aft and when a piece of paper was stretched across the stringers from top fuse longeron to bottom fuse longeron.

There are still a few parts needed to get the proper nose shape ahead of former F3A.

The two F2A 1/8" ply pieces are sanded on the back edge to match the angle of F3A and glued with CA+. Measure off the plans and make a mark on F3A to help position these when gluing.

Sand the edges of the F2A parts to match the angles of the upper keel and side stringers.





Use the plan templates to cut the 1/2" balsa contour blocks, and the 1/8" thick X 1/8" wide ply pieces that go underneath the contour blocks (to reinforce the thin edge after sanding).

Sand the aft ends of the contour blocks to match the angle of F3A and CA the blocks into place.

Glue the 1/8" ply reinforcing pieces onto the undersides at the outer edge of the blocks. Sand the blocks down to fair into the upper keel and F3A.

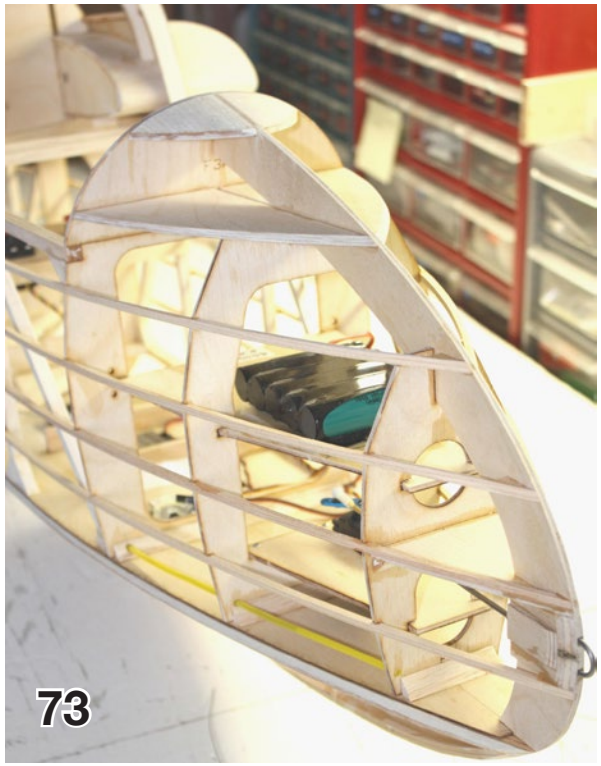
Add the little ply gussets at the front ends of the upper two stringers on each side of the upper keel.

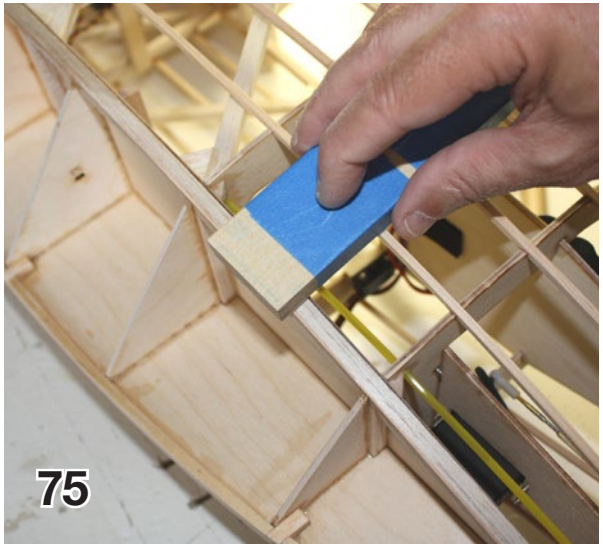
Also at this time sand the stringers at the front to blend in nicely with the upper keel. See pix 71 – 73.

Since the fuselage covering stretches across the stringers, it cannot attach directly to the fuse longerons and still have a nice smooth shape. So 1/16" X 5/16" hard balsa strips are added to the outside of the fuse longerons and beveled so the covering will transition smoothly to the stringers.

The top longeron strip only needs to go forward to the aft edge of the canopy (front edge of former F4).

Once the strips are glued on, you can do most of the beveling with a razor plane if you are very careful, but it is easy to get the plane blade into the stringers, so block sanding is a safer bet.





I lived dangerously and planed mine close, finishing with a sanding block, first with 100, then 220 grit.

Put some tape around the sanding block and let it rest lightly on the stringer to get the correct bevel. See pix 74 & 75.

Pic 76 shows the fuse with all the stringers in place.

Rudder Cables

Refer to the plans for the location of the 3/32" thick balsa plates that are glued between the stringers at the aft end of the fuselage on each side. These are 2.375" long with vertical grain. Glue these to the stringers and fuse verticals and diagonals. Also on the right side glue some 3/32" balsa pieces around the elevator control horn access hole.

Sand all of these pieces flush with the stringers (and the access hole balsa flush with the stringer and upper longeron).

The way to make the hole through the balsa plate for the nylon cable guide tubing is to use a sharpened 1/8" O.D. brass tube (sharpen the inside edge), and a small jig to hold the tube at the proper angle.

First, mark where the aft end of the hole is on the balsa plates for the 1/8 nylon control cable guide tubes – this is where the brass tube will begin its cut. The small support jig is made from a piece of scrap balsa with a 1/8" square notch.

Glue a scrap of wood across the bottom of the support jig so that when it sits on the tail post, the bottom of the 1/8" square notch is 1/2" inch high. Mark a centerline on the support jig.

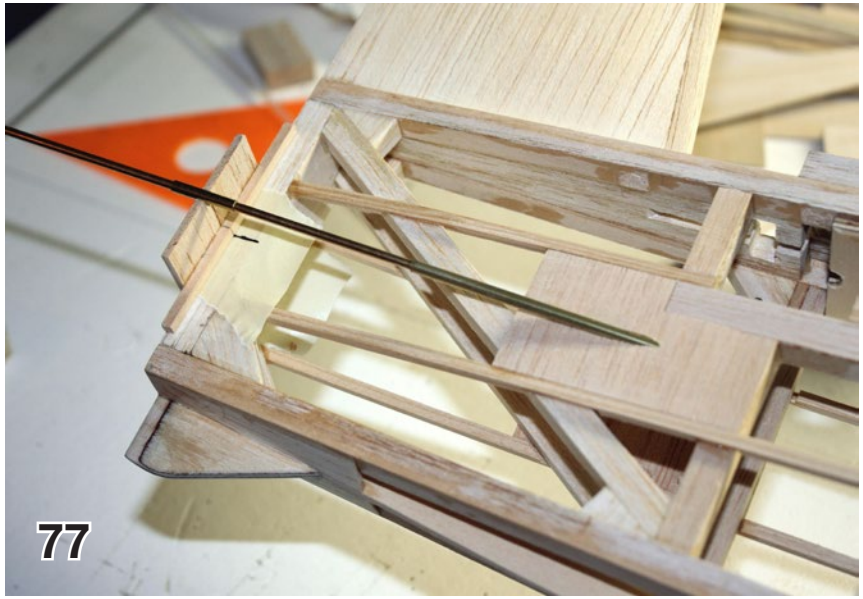
Put a piece of masking tape on each side of the tail post, temporarily install the rudder, and mark lines on the tape where the rudder horns are located.

