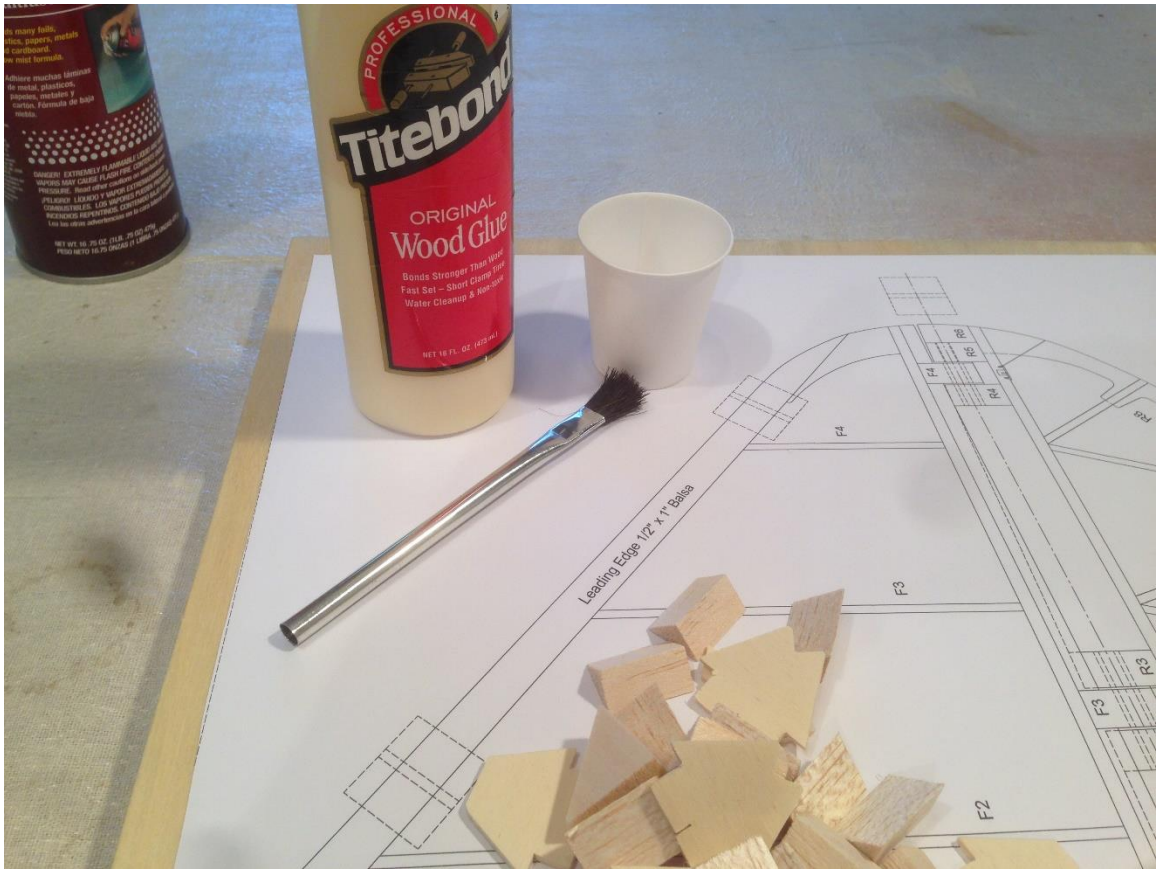
Riley Model B - Series 18 - Rudder Construction

July 1, 2024

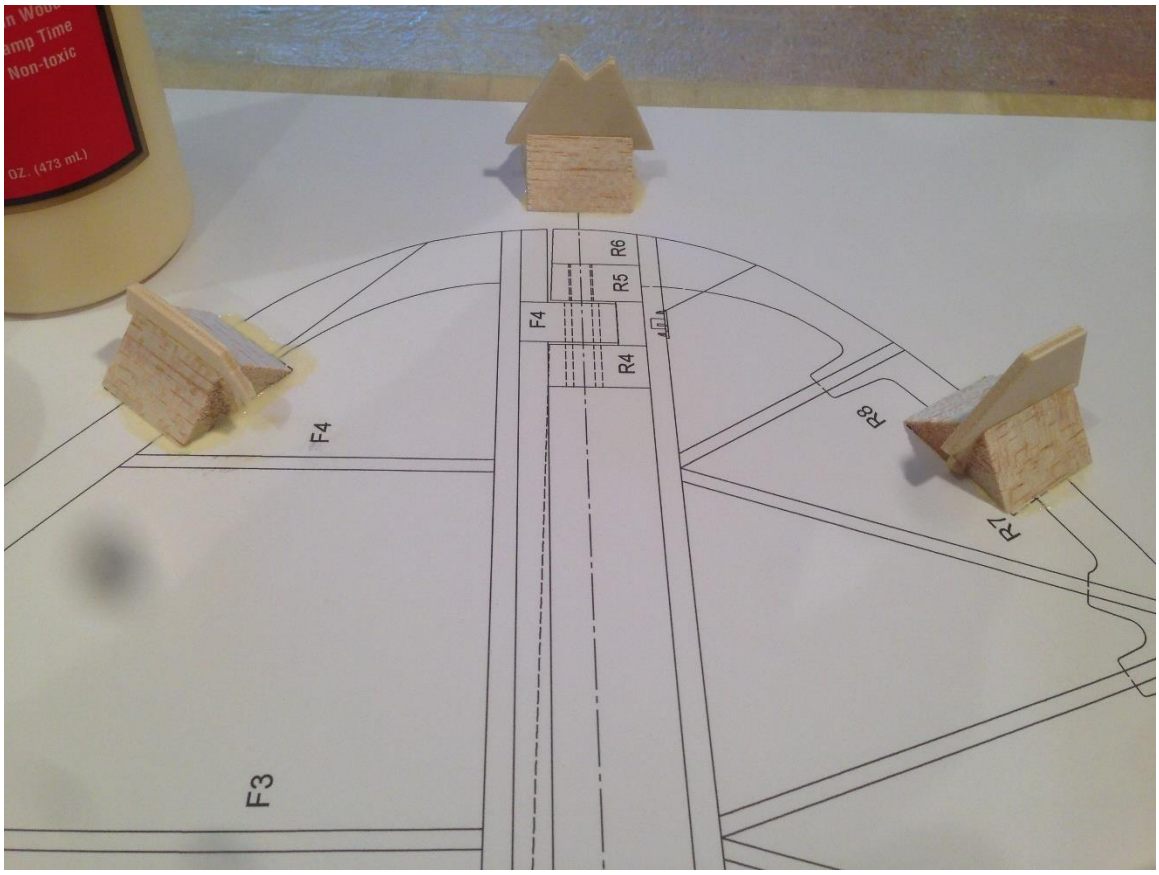
There is very little difference in the construction methods used for the rudder and the stabilizer but since the parts are labeled differently, a separate set of instructions is helpful. Some pictures are from earlier builds; all text has been updated.

