

KIS4 Cruiser

BUILDERS MANUAL

S/N 4052

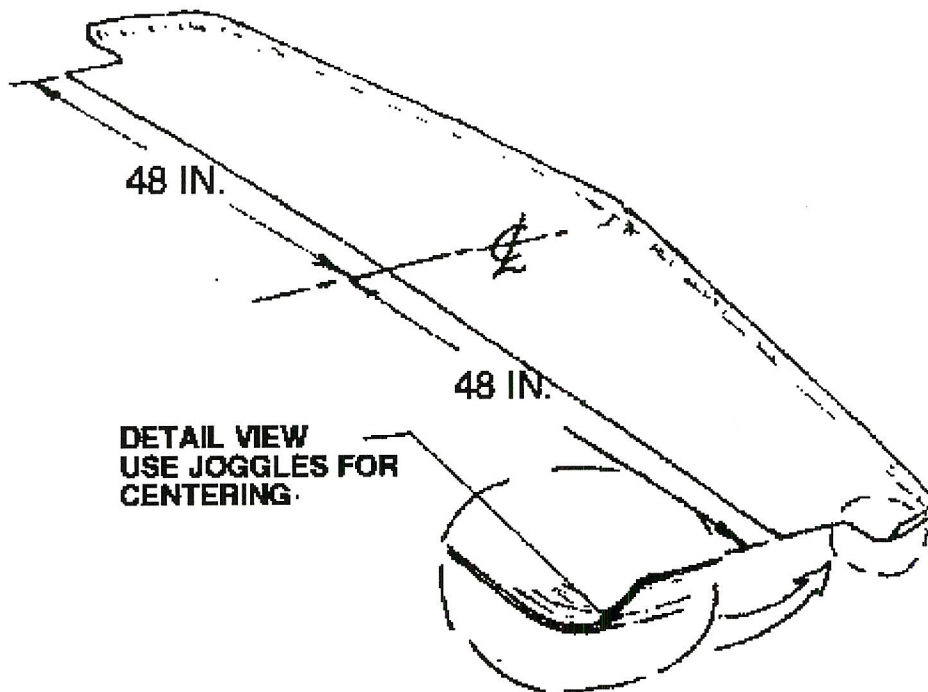
HORIZ STAB & ELEV

CONSTRUCTION OF THE HORIZONTAL STABILIZER

IDENTIFY PARTS - Inspect the premolded top and bottom horizontal tail skins. Note that each skin consists of a horizontal stabilizer skin and elevator skin which have been factory molded in one piece. Identify from the factory labels the top stabilizer (C104T) and top elevator (C104ET). Identify the bottom stabilizer (C104B) and bottom elevator (C104ET). The top surface is flat span wise with the leading edge radius extended further around the nose of the part. The bottom surface has a subtle crown at the center line (the tapered thickness of the horizontal surface is all taken in the bottom surface for a slight dihedral when installed, and the top has to be straight to avoid binding in the hinge line). Strip off the peel ply from all surfaces and clean away any residue from the surfaces. Using a felt pen label "top" and "bottom" on both the inside and outside of the stabilizer and elevator tops and bottoms. Also place arrows indicating forward (direction of flight) on these parts to avoid confusion when directions call out "forward face" of some member.

CUT APART STABILIZER AND ELEVATOR SECTIONS - Find the scribe lines that will part the stabilizer and elevator on the outside of each molded piece. These lines run straight across and then around the elevator balance. Note that on the bottom piece only that there is a joggle that will be used to bond a curved piece of fiberglass at a later date. Run a soft pencil along the scribe lines and at the forward part of the joggle for visibility. Cut along each line very carefully to cleanly separate the elevator and stabilizer skins. An electric saber saw with fine tooth blade or a hand saw may be used. (Razor back-saws and hack saw blades in special holders work well.) When the cuts are complete sand the edges of the stabilizer and elevator skins with a long block and 80 or 100 grit paper. Place the elevator top and bottom aside.

Some of the early horizontal kit parts may have the scribe lines for the centerline and the axial cut lines for the elevator counter weights slightly off true position. Using these scribe marks will not make an unsuitable nor dangerous part, but correcting these dimensions will lead to better symmetry of the final assembly.

