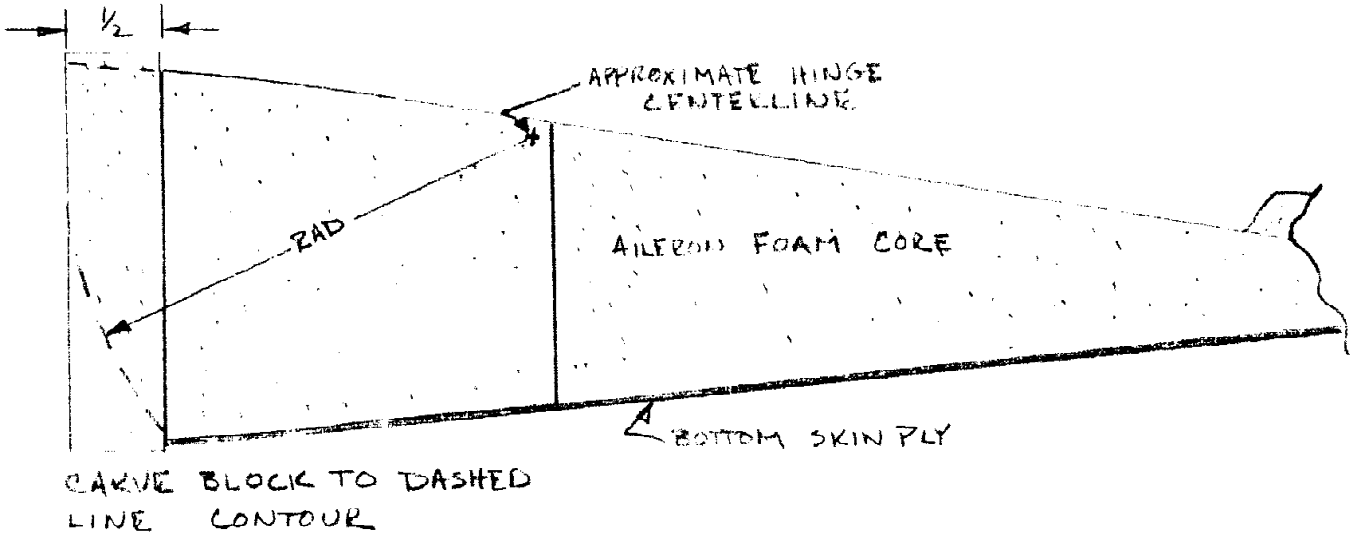
Repeat this process in the aileron bay area. Carve the foam along the hinge line back 3/4 to 1 inch into the wing. Carve a generous radius on each of the corners around the balance paddle cut-out to aid in getting the BID closeout plies to lay up easily. At the outboard end of the aileron bay carve out 1/2 to 3/4 inch foam at the hinge line and taper to a 1/4 inch depth at the trailing edge. Use the rotary file to prepare all of the skin laminates exposed for laminating. Lay up 2 plies of 45° BID over the foam and bare glass. This lay up may be done in several pieces of cloth that overlap 1/2 inch. The outboard end trailing edge gets a flox corner where it gets too tight for the "c" shaped glass closeout. Lay up the root rib and aileron bay closeouts, knife trim, and cure.

Step 9 Flaps and Ailerons

Clear off the edges of your work bench and sand down any epoxy drips or other interruptions in the flat surface. Drag out the flap and aileron foam cores. Fixture the foam core bottom side up with the top surface flat on the table and the trailing edge block over-hanging. Use some very small dabs of 5 min/micro to hold the cores in position. Protect the forward face of the aileron with masking tape. Lay tape down the nose of each flap to provide protection from over slop and a knife trim reference at the leading edge similar to the wing.

Cut sic pieces of 10 inch x 45 inch 45° BID for the two flaps and two pieces of 6 inch wide x 30 inch 45° BID for the ailerons. The flaps will require four strips of 4 inch wide peel ply 66 inches long. The ailerons will require two 30 inch long strips of 4 inch wide peel ply. Cut 2 strips of peel ply 1/2 inch wide, 30 inches long and two strips 1/2 x 66 for the trailing edges and 2 pieces 2 x 8 peel ply for the balance paddles. Lay up the flap skins (2 plies 45° BID) and the aileron skins (1 ply 45° BID). Note that the flap skin plies require an overlap to cover the full length (1/2 inch to 1 inch overlap). Do not overlap both plies in one place. Put one overlap inboard and one outboard. The whole surface of both flaps and ailerons is peel plied except the trailing edge joggle which is later to be filled with dry micro (after FAA inspection). Peel ply, knife trim, cure 24 hours minimum.

After cure, breake the flaps and ailerons loose from the table, carve the trailing edge foam blocks down fiar, and remove the peel ply strip from the exposed trailing edges. Sand the leading edge of the flap skin laminate fair, like the wing leading edge was done, to avoid a step where the top and bottom skins meet. Remove all peel ply and sand away any steps or humps where the peel ply edges met. Mark and tape the flap leading edges for a 1 inch overlap of the top skin lay up onto the bottom skin. Fixture (5 min/micro dabs) the flaps so the leading edges over hang the table. Cut six pieces of 12 inch x 45 inch 45° BID for the flaps and two 7 x 30 inch pieces of 45° BID for the ailerons. Four strips of 4 x 66 peel ply, 2 strips of 2 x 66 peel ply, 2 strips of 4 x 30, 2 strips of 2 x 8, and 2 strips 2 x 30 peel ply. 5 min/micro bond a 1/2 inch thick block of foam to the front side of the balance horn and carve the radius shown in the sketch.