Preparation

Apply plan template to a flat building board. Spray 3M #77 or Krylon Easy-Tack adhesive onto the plan; not the building board. If the plan is difficult to remove after construction is completed, a lite coat of ordinary paint thinner will easily soak through the plan and allow it to lift off the building board without difficulty.



Prepare (16) 3/8” x 3/8” x 1” basswood blocks and glue all jigs to the plan. Titebond glue applied with an acid brush works well. Unlike CA glue, Titebond will not soak through the plan and risk bonding to the building board, which would make it difficult to remove. Note: The two notched hinge alignment jigs have a kerf mark which should align with the center line of the hinge.



Making the Hinge

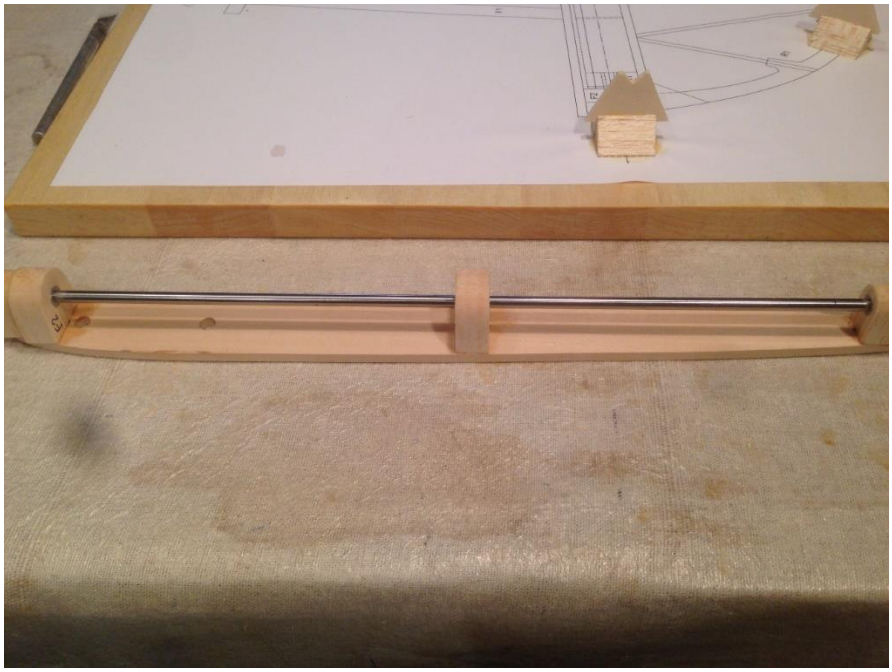
The rudder hinge is designed in the same way as are the aileron and stabilizer. A nylon spacer is inserted into a balsa hinge block. The nylon spacers are available from McMaster-Carr, part number 94639A355. These spacers are inserted into the 5/16” hole drilled through the balsa hinge block. Usually, you can just push them in with your finger. A better way is to chuck a short length of 3/16” dowel (metal or wood) into your drill press and using the dowel as a guide, press the spacers into the balsa hinge block. There is virtually no side force on the hinge, so just a little thin CA at each side of the hinge block is sufficient.

Use a .191" x 25” steel rod to create perfect hinge alignment. Available from Mc. Master-Carr.

Using the steel rod, *dry fit* the fin hinge blocks F2, F3, and F4 into the basswood fin hinge spar. Note: the spars should have a slight bevel and taper toward the trailing edge. The sides of the hinge blocks should locate exactly “on-center” between the 1/32” holes. The hinge blocks are sized for the widest part of the spar and will be sanded into shape in a later step. A gentle twist with a very sharp pencil can help make the 1/32” holes easier to see. The spar has a 4° bevel toward the trailing edge. Therefore, the hinge blocks should mount on the trailing edge side. When the alignment is correct, glue with thin CA.