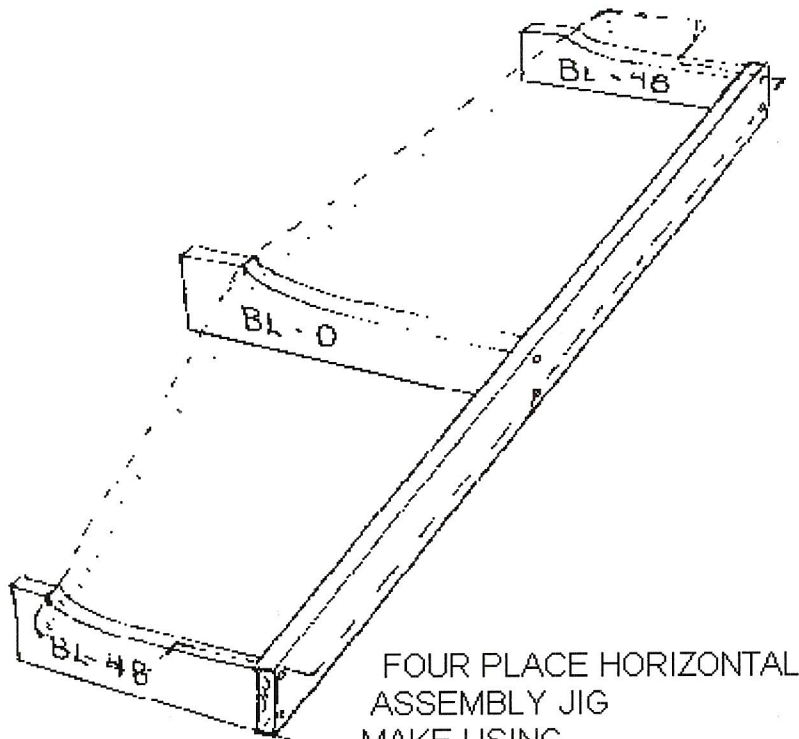


Re establish the part centerline by using the joggle near the tips as a reference. The part is more rigid at this point, and this is a mold controlled feature which is repeatable part to part. Establish a center point between these two features, and draw a line perpendicular to the scribe line for cutting the elevator from the stabilizer. Measure out 48 inches each side from the new centerline, and remark new lines for the longitudinal cuts for the counter balance. If you have one of the incorrectly marked parts, the new lines will be offset about 3/16 inch from the original scribe lines (if they match, then your parts were properly marked).

Be sure to check and correct both the top and the bottom horizontal skins, and proceed with the cutting and assembly.

PREPARE FOR ASSEMBLY - Measure and mark the center line, Butt.Line. 4 Left and Right, B.L. 20.5 Left and Right, and B.L. 48 Left and Right on both the top and bottom pieces. A large square will be handy here. Measure 1.25 inches forward of the scribe line (cut line) and lay out a line parallel to the scribe line for spar aft face location. After marking the locations for the spar and ribs it is a good time to prepare the areas of the skin for bonding. Take a piece of 80 grit sandpaper and roughen the areas around the spar and ribs on both the top and bottom. Light sanding is all that is needed to give resin a good surface for adhesion. Sand the area that lies within 2 inches of each side of the ribs. Sand the area from two inches forward of the spar back to the rear edge (hinge line) of the stabilizer.