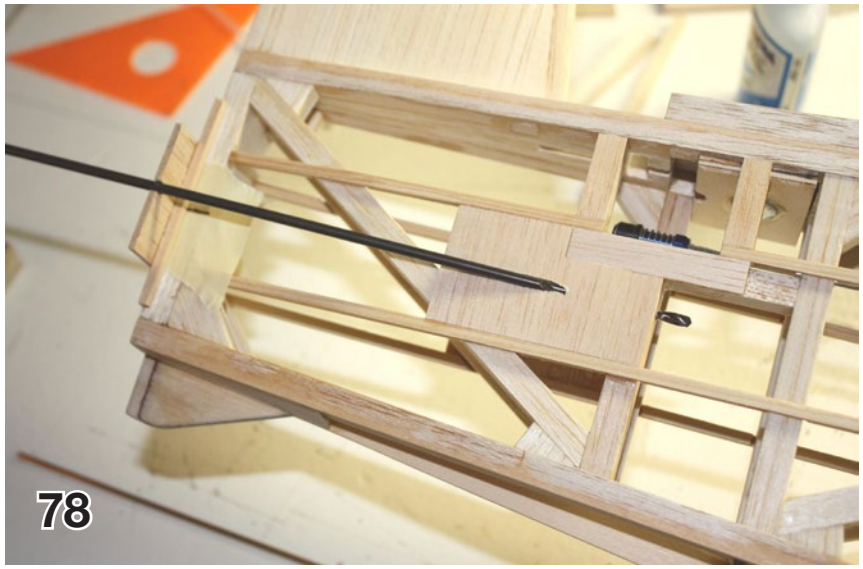
Remove the rudder and set the support jig on the tail post, aligning its center over the mark you just made on the tail post.

Set the brass tube into the support jig with the sharpened end of the brass tube at the mark you made earlier on the balsa plate.

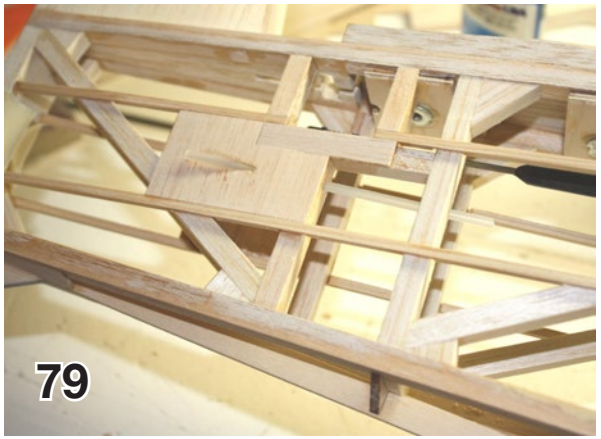
By twisting the brass tube you can now cut an angled hole through the balsa plate. See pic 77.

Once the brass tube has cut through the balsa plate, remove it, and still using the support jig, take a long 1/8" drill bit and continue to drill a hole through the two fuselage vertical members (the second vertical will just get kissed by the drill bit). See pic 78.





77 & 78. Use a small jig to get the angled hole correctly located and accurate. The hole is drilled with a piece of sharpened 1/8” O.D. brass tube.



Cut a piece of 1/8" nylon tubing so it extends about 1/8 inch aft of the hole in the balsa plate, and about 1/2 inch forward of the forward-most vertical under the stab.

Just about any nylon tube will work. I used some inner Nyrod type pushrod material.

CA this tube to the balsa plate and aft vertical, but not yet to the forward vertical, as some adjustment to the tube position will be made later. See pic 79.

Make up the rudder cables by attaching Du-Bro 2-56 rigging couplers to 45 lb. test nylon coated fishing leader using some Proctor swages (or the swages sold for the fishing leader).

Install a Du-Bro Kwik Link clevis onto the rigging coupler using some Locktite; we don't want this servo end to be adjustable.

Cut down a red Hitec heavy duty servo arm per the plan and attach the cables one hole in from the ends. See pic 80.

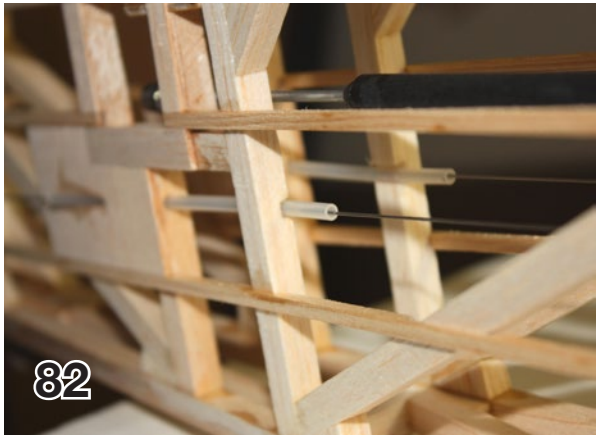
Run the cables aft through the nylon guide tubes so you have 6 or 8 inches extra outside the tubes.

Temporarily install the rudder and turn on the radio so the rudder servo arm is in neutral.

Note that for the servo arm to be perpendicular to the cables it needs to be offset 1.74 degrees. No big deal if you don't as the transmitter can be adjusted to get the correct throws.

Attach the cables at the aft end of the fuse to the rudder using the Du-Bro rigging couplers and Kwik Links, and also use a 2-56 nut on the rigging couplers to lock them.

Adjust everything so the rudder is in neutral and crimp the cable swages, then trim off the excess cable. See pic 81.



Now look at the forward ends of the nylon cable guide tubes and see if they are lined up with the cables. If not, file or sand the notches in the forward vertical member under the stab until the nylon tubes align with the cable right in the center, then CA the tubes to the vertical. See pic 82.

Adjust the rudder throws to get 3.5 inches each way, measured at the widest point on the rudder.

That finishes up the fuselage except for the canopy frame and instrument panel.