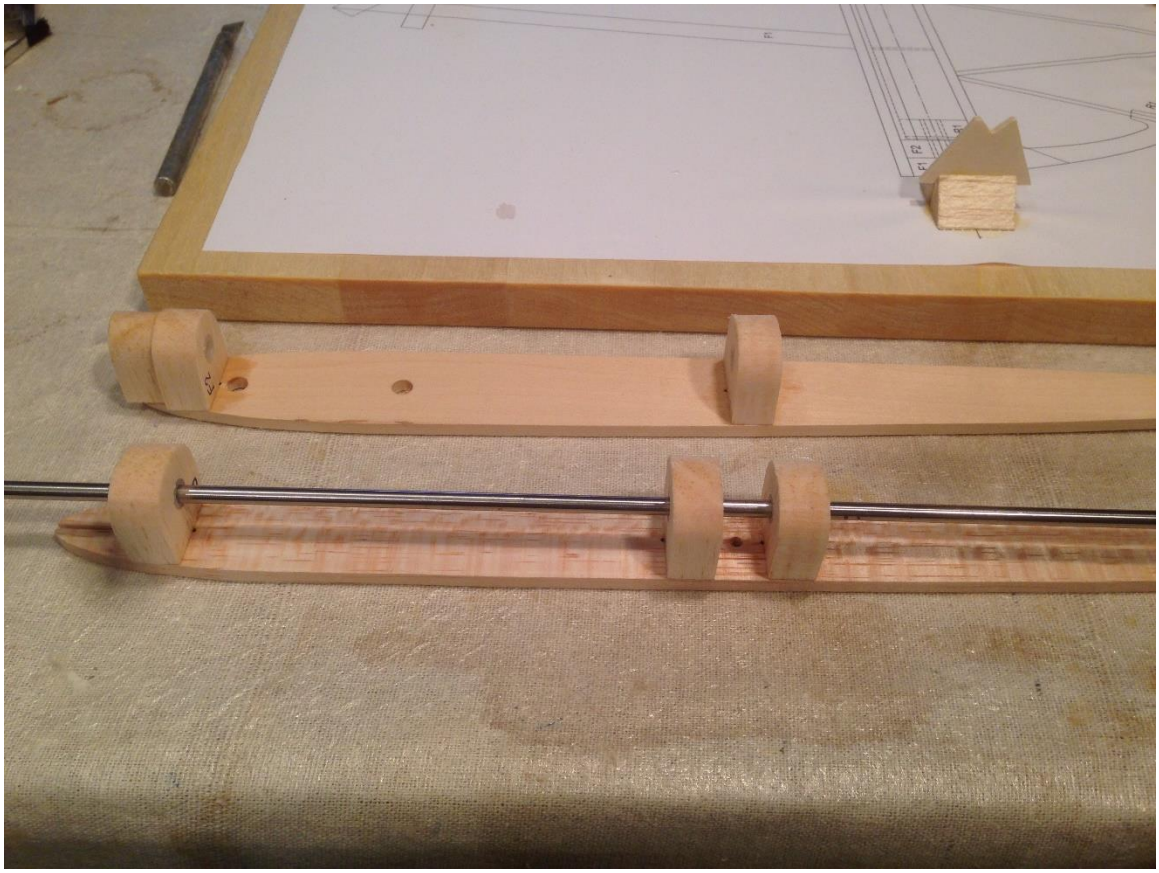
Glue F1 to the bottom of the spar.

Glue fin spar tip.



In like manner, tack glue the rudder hinge blocks R1 – R5 into the rudder hinge spar. Do NOT install R6 at this time. The rudder spar has 3° bevel toward the trailing edge. Therefore, the hinge blocks should mount on the leading edge side. Insert steel rod to insure good alignment.

When alignment of the hinge blocks is correct, glue with thin CA.

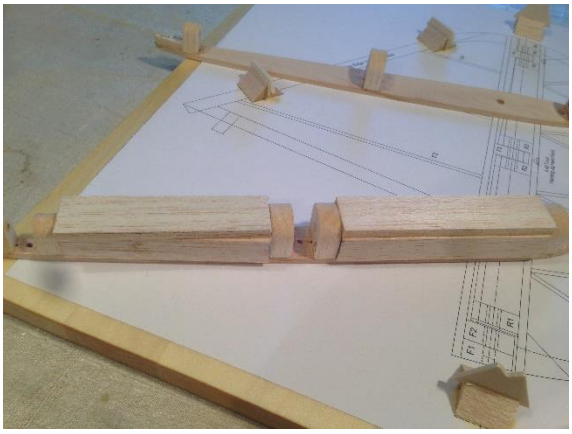


Assemble the complete hinge. Check for binding. It should be OK. Note: There should be a 3/32" gap between F2 and R1. The tail wheel control arm will be installed here in later step.

Rudder Hinge Spar – Fill Procedure

Fill rudder spar sides between the hinge mounts with 1/4” x 15/16” soft balsa. Fill with 1/4” x 1-5/16” on the top. Try to position the sides and top so that when about half the material is trimmed away, about half will remain. Mark the hinge blocks and the edge of the spar with a ball point pen to identify the shaping and sanding limits.



Fill gaps between R2-R3 and R4-R5 with 5/16" balsa triangle stock. (Resaw 3/8” triangle stock to make 5/16.”)

Shape rudder hinge with razor plane followed with a 40 grit sanding block. Allow about 45 minutes for this step.