HORIZONTAL STABILIZER JIG

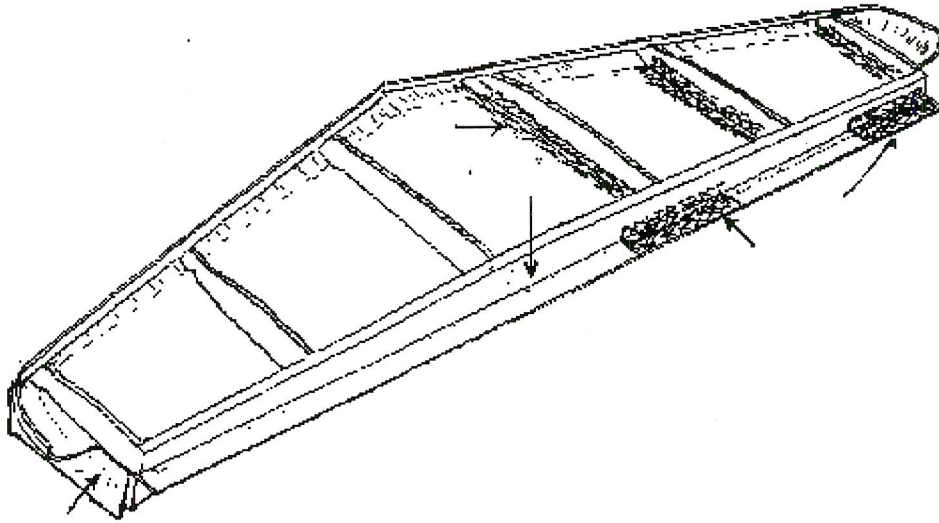


FOUR PLACE HORIZONTAL
ASSEMBLY JIG
MAKE USING
TEMPLATES SUPPLIED

Using the templates provided in the drawings (TR4-H2) fabricate the jig components from 1/2 inch plywood or particle board. Prepare a flat table top or other flat surface for assembly with an axial line roughly 100 inches long. Locate the center and draw perpendicular forward lines at this point (BL-0) and left and right BL-48. Align the back edge of the rib jig pieces with a line marked on the table and the perpendicular lines at BL-0 and BL-48 left and right. Center the rib jig cutouts on the appropriate BL line and bond to the table with bondo or 5 min epoxy. Cut a good straight piece of nominal 1x2 wood (or equivalent material) 97 and 1/2 inches long and secure to the back edge of the rib template jigs, aligned to be flush with the contour surface. This will support the horizontal stab skin at the spar location.

NOTE - YOU WILL BE BUILDING THE STABILIZER UPSIDE DOWN IN THIS JIG

Set the TOP skin into position on the jig, carefully centered, with the leading edge positioned by the rib template jigs. The rear edge should overhang the rear of the jig by 1.25 inches. The BL-48 rib jigs should be split down their center by the cutout for the counterbalance area of the skin. (see picture) Using dabs of bondo temporarily bond skin to jig.



DRAWING OF TOP SKIN ASSEMBLED TO JIG SHOWING HINGE AREA REINFORCEMENT AREAS

PREPARE AND FIT RIBS -Locate the 3/8" prepreg panel with ribs BL-4R and L, BL-20.5 R and L and BL-48 R and L cut with a fine tooth saber saw.. Cut just dlightly oversize and sand to final size checking the fit to the skin,. The outboard side of these ribs will be lined up with their appropriate lines .

INSTALL SPAR - Locate the horizontal stabilizer spar (C123) and remove the peel ply from the inside. Find and mark the center line. Measure outboard 48" R&L and trim. Clean and sand the top and bottom surfaces for bonding. Align aft face of spar 1.25" forward of rear trim line centered on BL-0. Drill three or four 1/8" holes through the spar and skin to hold the spar in place with cecos or screws. Mix a small amount of hysol adhesive and bond spar to top of skin. Let cure (note: Hysol is thin so a small amount of flox can be used to thicken).

Hysol }
EPOXY } ?

INSTALL RIBS - Sand rib sides to roughen surface for bonding into place with prewetted tape. Fit BL-0, BL-20.5 and BL-48 to horizontal stab. skin with 5 minute epoxy to hold in place. Cut two(2) pieces of bid glass 10" by full width of cloth and prepare a 2ply "prelam". After covering the prelam with the top plastic, mark for cutting the length



into 2 in. wide strips and cut. Mix up a small amount of micro for a micro/radius on both sides of each rib /stabilizer rib/spar intersection for a fillet. Paint on a small amount of resin to wet out where prelam strips will be added. Apply glass to rib/ stab, rib/spar over laping each by about 1". It is okay to overlap the prelam if you end up with a short piece of material. Overlap the glass by one inch. Work out all air bubbles and double check everything before you quit. Allow to cure and knife trim any overhangs at the rubber stage.