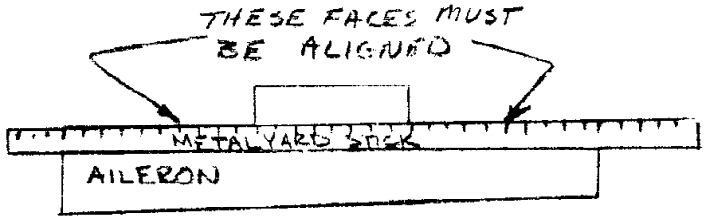
Lay up the top skins similar to the bottom, peel ply totally, knife trim, and cure 24 hours.

The flap ends will be closed later after the hinge brackets have been located. Set the flaps aside for now.

Trial fit the ailerons to the wing to obtain proper motion of the down going aileron you will have to remove about 1/4 inch of the lower aileron bay lip. The aileron is hinged at the upper surface. If necessary, sand away the aileron lower inboard edge to clear the aileron bay's inboard end. You need about 1/32 inch clearance to allow for glass buildup later.

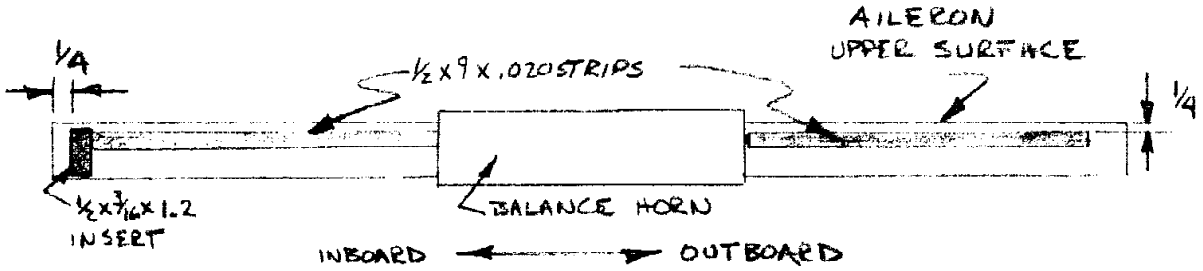
Prepare the ends of the aileron for a very small flox corner with the top and bottom skins. Lay up a 1 ply BID end cap on both ends. Knife trim and cure.

Check the forward face of the aileron to verify that the surfaces are flat and that the upper surface edges are aligned as shown below. It is important that the hinges, which mount to these surfaces, are in line with each other to minimize friction.



Cut two flat strips of .020 aluminum sheet 1/2 inch x 9 inches. Brighten both sides of the aluminum strips with sand paper or Scotchbrite and bond them to the forward face of the aileron foam core with 5 min/micro. The top edge of the strips should be located down from the ailerons top edge 1/4 inch and crowded against the balance paddle. It's important that the aluminum is flat. Curled edges from tin snips won't cut the program.

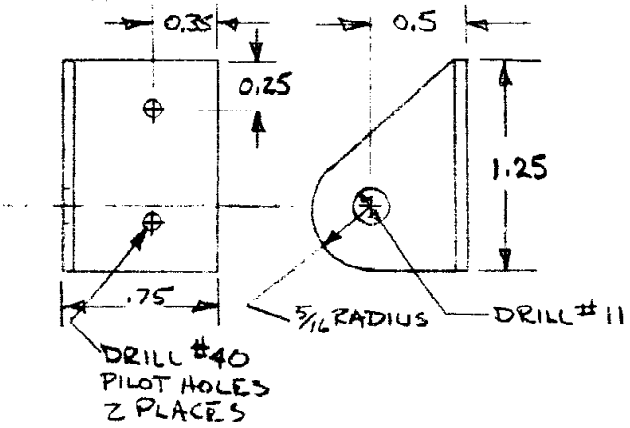
Cut two 1.2 inch long pieces of 1/2 x 3/16 aluminum (2024-T4 or 7075-T6) bar. Brighten it and carve an inset in the inboard end of each aileron which allows the insert to be flush with the foam surface. Bond in place with 5 min/micro.



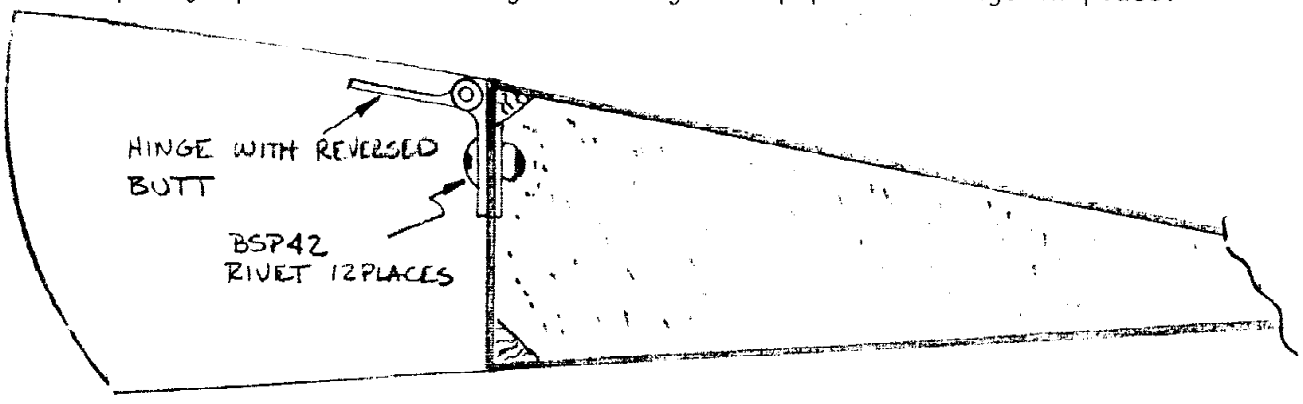
Prepare for a flox corner to the top and bottom skins and ends of the aileron along the hinge face and the sides of the balance horn. Leave the forward face of the horn bare. Lay up 2 plies 45° BID over these faces. Knife trim and cure.