Here are a few general principles to keep in mind while shaping:

1. Work slowly and patiently; there’s no hurry.

2. Use the plane first; then use sandpaper. The plane gives you a lot of control and makes it easier to see what you are removing.

3. Always plane down (remove) what is most obvious. Use your fingers and sense of touch to check your progress. It is best to plane down the whole part rather than to concentrate in just one area.

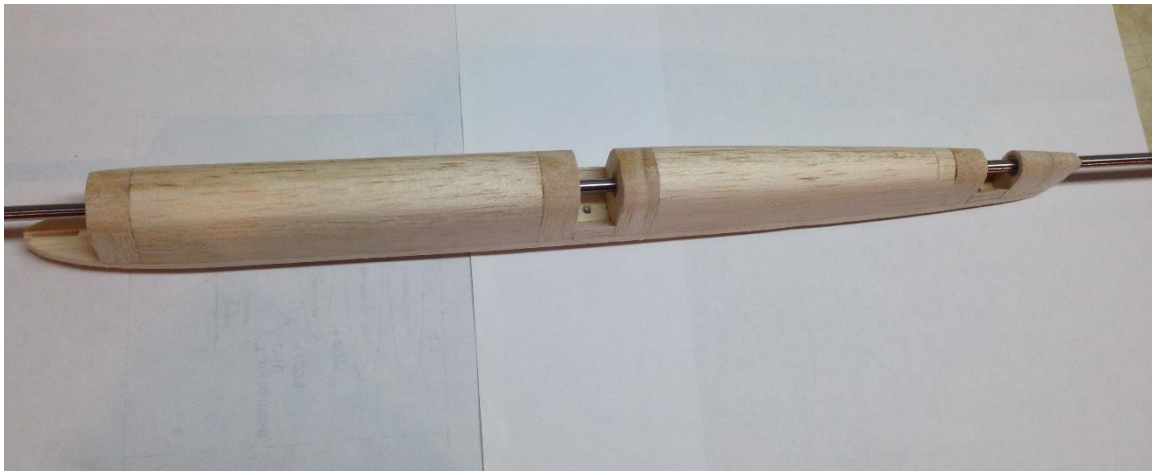
4. Use a ball point pen to mark any surface you don't want to plane or sand away.

5. Use 40 grit sandpaper and a large sanding block. For shaping, course grit and a lite touch is the best method.

These two videos show how to shape the rudder spar. Press Ctrl key and click on the link.

https://www.youtube.com/watch?v=U5N41eE47m4

https://www.youtube.com/watch?v=JUV8eWD8MgE

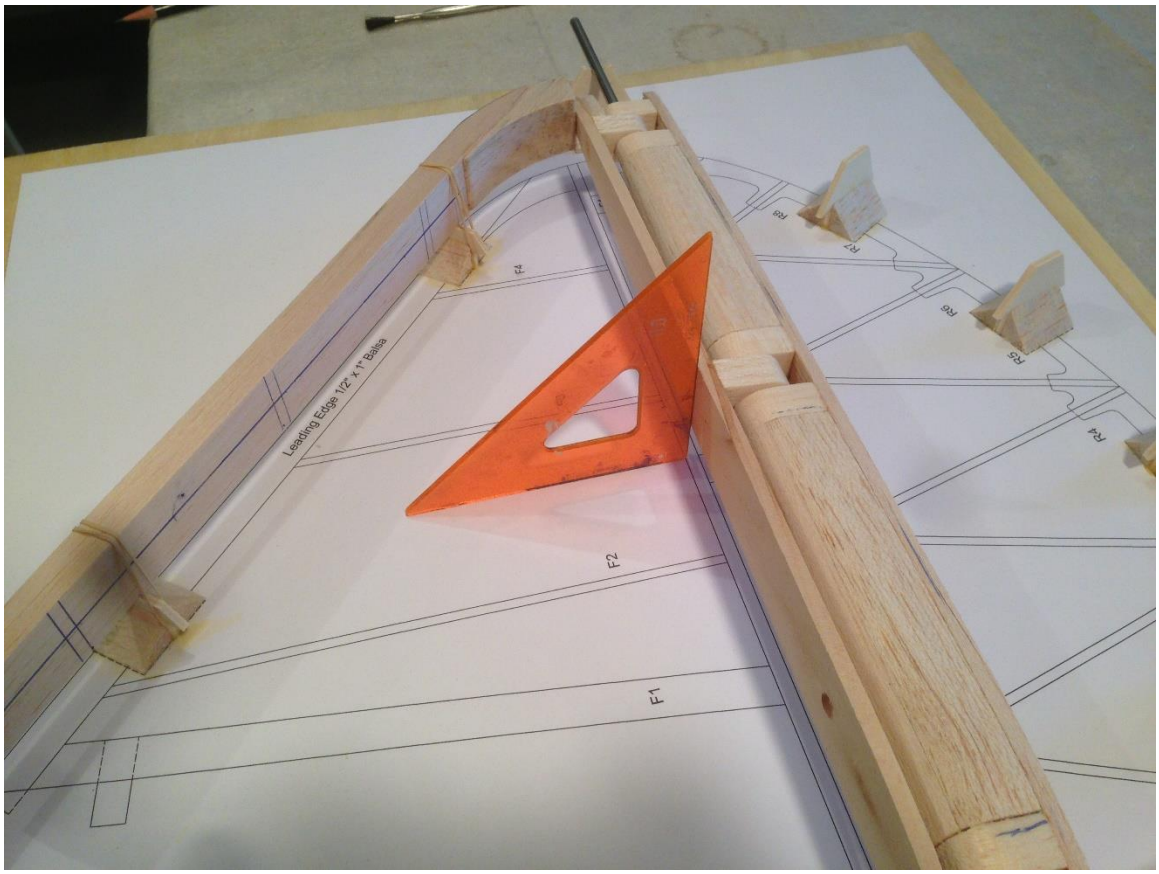


Framing the Fin

Glue balsa joining piece to leading edge as per plan.