.FITTING AND INSTALLATION OF BOTTOM SKIN - Final fit the bottom skin of horizontal stabilizer to ribs and spar by carefully sanding ribs to fit using bottom skin as a guide. Take your time and try not to over sand the ribs. The closer the fit the better. Align the bottom skin to the top along the leading edge joggle and drill several 1/8" holes and cleco or screw to hold in alignment. This can help in sanding ribs. Once everything fits to your satisfaction drill two small 1/8 in. hole in each rib fairly close to the top skin. This is to allow the air to neutralize in the individual bays during climb and descent.



Paint the inside bottom skin with resin wetting out the surface where ribs will contact skin.

Push down the edges of the exposed honeycomb in the ribs with a stick or similar tool and mix a good amount of micro/flox and fill in these edges of ribs allowing the microflox to mound 1/4" above the ribs. Mix a small amount of hysol adhesive and spread onto spar and joggle.

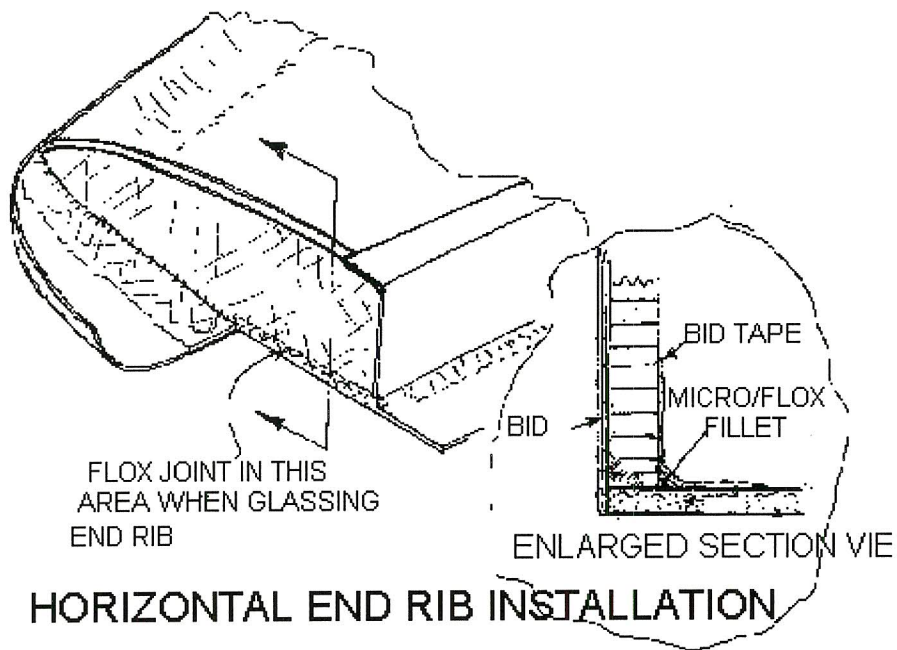
Carefully place bottom skin into place using previously drilled holes to align. Once satisfied with alignment place weights over ribs and spar. Drill additional holes along joggle and hold with clecos or sheet metal screws. Clean up any excess resin along spar and joggle and allow to cure.

After cure remove clecos/screws and rough sand holes and fill with flox. Don't over do it , your only interest is to bridge the hole. Using a 1/16" drill make several vent holes along the centerline of the spar. No more than two holes per bay are required.

PREPARE HINGE ATTACH AREAS - The elevator hinges are mounted on the upper skin (now in assembly jig) since this is a straight line. The lower skin aft line is angled and the resulting geometric error would cause binding. Prepare a 4ply "prelam" in order to make 4 pieces 12"x 3" and place on inside top skin over laping the spar for the hinges. These pads will go from BL-5 to BL-17 L and R and BL-36 to BL-48 L and R. Locate and mark location of hinges at BL-7 to BL-15 and BL-38 to BL-46 on both right and left side and measure forward 3/32" and cut out for hinge.

CLOSE OUT TIPS -You will notice that the tip cavities are open and the two surfaces are not joined at the tip. The open ends should be faced with a piece of 1/4 foam "tacked" in place with some 5 minute epoxy. This will also aid in aligning the unbonded edges at the tip.