Cut 2 sets of MS20257P3 hinge nine inches long. One-half of the hinge is reversed as shown in the sketches below. The hinge pin should be cut 9.3 inches long and one end bent 90° over the first 1/4 inch. Cut the aileron bell horns shown in the sketch from .063 2024-T3511 extrusion or formed .063 2024-T3 angle.

RIGHT HAND AILERON
BELLHORN



Locate the hinge assemblies on the cured aileron so that the outside edge of the hine is just flush with the top edge of the aileron. The bent end of the hinge pin should be next to the balance horn, which captures the pin so that it can't back out. Brighten the back side of the hinge which joins the aileron and 5 min/micro in place. Check hinge alignment. Drill 1/8 rivet holes for six equally spaced rivets along each hinge and pop rivet hinge in place.

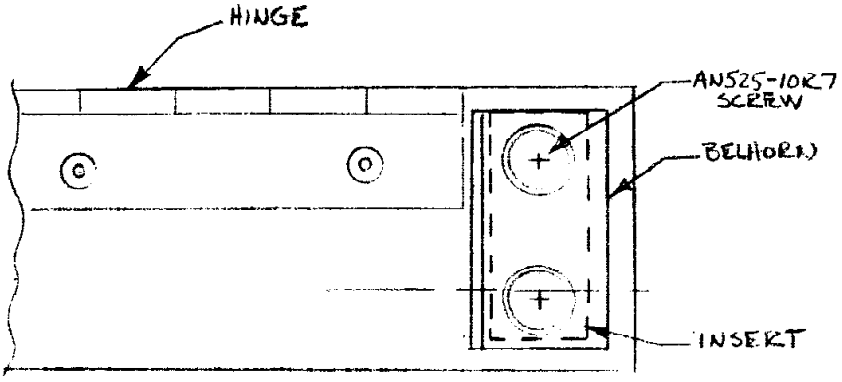


Hang the aileron by the hinges and tape weights (approximately 1/2 pound) to the top leading edge of the balance horn. You can use lead bar, steel bar, or anything else you prefer. When you get the balance fairly close, route out foam and mount the weights in the leading edge of the horn. The aileron should hang with the top surface level with the balance weights installed but before glassing the front face of the horn. Nine inches of 1/2 inch diameter steel rod weighs 1/2 lb. Six inches of 1/2 inch diameter lead rod weighs 1/2 lb. 4.5 inches of 1/2 inch square lead bar weigh 1/2 lb.

After balancing the aileron, prepare for a flox corner around the front face of the horn and lay up a 2 ply BID closeout. Knife trim and cure.

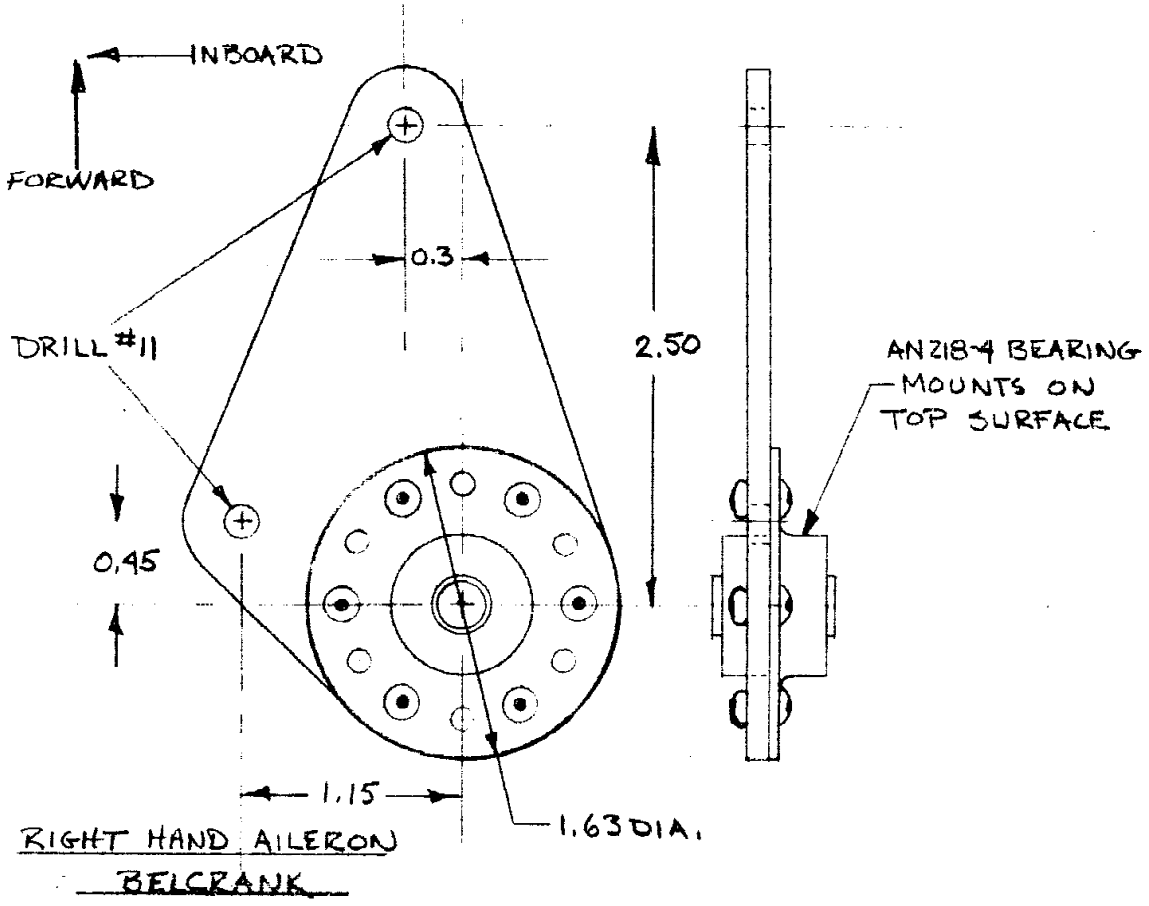
To fit the aileron to the wing so that the trailing edge of the aileron lines up properly with the wing, you may have to trim the edges of the aileron bay. The aileron hinge may also require a shim to correct any vertical offset between wing and aileron. Each hinge segment is attached to the wing with six equally spaced AN525-832R7 screws through the aileron bay lip and hinge. The screw holes should be located so that 0.35 inch is preserved from hole centerline to the edge of the fiberglass or metal parts. Install with AN365-832 nuts.