Draw the chord Line on-center on *both* sides of the leading edge.

Set leading edge on jigs and secure with rubber bands. Use a small square; make sure that the leading edge is perfectly aligned to the plan.



Assemble the hinge. Install into the jigs as shown on the plan. If needed, use masking tape to keep the rudder part of the hinge from rotating. Glue to leading edge to tip of fin spar. Make sure that the spar is square to the building board.

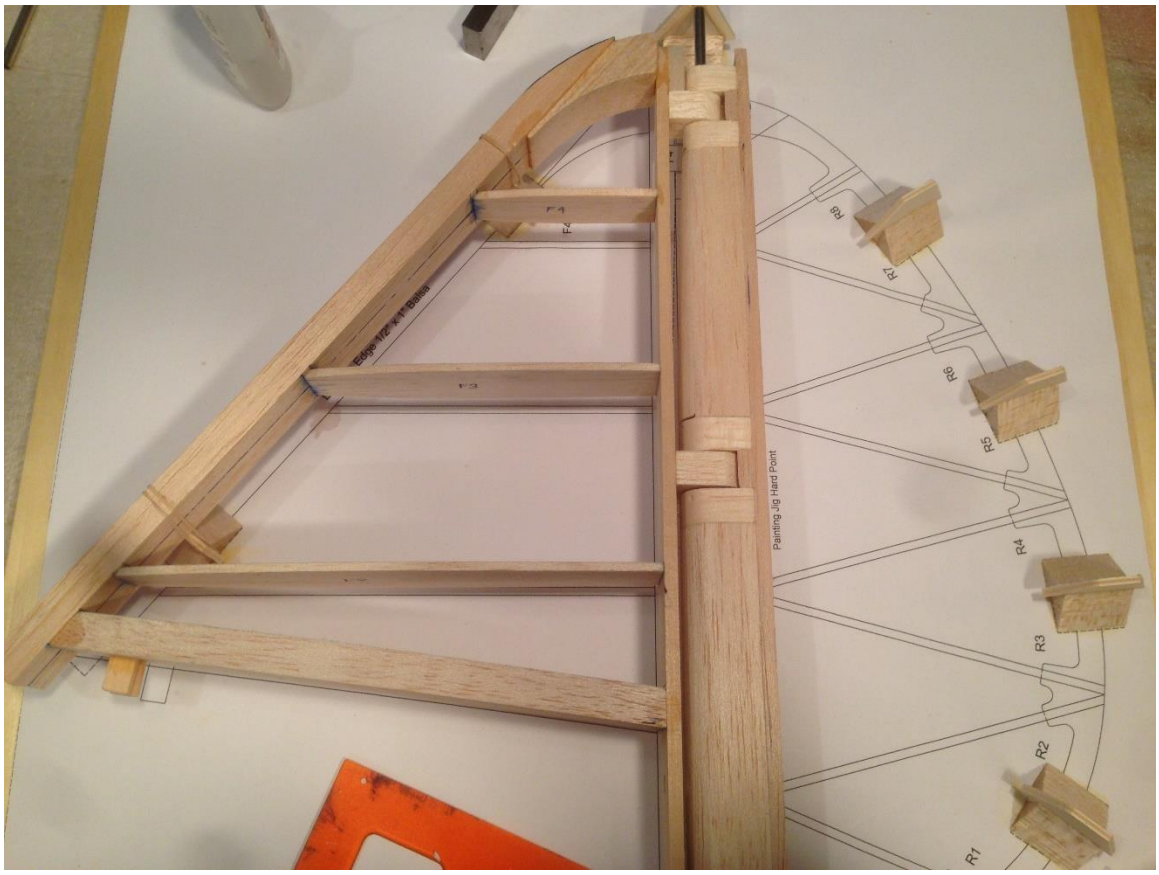
Use a small square and mark location of all ribs on the leading edge and the fin spar.

Glue (2) 1/8" x 3/8" x 1" basswood tenons into F1 as shown on the plan. These tenons locate the leading edge of the fin to the fuselage.

Swab the basswood spar with CA accelerator where the ribs F1-F4 will be glued.