Clean and sand the joggle areas and tape over this joint with 2 plies of glass cloth. Stay inside the joggle. After these are in place prepare the corners of the foam close outs for a flox joint. Add the flox, and face the foam with one layer of wetted out glass cloth. Knife trim the overhanging edges of glass when the resin cures to a rubbery stage



Remove the completed stabilizer from jig after curing is complete, and if you want a confidence building experience, put it on the floor laying on blocks at BL-48 L and R. Step on top and bounce around a little to give you some idea of the strength. Bring out the wife and kids and have them join you. This part is very strong and light, but please be advised no high heels or foot ball cleats.

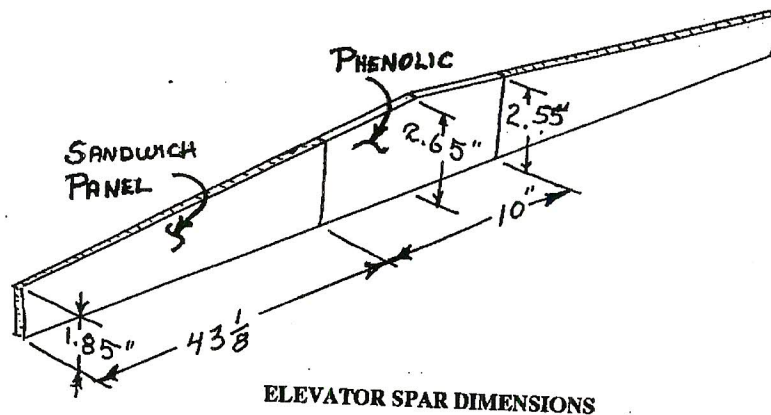


CONSTRUCTION OF THE ELEVATOR

Construction of the elevator is performed somewhat like the stabilizer except it is best to prepare selected metal parts, prepreg and phenolic spar pieces, and prepreg ribs prior to starting other efforts. Verify that the peel ply and other debris have been removed from all molded parts for this assembly.

CUT OUT AND PREPARE RIBS AND SPAR SECTIONS - Cut the ribs out of 1/4 prepreg honeycomb core sheet using the templates supplied. Make the 1/4 prepreg panel components and 1/4 phenolic center section to the spar dimensions shown below. (A band saw or saber saw is best for the phenolic. .

Note that the spar lower surface is angled so each piece should be marked "UP" so the spar can be assembled correctly. The flat edge of the spar is the top edge.



NOTE - THE ELEVATOR ASSEMBLY WILL ALSO BE FABRICATED UPSIDE DOWN

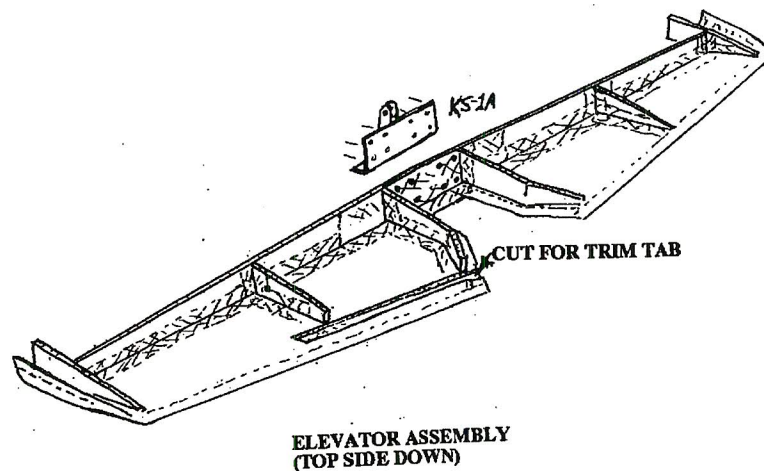
The view above is inverted to the assembly orientation. Transfer the center line to the inner surface of the elevator top skin (C104ET). Lay the top skin on a flat surface and use small dabs of bondo to hold in place.