Locate the aileron belhorn bracket as shown below, brighten the backside and bond to the aileron with 5 min/flox. Drill the #40 pilot holes through the glass and 3/16 aluminum insert. Drill the pilot holes up to #21 (tap drill for 10-32 UNF). Drill the belhorn fitting and glass only (not the insert!) up to #11. Tap the insert 10-32 threads. Finally, install the fitting with two AN525-10R7 screws. To safety the screws, dip the threads in 5 min/flox before tightening.



Bore a hole through the aileron bay into the belcrank bay which is one inch outboard from the flap/aileron intersection, inboard face of belcrank bay, along WS79, etc. The hole should be centered about 1/2 inch above the bottom edge of the aileron bay. Drill a small hole to start with and enlarge it to 3/4 to 1 inch diameter with drills or a rotary file.

Fabricate the aileron belcrank shown below from 1/8 inch 2024-T3 or 6061-T6 aluminum plate, one AN218-4 belcrank bearing, and six 1/8 pop rivets. The neutral aileron position of the belcrank is shown in the drawing. Install the belcrank in the wing one AN4-11A bolt.



To make the short aileron pushrod requires a 2.4 inch length of 1/4 OD x .049 wall steel tubing and two HM-3 rod ends. Run a #21 drill into each end of the tubing to a one inch depth. Tap each end 10-32 to 3/4 inch depth. Screw the rod ends into the ends of the tubing to make the pushrod assembly 3 inches from center to center. The pushrod attaches on the outboard side of the aileron belhorn with one AN3-6A bolt and AN365-1032 nut. The pushrod attaches to the bottom side of the belcrank with one AN3-7A bolt, AN365-1032 nut, and AN960-10 washer.

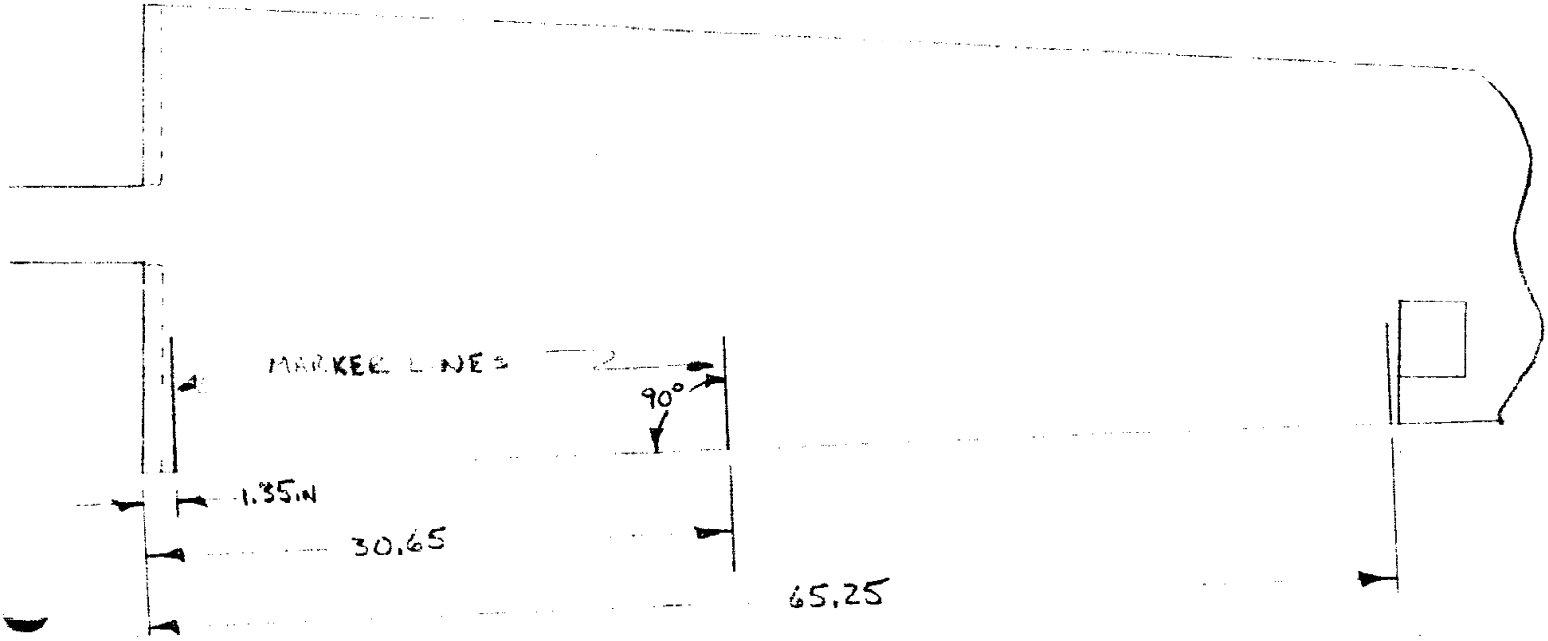
The long pushrod requires 69.5 inches of 1/2 OD x .035 wall 2024-T3 tubing, two HM3 rod ends, two threaded inserts, and two jamb nuts (plain 10-32 nuts) The inserts should be 1.5 inches long, 0.429 inch outside diameter (tight slip fit in 1/2 x .035 tube) and threaded 10-32 (female) in the center. (Inserts are available from Ken Brock Mfg.).