I will wait to make the canopy frame until after the canopy is vacuum formed so I will know the thickness of the canopy plastic.

The instrument panel will be made after the canopy is completed to endure a good fit with the front of the canopy frame.

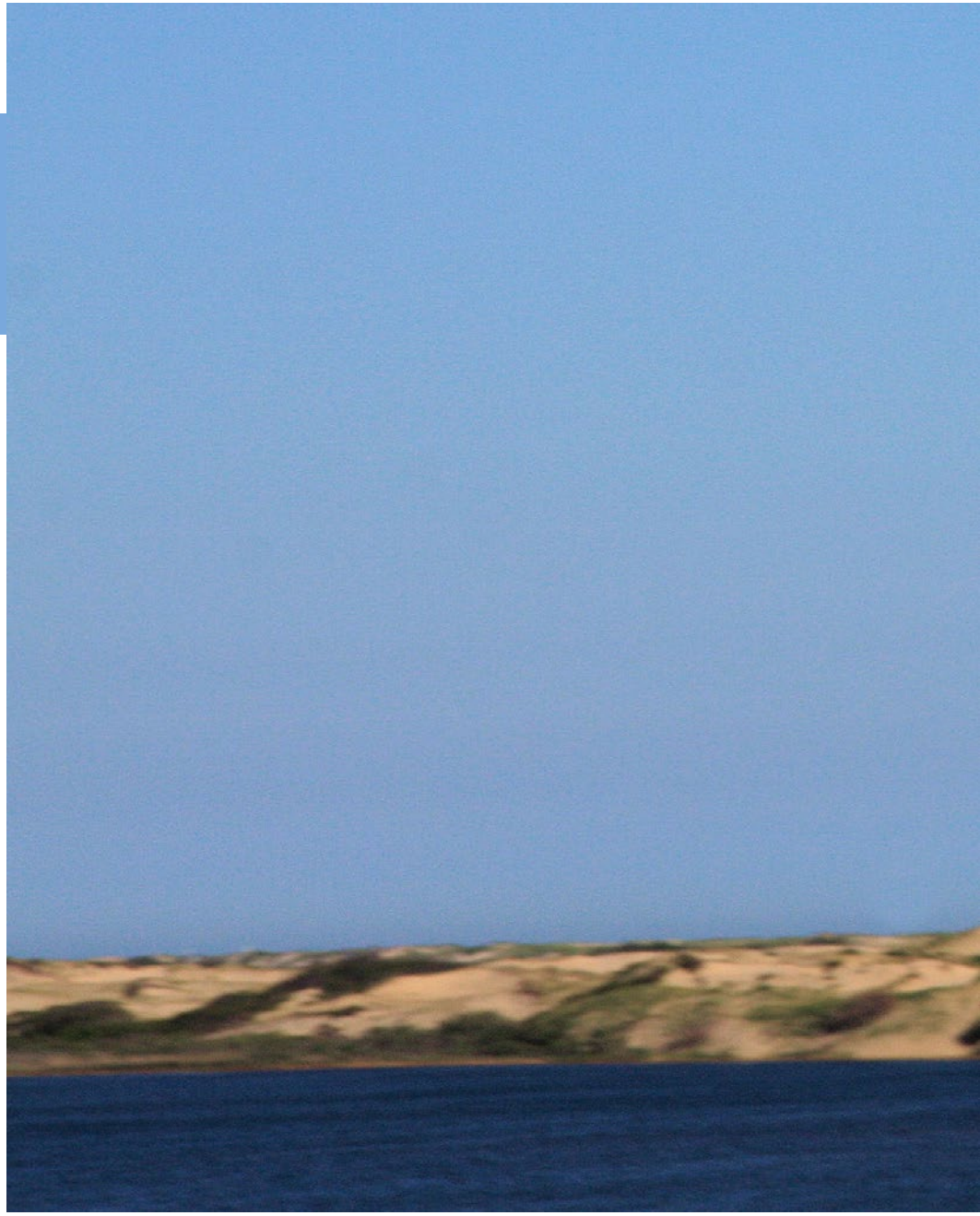
Pic 83 shows the finished fuselage.

WINGS ARE NEXT!

1/3 scale Cherokee RM plans are available for free: <http://www.rcgroups.com/forums/showthread.php?t=2246733>. The wood list is available at: <http://www.rcgroups.com/forums/showthread.php?t=2246779>.

dream-flight

alula TREK



The Alula Trek is a new molded foam, 34-inch (900mm) span slope soaring and hand-launch glider from Dream-Flight, a manufacturer with a well-established reputation for superlative design innovation, and exceptional quality products. This is the third iteration of the foam Alula design, starting with a hot-wire cut version, progressing to a molded version, and here now a refined molded variant. In online discussion boards RC pilots report catching their first thermal with an Alula, and for some the Alula has equipped their personal introduction to slope soaring.

RETROSPECTIVE

In October 2012, philosopher and flying buddy Jan Carstangen and I sat on a park bench in Truro, Massachusetts, flying for hours in 12 mph (19 kph) winds over the Cape Cod Bay. I asked Jan what he thought were the essential characteristics of the sailplanes we most like to fly.

He replied: “They groove. They carve a turn like skiers, snowboarders, surfers. They are both stable and agile. They will fly hands off when you want a rest, and they are maneuverable enough for aerobatics when you want aerobatics.”

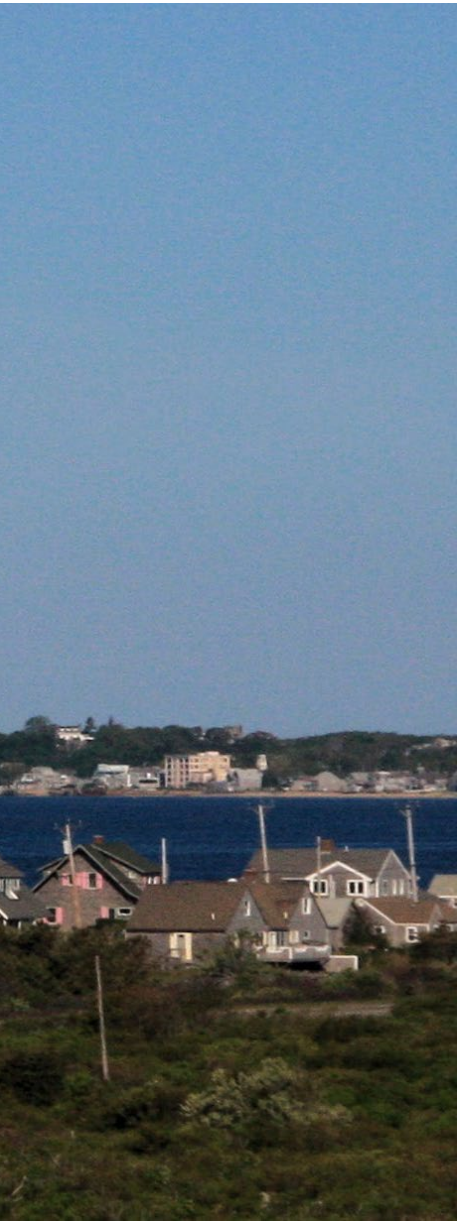
Jan further said, “I have the most fun with a plane that you don’t have to keep chasing. You put the plane in a bank and give it a little elevator, and it carves its own turn. It holds the turn until you roll it back out to fly straight and level.”