CUT AWAY FOAM IN TRIM TAB HINGE JOINT AREA - Measure forward of the trailing edge 3.75 inches in several locations on the left of centerline (this will end up being the right side of the assembly when it is installed on the plane) and draw a line from BL-0 to BL-27 on the inside of the skin. Measure forward 2.25 inches and repeat the above steps. at BL-27 using a square make a line perpendicular to the trailing edge. Carefully cut along the first two lines on the inner skin only. Cut the inner skin off between the lines at BL-27 and remove the foam in this area. It is recommended that this same procedure be used to prepare the trim tab area in the lower skin at this time. **Be particularly careful that these cuts are made on the matching portion of the other elevator (bottom) skin assembly (C104EB).**

SPAR LOCATION - Measure aft of the forward trim line 1.25 inches and draw a line from BL-48.125 Left to BL-48.125 Right. This line will locate the forward face of the elevator spar. Make a perpendicular line at BL-4.5 L and R, BL-20.5 L and R, and BL-48.125 L and R for the rib locations. Sand the area within two inches of these lines (both spar and rib areas) with 80 grit sandpaper to roughen the surfaces for subsequent bonding, and remark for easy identification.

Assemble the spar by gluing the phenolic block into the center of the two spar pieces with 5 min. epoxy making sure that the top edge is straight . It may help to thicken the 5 min. epoxy with floc or micro balloons and to lay the spar down on a flat surface with the center (glued) area on wax paper. Don't use too much glue and clean up excess.

After the bond has cured, sand both front and back surfaces of the spar *for bonding). Slightly bevel the top (straight edge) and using several of the ribs as guides and supports to set the angle, tack glue the spar onto the skin with 5 min. epoxy with the forward face at the 1.25 inch line and at the tilt angle set by the ribs. Be sure to clean off any excess resin.



Sand all the ribs sides to roughen the surface for subsequent bonding with wetted glass tape. .

Make enough bias cut 2 ply "prelam" for a two inch strip 96 inches long and make a 3 ply pre lam 4 inches by 20 inches. Mix a small amount of resin and wet out the aft face of the spar and skin where you will be adding the 2 inch pre lam and also the full surface of the spar between BL-10L and R.

Mix some MICRO and put a small radius at the aft spar/skin intersection cleaning up any excess .

LAMINATING SPAR AFT FACE - Apply the 4 inch by 20 inch pre lam to the aft surface of the spar from BL-10 L to BL-10 R covering the spar completely and overlapping the skin by at least one inch spanning the entire phenolic insert and

overlapping onto the outer spar sections. Apply the 2 inch wide pre lam from BL-48 L to BL48 R overlapping each surface by one inch and also over the top of the previously laid up material. To support the spar in its proper position during cure , bond the BL-20.5 left and right rib into place with dabs of 5 min. epoxy. Use tape to hold during cure. All the above should be done in one session. Remove any air bubbles with a brush. Knife trim any edges of the prelam that extends up past the surface of the spar when the resin cures to a rubbery state.

Verify that the sides of the rest of the ribs have been sanded and place them onto the skin for fit up. The BL-4.5 rib will have to be cut to allow it to bend the contour of the elevator cutout. This is best done by cutting the skin on the inside of the bend with two cuts about 1\4" apart and then bending. 5 minute epoxy can be used with micro to hold into shape. All the ribs shall be lined up outboard of their referenced lines, the BL-4.5 ribs with their bent profile, being aligned 1 inch in from cut edges . Spot glue the ribs into place. Cut off the BL-4.5 and BL-20.5 ribs where they extend past the cut out foam area for the trim tab, and discard these sections. .

From the 1/4 honeycomb core panel make two small spar sections, that will go into the cut out area of the elevator for the trim tab spars , judge the height required from adjacent ribs, keeping in mind that these spars will be bonded to the lower skin where the foam has been cut away for the trim tab hinge . (See drawing). Spot glue these pieces to the glass section of the skin tight against the cut edges of the foam. Using MICRO make a small fillet on all ribs, and on the inner panel side of the small added spars (on the sides away from the hinge area). Glass all the ribs, and the filleted sides of the small spars, into place with a two ply prelam except for the inboard side of the BL-4.5 rib.