Slip the insert in one end of the tube until the ends are flush. Back up 0.8 inches from the end, drill a 1/8 inch hole through the tube and insert, then drive an AN470AD4-12 rivet in the hole. Use a hammer and your vise to upset the rivet, don't go looking for a pneumatic rivet gun. Rotate the tube 90^{0}, back up 1.1 inches from the tube and insert end, drill 1/8, drive another rivet. Screw one HM3 rod end (with jamb nut) into the threaded insert until they bottom. Run this end of the pushrod into the aileron hole through the wing and attach it to the top side of the belcrank with one AN3-7A bolt, AN365 nut, and AN960 washer. Leave the drilling and riveting of the inboard pushrod end undone until final assembly of the airplane. The pushrod may have to be shortened slightly.

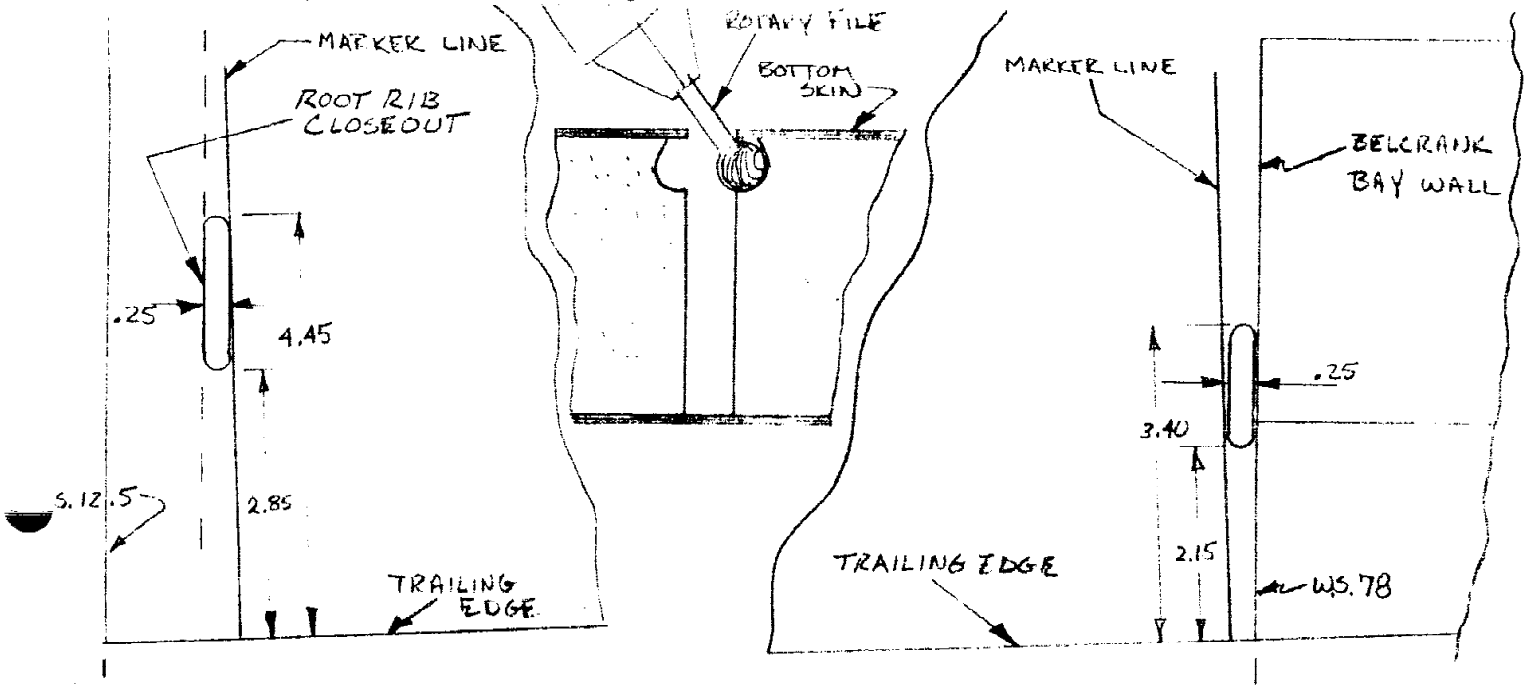
Step 10 Mounting the Flaps

Start by making the 12 aluminum hinge brackets shown on page and the four masonite jig blocks shown on page . Full size patterns are provided for these parts.