Beginning with F4, install and glue F4, F3, F2 and F1 in place. Make sure to align all rib kerf marks to the centerline of the leading edge. After F4 is glued in place, loosen the

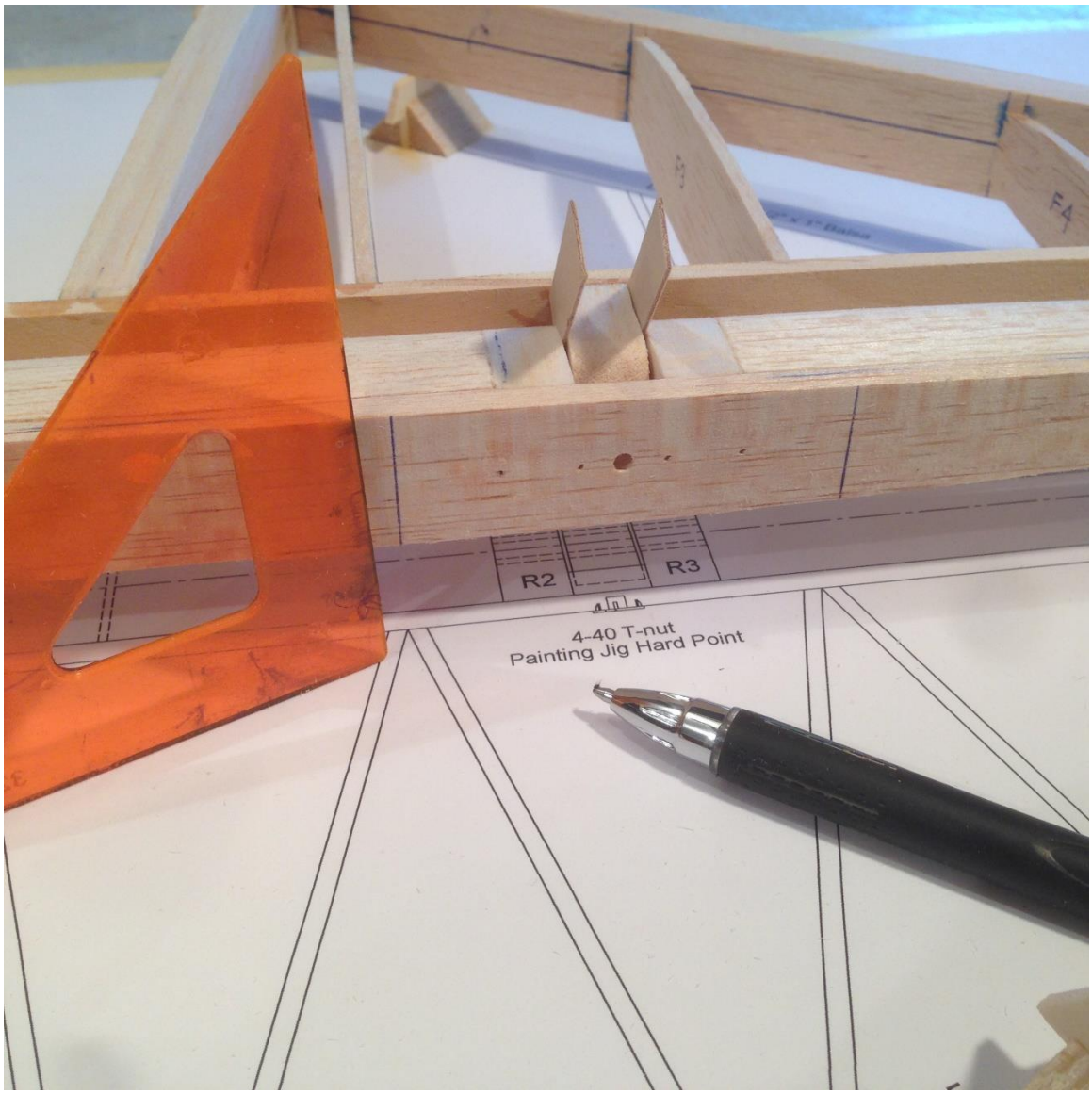
leading edge rubber bands to relieve any stress. It is usually easiest to tack glue the ribs in place. Additional glue may be added, if needed, in a later step.



Framing the Rudder

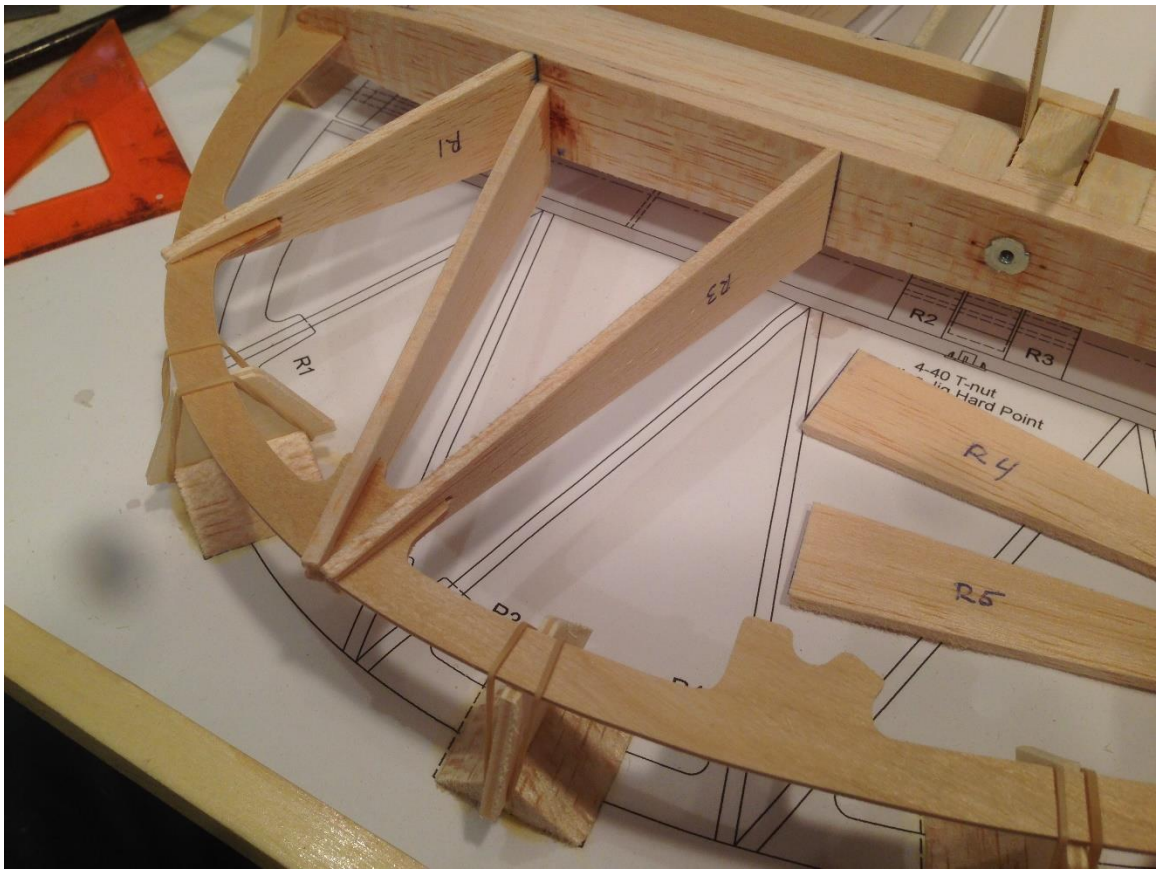
Align rudder spar to fin spar so that the hinge clearances are as even as possible.