Take a piece of scrap 1/4 inch foam and make bulkheads for the counterbalance weight areas. These should be securely installed as shown in the counterbalance areas about 3.5 inches back from the open end with 5-minute epoxy. Their only purpose will be to temporarily trap small shot when the balancing step is carried out later. They need not be glassed at this time. Note that at this time the forward end of the counterbalance sections are open.

FIT AND INSTALL BOTTOM SKIN - The bottom skin may now be added. Take plenty of time to make sure that the bottom fits properly on top of the spar, ribs, and trim tab spars. Remember the foam cutout for the trim tab. No doubt some

areas will have to be relieved with a sanding block to permit a good flush fit of the skin at all the joining edges.

Line up the skins for a final time and when satisfied drill two alignment holes at the ends of the trailing edge of the elevator for later gluing. The height measurement from the outside skin to outside skin at BL-0 is 2.75 inches and at BL-48 is 2.3 inches. **It is recommended that you set the horizontal stabilizer assembly against the elevator for a fit check to verify that the height of the elevator is consistent with the mating height of the stabilizer and correct any fit up problems.**

Prepare the edges of elevator spars and the ribs for micro-flox joints. Collapse about 1/4 inch of the honeycomb core along the top edges of the ribs and spars using a flat edge screwdriver. Mix up some 50/50 micro-flox and fill the resultant channels in the spar and ribs. Pile the micro-flox an extra 1/4 inch above the glass edges. Put a very small amount along the top of the two trim tab spars. Apply a flox "bead" about 1/4 in. dia. along the trailing edge of the elevator.

Place the bottom skin in position avoiding sliding and use small screws or clecos through the line up holes previously drilled. Tape the edges and apply weights to hold everything in position until the resin cures. Be sure to clean up excess resin especially along spar area.

Break the bondo dabs that hold the elevator to the table and remove it for ease in carrying out the remaining steps. Setting the elevator on its trailing edge will help do the next steps.

Make a 3-ply Pre lam 5 x 97 to go down the spar face and around the "U" channel covering all surfaces. Sand the face and skin to prepare for glassing. Fillet with micro/flox making sure the fillet is very small at the phenolic area. Prime with resin before installing pre lam and make sure you work out any air bubbles. Make enough 4ply pre lam for 2 - 3x 12 pieces to go on the inboard hinge points from BL-5 to B L-17 L and R overlapping the spar by one inch. Make enough 6ply pre lam for 2 - 3x12 pieces to go on the outboard hinge points from BL-36 to BL-48 L and R overlapping the spar by one inch. Trim any overlapping glass when it has cured to a "green" rubbery condition.

Sand the out board joggles and apply a two ply prelam closing out the ends of the elevator in the same manner previously used for the stabilizer. Also apply a single ply of BID to the foam bulkhead previously installed at each end for the counterweight area, overlapping to both the top and bottom skins.

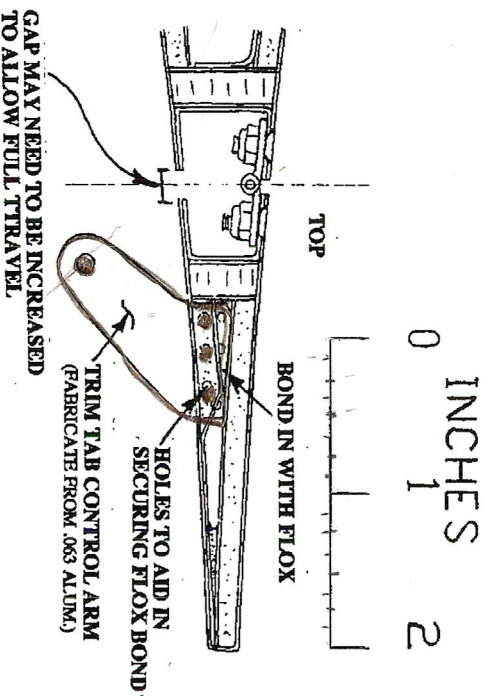
is this different
from p 16

CUT TRIM TAB SURFACE LOOSE - On the trim tab side of the elevator measure and mark a line, 3 inches forward of the trailing edge, from the centerline to BL-27 on both top and bottom skin. Cut along this line through both skins with a fine tooth saw, removing the trim tab from the elevator. Do this carefully so as not to loosen the skin where it bonds to the inboard ribs. Be sure to mark the top of the trim tab. Remove an additional 1/8 inch skin from the bottom of the tab to allow tab downward movement.