Lay the wing on your work bench bottom side up with the trailing edge close to one side. Mark the wing with three lines, 90° to the trailing edge, as shown in the sketch below

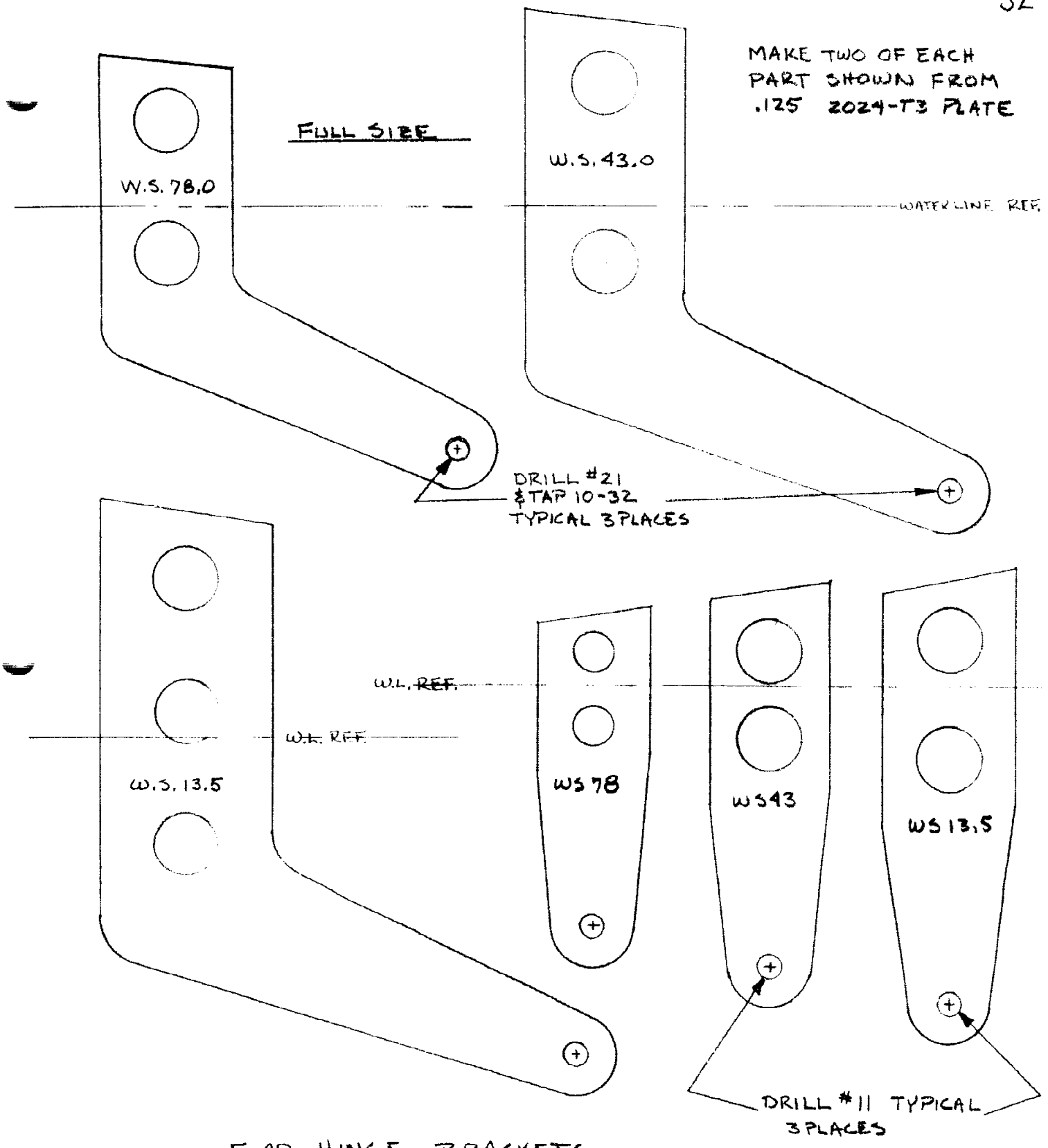


Refer to the sketches below and route out 1/4 inch wide slots in the bottom skin and the foam core. The slots should go all the way to the upper skin but not through it. Use your drill bit carefully and clear away all foam chips from the top skin at the bottom of the slot. The inboard slot should have the root rib closeout laminate as its inboard side. Careful of the rivets sticking through the belcrank bay wall when you route the slot. Along the edges of the slots in the bottom skin use your little 1/4 diameter ball end rotary file (moto tool steel cutter number 100 is a good one) to clear the foam away from the inside edge of the hole as shown.