We flew five different slope gliders that afternoon, and even swapped transmitters and flew each other’s planes. The glider Jan was flying when he relayed those thoughts: the Dream-Flight Alula Evo.

These remarks are from the *RCSD* review of the Alula Evo. I’m here now to tell you the Alula Trek is even better.

Alula-Trek over East Harbor in Truro, Massachusetts.

Alula-Trek flies over Truro beach cottage strip in foreground, Provincetown in background, Cape Cod Bay between.



DISCLAIMER

I have flown with designer Michael Richter and consider him a personal friend. For years I have greatly admired his manifold design skills and production engineering capabilities ever since I first built and flew his Weasel and Alula slope soaring sailplanes.

Now my admiration for Michael vaults to the next level with the release of the Alula Trek, because refinements in design and manufacturing have made it an even more impressive sailplane. Designers that work to REFINE an already good design are rare and wonderful.

KIT CONTENTS and ASSEMBLY

The manufacturer claims one to two-hour assembly and radio setup time. I've completed two builds, both in under an hour. No glue is used, only magnets and tape.

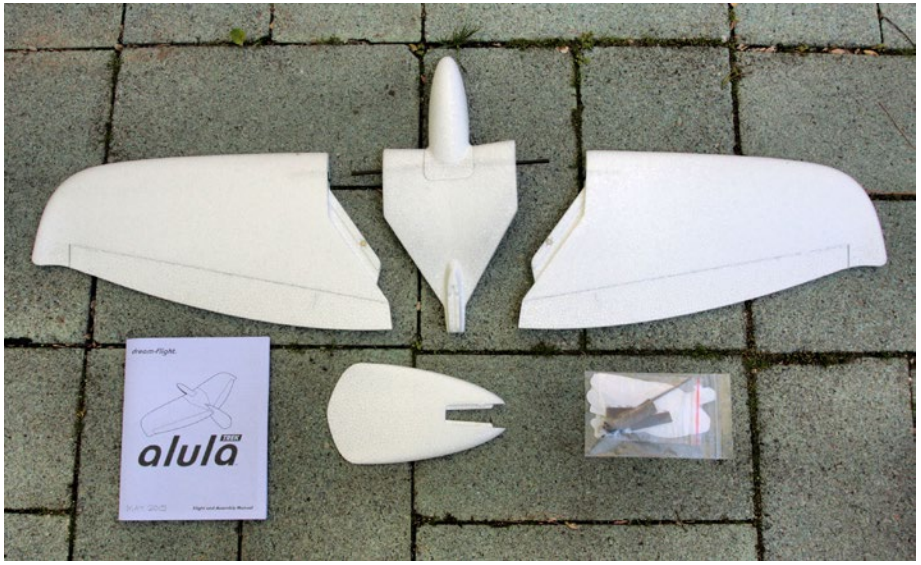
The Alula-Evo is truly designed to disassemble easily to fit back into its original shipping box for safety in transport and ease of storage.

The assembly, setup and flying manual is complete, well organized, well-illustrated. The best in the business in my estimation. It includes sections on slope flying and thermal finding.

The molded foam parts have a much smoother surface finish than the Alula-Evo, and mold-ejection marks are absent.

The wing mount magnets are installed. The main spar tube and CF blade wing stiffeners are installed. The control rods are already assembled. The fuselage half-shell comes already attached.

Alula-Evo (L) and Alula-Trek (R).



Alula-Trek kit contents: five molded foam parts - wing halves with elevons pre-hinged, fuselage with hatch, vertical fin. Also a complete hardware bag and the superb construction, trimming, and flying manual.

Alula-Trek over Route 6 beach cottage strip. Truro East Harbor at right, Cape Cod Bay at left.

I painted the wingtip markings in two evenings, and on the third evening assembled the airframe, installed the receiver, battery pack, servos and control linkages in 40 minutes.

The plane balanced on the molded balancing marks with no additional weight needed.

It took another 15 minutes for me to set the control throws to specification. My Trek was ready to fly in 55 minutes. I had built an Alula-Evo previously and I was familiar with setting up elevon (Delta wing) controls in my transmitter. RTF weight was 6.1 ounces (172 grams).

The wing mount clamp screws, and the elevon clevis clamp screws are quite tiny. Smaller than small. I worked over a towel to make it easier to find the screws I would inevitably drop during installation.

The manufacturer's tip on page 13, using tape to mark the extent of the control surface travel, works just great. It saved me time and frustration over my previous method of holding a scale against the control surface with one hand, and using my other two hands to hold the model and the transmitter.

I used the manufacturer's Flight Pack (Part Number DFFA008) which includes a pair 4.3 gram digital servos, a 300 mAh NiMh battery pack, and special short Battery Extension Wire. All parts dropped into place without modification or foam carving. The servos are held in place with clear tape, and the battery pack is mounted with hook-and-loop tape – both provided in the kit. I found the Battery Extension Wire is needed for an end-pin receiver and not needed for a top-pin receiver.