Mark the vertical location of the rudder ribs on the rudder spar.



Place on trailing edge on jigs with rubber bands. Glue trailing edge to rudder hinge spar at both ends.

Beginning with R1, and proceeding in numerical order, set in place and glue all rudder ribs. Note: Every other rib will be labeled upside down, but since the airfoil is symmetrical, it makes no difference. What does matter is that you correctly orient the rib so that the bevel fits nicely with the spar. (Note: In this picture, R2 is obviously out of position. It was corrected after the picture was taken.)



Remove Fin and Rudder from Plan

At this point all jigs have served their purpose. The fin/rudder may be removed.

Remove hinge pin and separate the fin from the rudder.

Go over fin and rudder to check for any joints that are loose and need more glue.

Shape and Finish Rudder

Add balsa gussets at the top and bottom of rudder spar.

Glue balsa tip to fin spar.

Glue R6 to tip of rudder spar.

Plane and sand rudder ribs so they taper to zero at trailing edge. Shape the tip also. Use razor plane and 60 grit sanding block to shape.

These two You Tube videos show how. Press the Ctrl key and click on the link.

https://www.youtube.com/watch?v=YqS7HNSdpXU

https://www.youtube.com/watch?v=IjVhwa9HGVc

Fin spar

Fill gaps between F2 and F3, and F3 and F4 with 5/16"” balsa triangle stock. The top edge of the triangle should be at the same height as the surface of the hinge block.

Shaping the Leading Edge

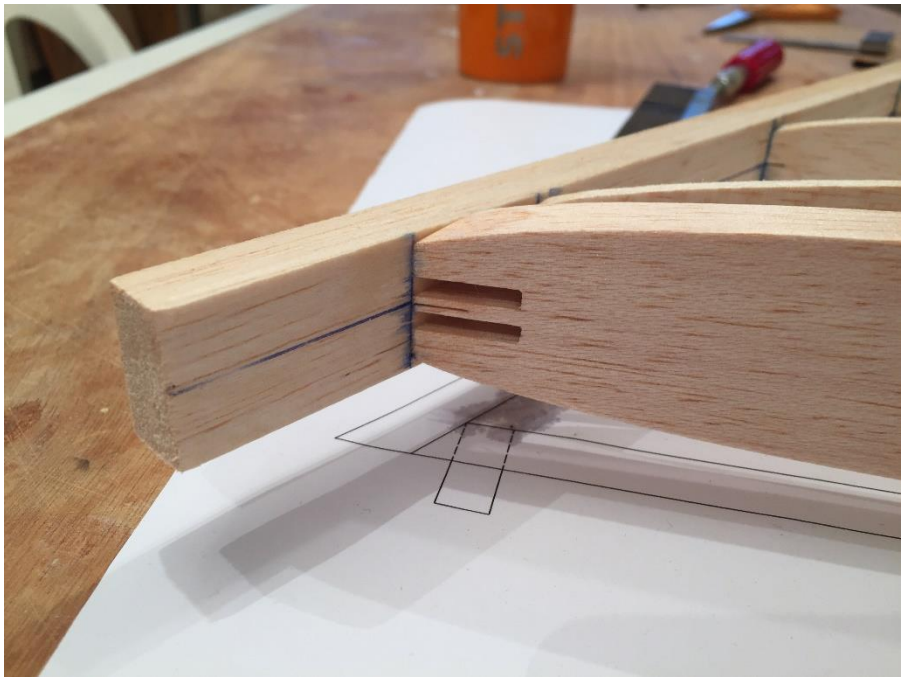
Shape the leading edge. When almost finished, join the fin and rudder and insert the hinge pin. You may need to do some additional shaping and sanding at the tip. Use a razor plane and 60 grit-sanding block to shape. final sand with 100 grit. Allow at least 30 minutes to do a nice job.