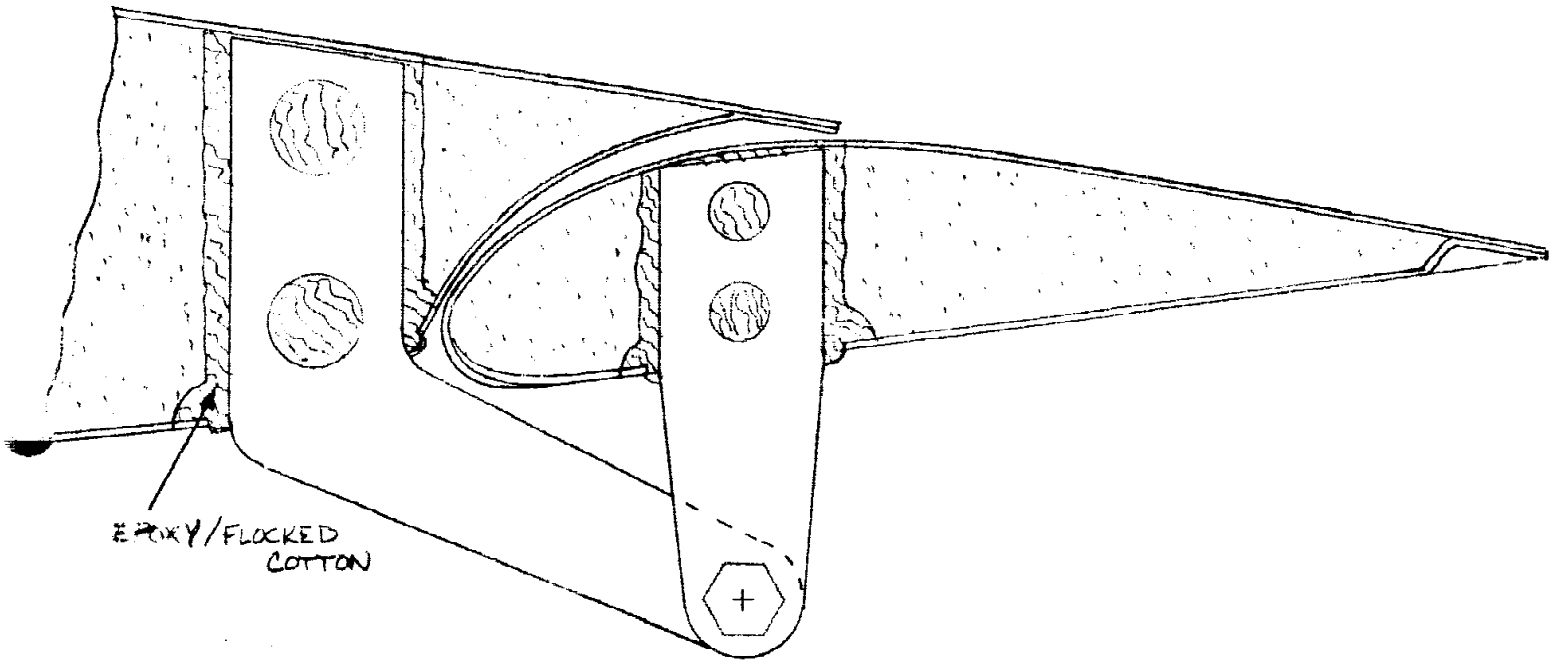
MAKE TWO OF EACH PART SHOWN FROM .125 2024-T3 PLATE

FULL SIZE



FLAP HINGE BRACKETS

Locate the two jig blocks on the bottom skin with the edges lined up with the marker lines. The inboard block goes outboard of the line and the outboard block goes inboard of the line. Your jig blocks should be 1/16 to 1/8 inch to one side of the slots. Fix the jig blocks to the wing with a couple of little foam blocks and dabs of 5 min/micro. The jig blocks should be 90° to the bottom surface of the wing. Be sure that the jig blocks are a reasonable fit of some kind. The jig block should be protected against the hinge bonding operation to come or it may become permanently attached to the wing. If everything has worked according to plan, you should be able to drop the dog legged hinge brackets into the slots and put a 10-32 bolt into the hole in the jig block without interfering anywhere. Stack washer between the jig block and hinge fitting to space the fitting into the center of the slot. If necessary you can file the hinge fitting to clear things or sit down into the slot properly. The sketch below is a typical section through a completed set of hinge fittings.



Brighten the hinge fittings with Scotchbrite or sand paper. Mix epoxy and make a wet flox mixture that will pour with a little help from a mixing stick. Fill the slots about 1/2 to 3/4 full of the flox, then push the hinge fittings down into the slot with a gentle up/down motion that will help purge any air and thoroughly fill the holes in the fittings with flox. Stand by to clean up excess flox that squeezes out around the fitting. You should get good squeeze-out to be sure that the slot is full. Bolt the fitting to the jig block and verify that the fitting is spaced out into the middle of the slot and that it is perpendicular to the bottom of the wing. Allow 12 hours minimum cure before removing the jig blocks.