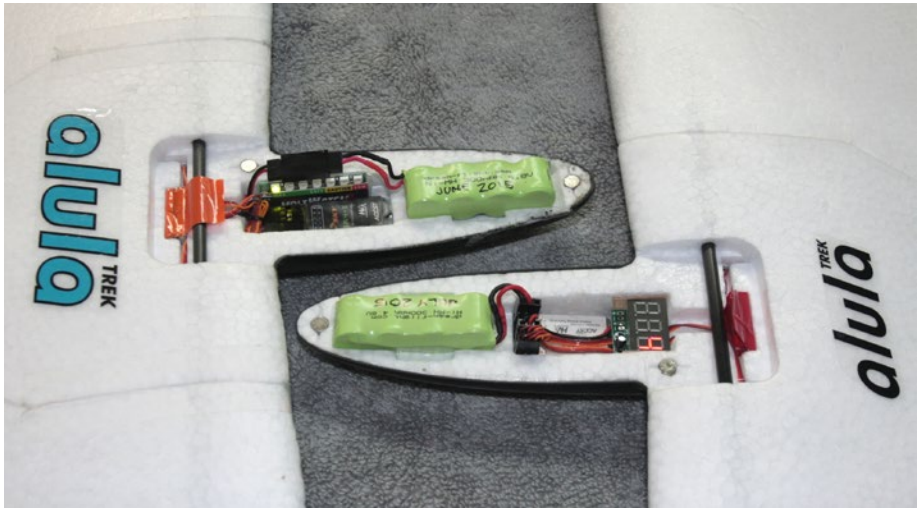
One more example of design genius is a ballast compartment molded into the airframe, sized perfectly to hold four Dream-Flight Steel Balance/Ballast Weights (Part Number DFFAA002). The four add 0.7 ounce (20 grams) to the airframe for added speed and gust handling, and they install or extract in a jiffy.

Half-inch (13mm) wide 3M ™ Blenderm Tape (Part Number 1525-0) works well for mounting the vertical fin, and for securing the wing for the centrifugal force of tip launches. A rubber band may be helpful in securing the molded foam hatch in the event of an untoward one-point landing.

FLIGHT REPORT

The Alula Trek has subtle changes over its predecessor - reduced wing sweep and thinner airfoil and IT FLYS EVEN BETTER THAN Alula Evo. The improvements make it noticeably more stable in launch and seemingly groovier in flight - perhaps a little faster, yet very smooth and still floaty.

For me the Trek launches arrow-straight, predictable and repeatable. My older Evo version is not nearly so predictable, diving toward the ground or



TOP: The end-pin FrSky V8R4-II four channel receiver allows room for a Hobbico VoltWatch2 Rx Battery Monitor, Tower Hobbies P/N LXHDJ2. The Dream-Flight Battery Extension Wire serves as the on/off switch. BOTTOM: The top-pin FrSky V8R7-II eight channel receiver allows room for a Hobby King LED RX Voltage Indicator - HK Product ID: 067000001. With a top-pin receiver, the Battery Extension Wire is not needed. The orange and red tape are pull-handles for the Dream-Flight Steel Weights ballast, nestled in their molded ballast compartments.

climbing straight up if my launch angle is not right on. My new Trek launches like it was shot from a crossbow.

For me the Trek just grooves through turns, making me look like a little better pilot than I am. The controls feel 1:1, and this gives me confidence to fly in more daring locales - places where a downed glider is not recoverable. It lets me try new slope soaring locations that did not work well with other airframes.

Aerobatics are rewarding with the Trek. Inverted flight feels very natural. Big loops, small loops - all good. Outside loops are a special joy - this plane practically flys itself through the biggest, prettiest outside loops of any sailplane that I can remember flying.

I have trouble flying smooth axial rolls. For me the Trek falls out of the

The Alula Trek against a deep blue sky.

Above left: Dave turns and burns at Oakwood Avenue overlook in Troy, NY. Jim Harrigan made this action shot with the Empire State Plaza, Albany New York, about 11 miles away in the background.

Above: Catching your slope sailplane is one way to land safely in the heavily-wooded northeastern United States.
Photo by Jim Harrigan.

The Alula Trek is also happy off the slope. Here Dave does a nice sweeping turn with the Alula Trek on the flatland.
Photo by Jim Harrigan.

maneuver in the last quarter of the roll. Pouring on the speed in a preparatory dive helps. Next for me to try is dialing in some aileron differential. But up to now, good-looking rolls have eluded me.

The tip-launch capability allows soaring over tree lines at the edge of the slope, gaining some altitude to venture out and work very light lift. In case you are elected “Wind Dummy” the first to launch a sailplane and prove or disprove there is sufficient lift to fly on the slope, you’ll be happy to have the discus launch capability. And of course, tip launch (also called discus launch, and sidearm launch) enables flatland thermal-hunting flying.

METICULOUS SETUP IS THE KEY TO HAPPY FLYING

Airframe balance and control throw setup is critical to having a pleasant flight experience with any “plank” glider and it is certainly true with Alulas. Dream-Flight has done their part with molded-in balance marks and detailed control throw specifications in the assembly manual. Work meticulously here. All launch and flight problems that I have seen with Alulas can be fixed with careful attention to balance and control throw setup.

CONCLUSION

The Alula Trek is an advanced version of an already truly cool slope and hand-launch glider, superbly designed and exquisitely manufactured. I will nominate it for evaluation as a New York Slope Dogs “Must Have” sailplane. Testing usually takes five or more flyers about a year. I hope to return to R/C Soaring Digest with the results of that testing and a long-term use report. For me personally, it is already a “Don’t Leave Home Without It” sailplane.

ALULA TREK SPECIFICATIONS

Wing span: 35.4 in (900mm)

Wing area: 259 sq.in (16.7 sq.dm)

Weight range: 5.5 - 6.5 oz (156 - 184 grams)

Wing loading range: 3.1 - 3.6 oz/sq.ft (9.3 - 11 gm/sq.dm)

Wind speed range: 0-15 mph

Building time: 1-2 hours (plus delta wing radio setup time)

Minimum radio requirements: Two channels with elevon mixing, dual rates and ATV (Adjustable Travel Volume).

Recommended on-board components: micro receiver (4 - 6 grams), two sub-micro servos, 4.8V 300mAh 1/3AA NiMH battery pack

RESOURCES

Dream-Flight (Alula-Trek kit supplier)
www.dream-flight.com

Alula-Trek build thread on RC Groups
www.rcgroups.com/forums/showthread.php?t=2362949

ALULA REVIEW HISTORY in *R/C Soaring Digest*

1. Alula original hot wire cut kit - Bill Kuhlman, *RCSD* OCT 2004
2. Modifying the Alula for three servos, Part 1 - Bill Kuhlman, *RCSD* MAY 2005
3. Modifying the Alula for three servos, Part 2 - Bill Kuhlman, *RCSD* JUN 2005
4. Modifying the Alula for three servos, Part 3 - Bill Kuhlman, *RCSD* JUL 2005
5. Alula Evo (molded version) - Dave Garwood, *RCSD* February 2013

A conversation with designer Michael Richter

Michael, to you what makes a great-flying sailplane? What are the essential flight characteristics of the sailplanes you most like to fly?

To me, flying R/C sailplanes is as much a visual experience as it is a challenge to my reflexes.

With that said, I'd have to say a great-flying sailplane is one that is versatile, maneuverable, and doesn't have any bad habits. It should be mellow and also keep up when you are feeling feisty.