These two You Tube videos show how. Press the Ctrl key and click on the link.

https://www.youtube.com/watch?v=_wmmY9t_nnc

https://www.youtube.com/watch?v=vaznFHRkeVQ

Trim off excess leading edge at S1.



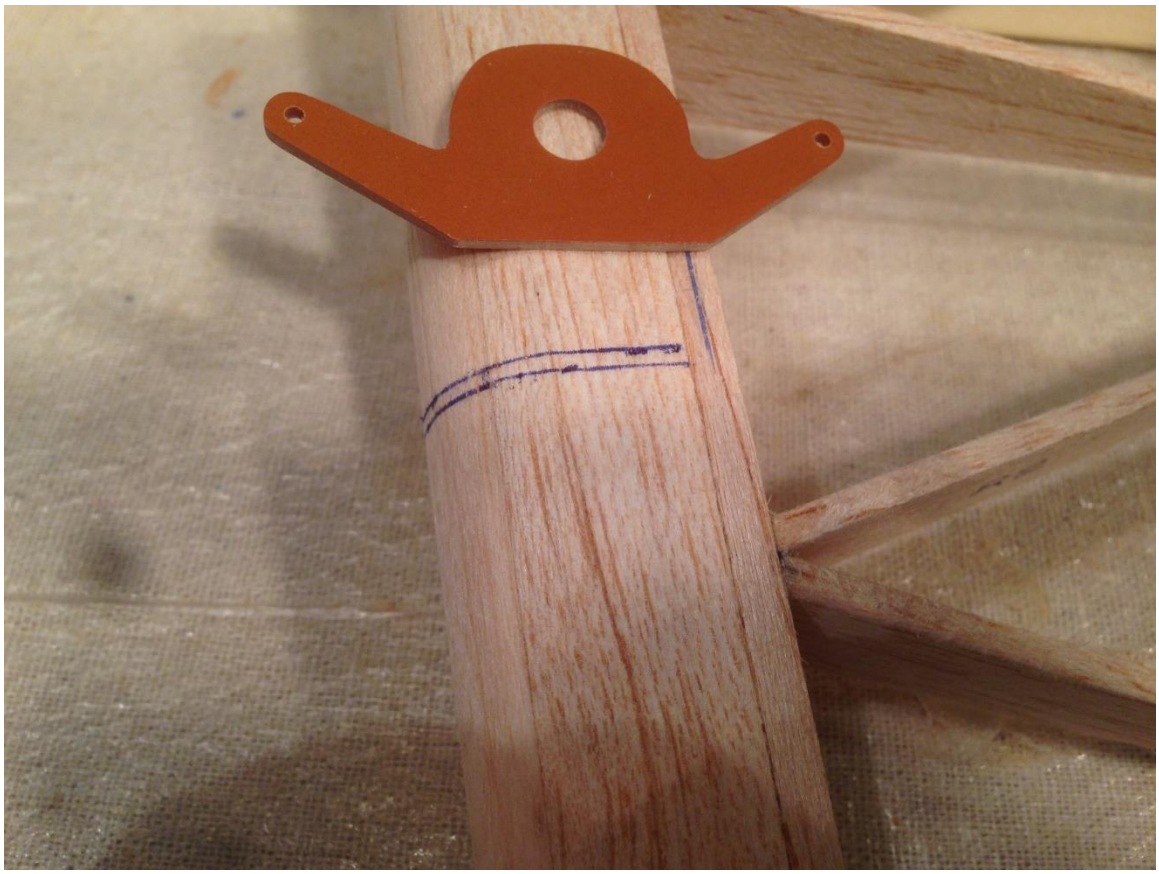
Install Control Horns

The rudder has two control horns. The rudder pull-pull horn is located in line with the bottom edge of F1. See plan. The tail wheel horn mounts flush with the bottom of R1. Lightly sand both horns and swab with CA accelerator.

Using a razor saw carefully cut a 1/16" slot for the rudder pull-pull horn. See plan for reference. CAUTION! DON'T CUT THE SPAR!!

Glue rudder pull-pull horn in place with thin CA.

Glue tail wheel horn to R1. Orient the arm to the right side. When the tail wheel is mounted to the fuselage, its arm must also orient to the right side. In other words, both the horn that attaches to the rudder and the horn that attaches to the tail wheel, need to be linked on the same side.



Delrin Hinge Pin

Cut a piece of 1/8" Delrin tubing to a length of 17." After covering and painting, the tube will be shortened so that it fits about 1/4” inside the bottom tip. The tube will be secured (semi-permanently) by gluing a 3/16" x 1/4" piece of wood dowel.

Complete Rudder Construction

Fill cracks and dings with spackle.

Final sand with 180 paper.

Weight – Complete – Ready to Cover

3-1/2 oz.

Make Jigs for Painting Rudder

It is virtually impossible to paint the rudder without some method to hold it while you paint. That is why there are 1/4-20 tapped holes in the rudder spar. To make these jigs cut pieces of 3/8" dowel to a length of about 9" inches. Disk sand the ends so they are flat and square. Sand the heads of 1/4-20 x 3/8" nylon socket head screws by scraping across 100 grit paper on a flat surface such as your sanding block. Apply CA accelerator to the wood dowel only. Hole the nylon screw to the end of the dowel and wick in thin CA around the perimeter. When the glue sets, the jigs will have plenty of strength. When the jigs are in place for painting insert the plane ends into any suitable block of wood drilled with 3/8" holes.