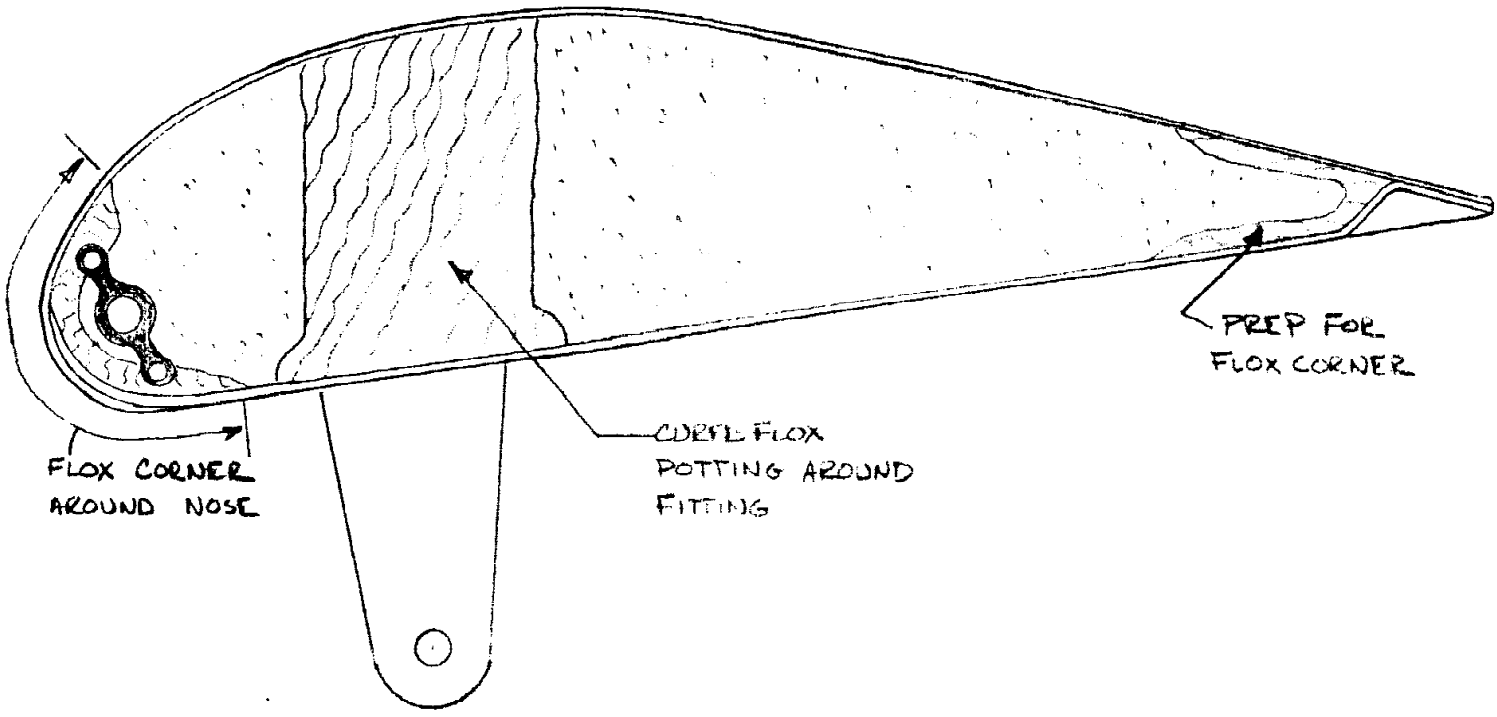
Measure up the middle marker line 2.45 inches from the trailing edge and 3.9 inches from the trailing edge and mark each location. Route out another slot for the center flap hinge which is centered on the marker line between the two marks just made. Drop the center hinge fitting into the slot. Jig the center hinge so the screw hole is exactly in line with the two end hinges. Use a spring clamp or C-clamp to amke a fixture which can be lifted off of the wing. A string stretched tightly from the two end fittings through the centers of all three three fittings is the best way to align the middle hinge. Bond the center hinge in place with wet flox as the end fittings were done. Leave the string in place to final check the alignment of the fittings before you whack away and let things cure. Be careful on this operation. Screwed up alignment is difficult to fix.

Cut out the two masonite flap positioning templates shown on page . Locate them at the root (W.S. 12.5) and tip (W.S. 78) of the flap bay on the tops side of the wing. Temporarily bond the jig blocks in place with foam scraps and 5 min/micro dabs. Flip the wing upsdie down again and position the flap in the jig blocks. Use th hinge fittings bonded to the wing to locate the corresponding flap fitting location on the flap. The inboard and outboard flap fittings go inboard of the wing fitting,the center flap fitting goes outboard of the wing fitting. Route out slots to accomodate the fittings in the flap similar to those in the wing. Fit check the fittings by installing 10-32 screws or bolts to join the two halves of the fittings. Brighten the three flap fittings, mix wet flox and bond in place with the hinge bolts installed to maintain alignment. Cure 12 hours minimum.

Remove the flap from the wing. Remove foam from the outboard end of the flap until the cured flox potting around the hinge fitting is exposed (about 1/4 to 3/8 inch). Prepare a flox corner around the skins at this end of the flap, prep the exposed flox block for bonding, smooth out any abrupt changes in contour in the end of the flap, and then lay up a 2 ply 45^{0} BID end rib.

Take a K1000-3 nutplate and fill the threads with silicone rubber bath tub caulk. Let the rubber cure over night.

Route the foam from the inboard end of the flap to expose the inboard side of the flox potting around the inboard flap hinge (about 1 inch deep). Level the foam surface from the flox block to the flap leading edge. Inset the bath tub caulk filled nutplate in the foam core of the leading edge as shown in the sketch. Prep the glass skins for bonding and flox corners in the areas shown on the sketch. Lay up a 2 ply 45^{0} BID rib over the inboard end of the flap. Lay up 4 additional BID patches over the nutplate area.



Final attach the flap to the wing using AN525-10R-9 screws bottomed in the fitting's threads and jammed on the backside with MS21042-3 lock nuts. The flap actuating pushrod attaches to the nutplate. It will be necessary to cut away the leading edge flange to admit the pushrod. The cut-out will be about 5/8 inch of the flange on top and bottom from the nose of the flap. This may be enlarged as required to allow full flap travel.