To me a great-flying sailplane should maintain energy well, and not just count on its weight to do so... not too light, not too heavy; it's about balancing the weight and drag of the design so that it "feels" right in varied conditions.

How did you come to the decision to refine and improve the ALULA, rather than, say, develop a new design, as you did with the Libelle? I mean, we did not know our beloved ALULA EVO ***could*** *be improved until we flew the ALULA Trek.*

The Alula design has been one of Dream-Flight's most popular gliders. It allowed us the ability to grow, since it appealed to a wider group of R/C pilots. How then could we not bring it back?

Since the Alula-Evo molds were outdated, we were given the rare opportunity of a re-do. So, we decided to finesse the design so that the core flight and aesthetic characteristics that we've come to appreciate are maintained or even enhanced.

Please say a little about the changes, enhancements, and improvements you have made to the ALULA Trek over the ALULA EVO?

1) New airfoil: It's a secret recipe! We took what we learned from the EVO series and applied this to the new Trek series. We wanted to achieve trimmed flight with the elevons close to neutral position, at best glide.

Both the Evo designs always required a little trim to get it right.

Basically, we took the best characteristics of the EVO airfoils and attempted to merge them, and at the same time thickness was reduced for the Alula-Trek and camber is adjusted lightly as you get closer to the wingtip.

2) We finessed the shapes and the thicknesses of the parts to reduce the volume so that we could use a little more dense foam for added durability. But this was a balance, since we did not want to affect the flight performance and style much.

In the end these changes, in my opinion made the design better in flight too.

3) Design: In addition to the airfoils, we made some slight changes to overall wing planform.

Forward sweep angle was reduced slightly to reduce amount of nose weight, and the nose length was increased slightly for the same reason.

The chord lengths are also a little different from root to tip than the EVO — a little less area at the tips, and with less wingtip up-turn. Elevon area has also been increased slightly, and the reduced hinge angle affects the flight and control slightly too.

When will we see a new release of the WEASEL, and what might be improved over the last molded WEASEL?

In manufacturing, "planned" lead times don't always turn out exactly as planned. That being said, we are hoping for a release sometime between late 2015 and early 2016.

As far as improvements, we will be taking a similar approach with the upcoming Weasel as we did for the new Alula-Trek.

What might be next for Dream-Flight?

That would take all the mystery and fun away! Really though, George and I are so looking forward to working on some fresh designs in the coming year. Stay tuned!

Dave flies at John Thatcher State Park. Empire State Plaza, about 15 miles away, in background.

Looking over the wall of the Helderberg Escarpment at John Thatcher State Park, Albany County New York.

F3F slope racing

Mt. Terrible, South Australia

Text by Mike O'Rielly, photos by Anatoly Patrick, anatolypatrick@gmail.com

Line up from the front; Adam Fisher's RCM electric hotliner, Simon Morris' Tragi 603, Mike O'Reilly's Freestyler 3, two Southern Sailplanes Ricochet of John Tonks, and John's Crossfire at the back.

Planes. Simon Morris' Multiplex Cortina in the foreground, John Tonks' Ricochet and Mike O'Reilly's Mini Corrado behind. Mike O'Reilly's Freestyler 3 is off to the left at the edge of the hillside.

Mount Terrible, 40 minutes south of Adelaide on the Fleurieu Peninsula, with panoramic views was a spectacular place to launch the first F3F event in South Australia.

On the plains below are the McLaren Vale and Willunga basin, famed as a wine growing region, and to the west is the sparkling ocean of St. Vincent's Gulf.

Several wedge-tailed eagles were sharing the slope with us and in the past they've have had the odd tangle with our planes.

The slope has been used by Southern Soaring League members since the early 1970's. In fact a group of international pilots flew here in the week after the 1985 F3B World Championships which were held at Waikerie South Australia.

With a drop in enthusiasm for F3B events but with a number of members still flying F3B models it was thought that some winter slope flying might generate some interest and provide a chance to go fast with these slippery models.

And so we had our first F3F event at Mt. Terrible in June. The weather forecast was encouraging all week with a forecast for moderate strength N-NW winds which are perfect for Mt. Terrible.

About 15 members arrived around the 10:00 start time and had some test flights and in the end six pilots nominated for the F3F event.

Mike O'Reilly's Freestyler 3 silhouetted against the sky.

Connor Thomas and his Faser.

Mike OReilly about to launch his Freestyler 3, John Tonks (timing), Mike Seyfang (assisting).

Mike O'Reilly (timing), John Tonks (flying), Mike Seyfang (calling) as John's Crossfire completes a turn at Base A.

Mike O'Reilly's Freestyler 3.

The curvature of the hill made it difficult to layout the preferred 100 metre course so we made do with approximately 70 metres.

The wind blew at around 6 m/sec and slowly moved from the north to more NW. This increased the strength of the lift but placed the Base B turn point in an area of less lift.

As the morning progressed most pilots got faster in the later rounds and were certainly enjoying themselves.

We saw a variety of models including the winning Crossfire of John Tonks, a Freestyler 3, an old but immaculate Tragi 603V and two Caracho 3000's.

Our next event is scheduled for late August and we hope that the weather gods will smile upon us again.

Mike O'Reilly's Freestyler 3 exits the course.

Accessories for the Dremel 580 Table Saw

Bill & Bunny Kuhlman, bsquared@rcsoaringdigest.com

Our Dremel 580-2 table saw.

The Dremel 580 series table saw is one of those items modelers simultaneously love and hate.

This relationship has its roots not in the design of the saw, which is actually pretty good, but in the downright pitiful quality of the included accessories.

We purchased a Dremel 580-2 table saw at a garage sale a few years back. With light use by the original owner (primarily cutting thin sheet wood for small doll houses) the saw was in good shape but was missing the miter gauge and could benefit from a new belt.

In looking for a new belt, we found Bob Beecroft's web site <theaerosmith.com>. Bob is into free flight modelling, but his web site is a fantastic resource for every aeromodeler. It's through Bob's pages devoted to the Dremel table saw that we transformed our own saw into an astoundingly useful tool. This successful transformation is due almost entirely to four accessories we purchased from Bill Wilson.

The four items we purchased:

- Miter gauge
- Cross-cut sled
- Dust plate/wobble lock
- Rip fence

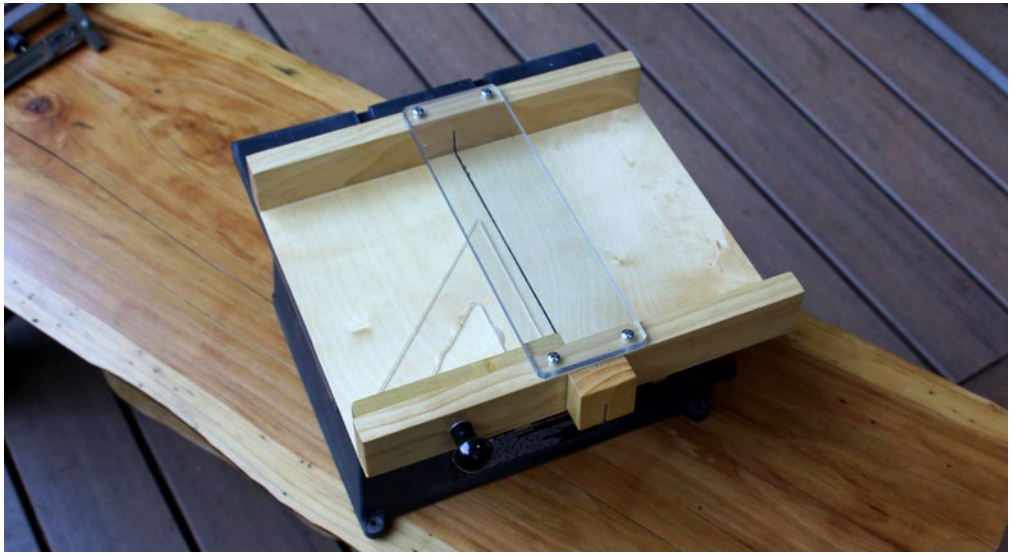
We'll describe each of these in order...

The miter gauge

The miter gauge which comes with the 580 table saw is of bent sheet metal. The fence is relatively low and the locking mechanism is difficult to adjust and not all that accurate over the long term.

Bill Wilson's miter gauge is a work of art. Made of made of 6061-T6 aluminum, the fence is roughly double the height of the Dremel version and is substantially longer, overhanging the edge of the table.

Bill Wilson's miter gauge.



Bill Wilson's cross-cut sled.

The knurled knob is larger than the Dremel, so it locks more securely, and sits higher, making it easier to adjust.

Bill sells this miter gauge for $24.50 & $5.85 shipping.

The cross-cut sled

The cross-cut sled is of wood construction and comes with a clear finish applied. The sled base is 1/8" plywood and the blade slot is precut. The whole rig slides smoothly and there's no noticeable play. There's a built-in plexiglass shield and a 45° plastic triangle which is removable for 90° cross-cutting.

Price for the cross-cut sled is $24.50/$8.85 shipping.

The dust plate/wobble lock

The dust plate/wobble lock provides two important benefits:

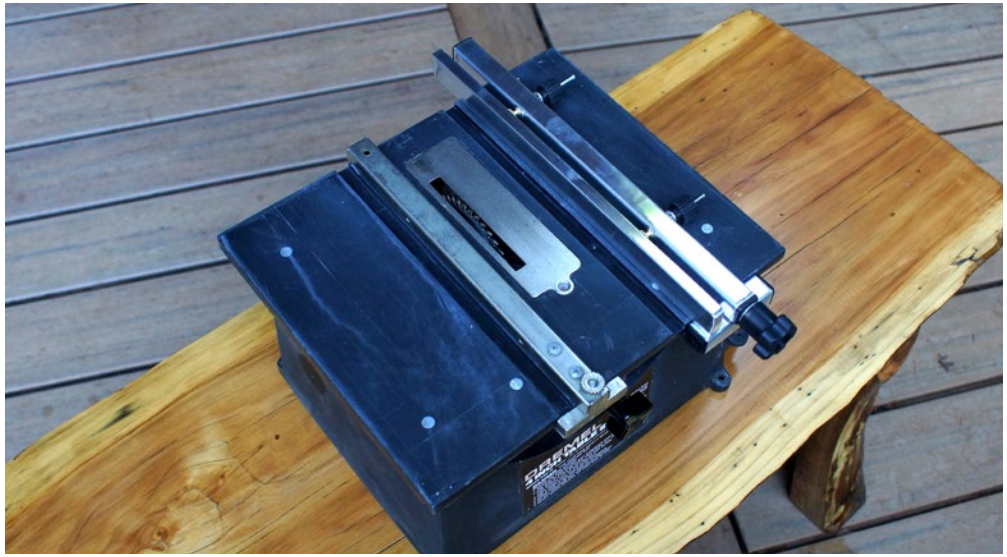
(1) The tube that cemented to the plate can be hooked up to a 1" shop-vac hose. This allows nearly all of the produced sawdust to be collected from directly below the saw. Someone with good electrical skills could figure out a way of automatically turning on a dedicated vacuum any time power is supplied to the saw.

(2) Once installed on the saw, the open back is sealed and the sides of the saw base are interconnected. This makes the base much more rigid. Also, the plate is attached to the saw shield through use of a second blade angle adjustment mechanism, thus making the blade much less likely to wobble.

There is one disadvantage to the dust plate, however. The Dremel supplied finger guard can't be used without drilling two holes in the dust plate at the appropriate locations and attaching the finger guard with longer screws. And reattaching the finger guard in this way prevents the blade angle from being set to any angle other than vertical.

The dust plate/wobble lock is only $22.50 with $8.45 shipping.

Bill Wilson's dust plate/wobble lock.



Bill Wilson's rip fence compared with the supplied Dremel product.

The rip fence

The rip fence supplied by Dremel is of stamped steel, is difficult to adjust, and doesn't seem to remain accurate with use. Bill's rip fence, on the other hand, is another work of art made of made of 6061-T6 and 6063-T6 aluminum.

The main piece is 3/4"square tubing and the adjustable fence is a solid bar 1" high and 3/8" thick. Small knurled brass fittings allow for true micro adjustment. The front piece which presses against the saw table is a full 2 1/2" long and the large locking knob allows for a firm placement with absolutely no lateral movement while in use.

Bill's rip fence is, in a word, perfection. The rip fence was the most expensive of the four items we purchased at $39.50 and $9.45 shipping, but it's well worth the price.

As we mentioned, we ordered all four of these items from Bill at the same time. Doing this saved about $15 in shipping costs which Bill refunded. Everything was delivered in one box and was very well packed.

Check out all of Bill's Dremel table saw accessories on Bob Beecroft's web site: <http://theaerosmith.com//catalog_3.html>.

And on Bill's EBay page: <http://tinyurl.com/qjdewwp>.

Tom's Tips

Super strong clevis rods

Tom Broeski, T&G Innovations LLC, tom@adesigner.com

I was having trouble with the clevis rods for my flaps bending or breaking on landing.

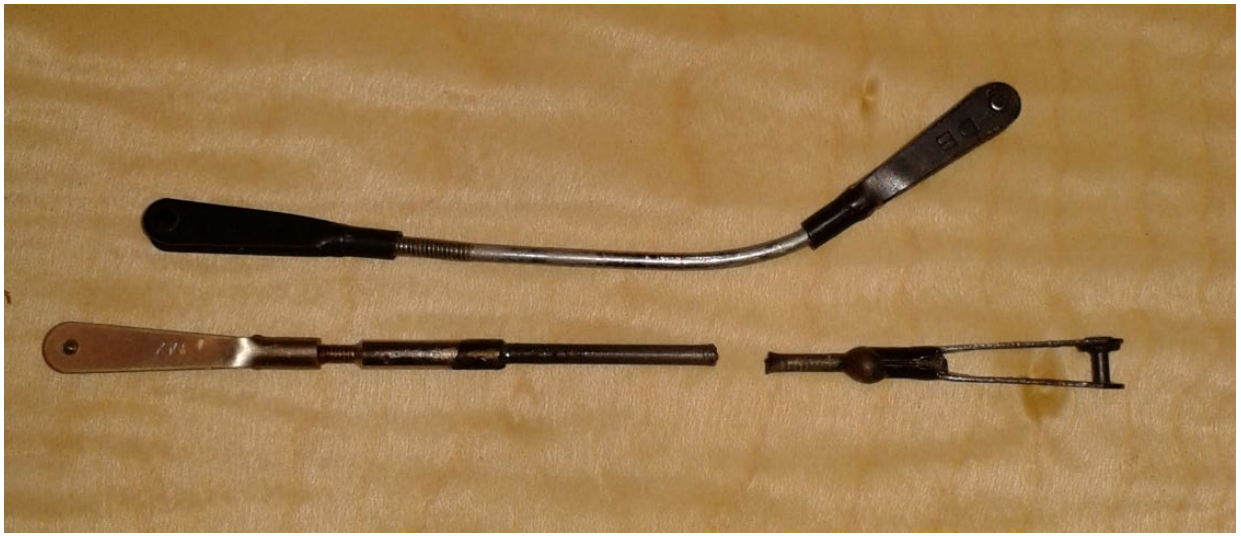
I tried carbon rods and they broke.

I tried the regular 2-56 rods and they bent. Sooooo....

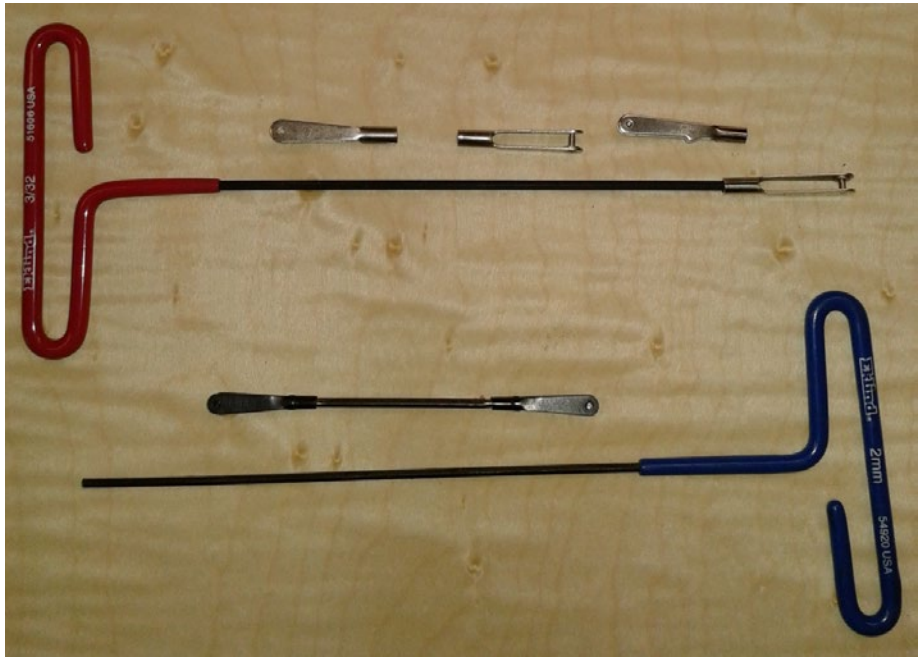
I looked around the shop for something strong enough to do the job.

I looked for some drill rods, but didn't have anything small enough.

I had some extra hex wrenches and realized they were strong enough not to bend or break and I could cut them to size and thread them, Something I couldn't do with a drill rod.



Bent and broken clevis rods.



A 3/32" hex wrench works for 4-40 clevises and a 2 mm works for my 2-56 clevises.

And the hex wrenches can be threaded, something you can't do with drill rod.

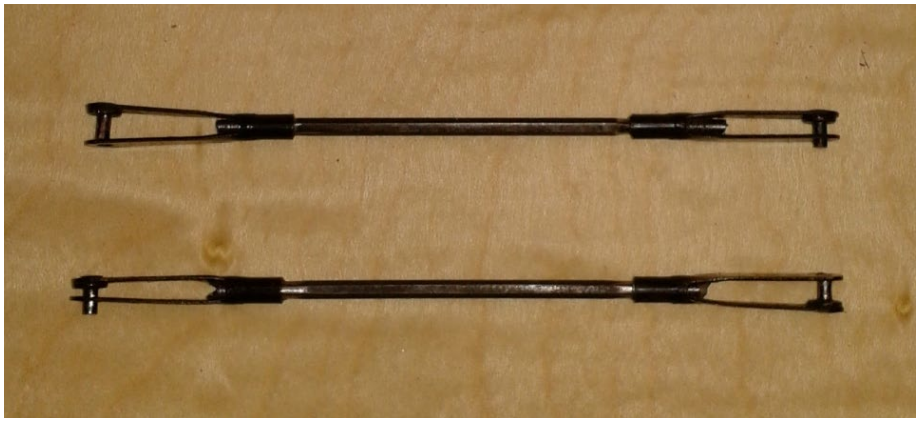
I found that 3/32" works for 4-40 clevises. You can thread the shaft or glue on the clevis — it doesn't solder very well.

The 2 mm works for my 2-56 clevises.

The 2 mm I got for $2 at ACE and was 10" long, so I got the two rods I needed and still have a usable tool.

I sanded the end down a bit to get the die started. It threaded just fine.

And there you have it. These are in my Royale and are holding up great.



The finished product.


VIPER