HINGE TRIM TAB - Clean up the center channel area in the trim tab, and the opened edge of the stabilizer, and lay in two plies of BID. Do not fillet these areas with micro (a radius at this point will not leave enough room for the hinge).

Use the small hinge and make sure it will fit prior to glassing the close-out ply.

Hinge the tab using the 12" by 3/4" hinge material. Cut the hinge into two 6" pieces and remove the hinge pin so that you can make the pin a 1/4" shorter than the hinge. Replace the pin and lightly crimp the ends of the hinge to retain the pin. Attach the hinge to the top flange edge with locally purchased countersunk pop rivets or use countersunk #4-40 screws and #4-40 locknuts provided in the kit. Locate these holes carefully since both the hinge and composite flange are quite narrow. The hinge apex should face down and the cut edges at the hinge line should have about 1/16 in. clearance..



**ELEVATOR TRIM/TAB ASSEMBLY
(ENLARGED FOR CLARITY)**

Make a trim tab horn of .063 aluminum as shown in the attached sketch. Cut a slot into the trimtab bottom skin close to the inboard end and inline with air flow. Using a small cutter in dremel or similar tool, cut through both surfaces of the sandwich panel, but do not cut into the tab spar or flange. FLOX into place through the slot and the open end of the tab. Close out the open ends of the tab, and the open end in the stab trim tab cut out, with 1/4 inch foam and one ply of BID.

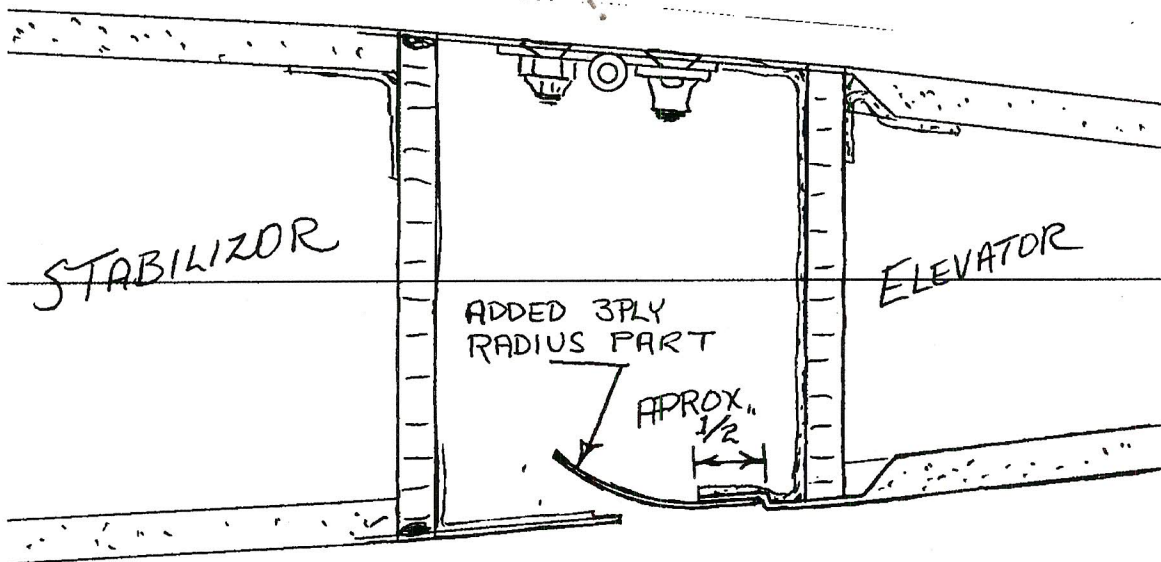
MOUNT ELEVATOR CONTROL "HORN" Locate the KS-1A pre-made control "horn" and fit to the spar face trimming the lower skin as required. Some trim work may be required on the metal edge so that only 3/4 inch is cut out of the

skin. This part will center on BL-0 . Using KS-1A as a guide drill the eight holes with a 3/16 drill bit and temporarily mount in place with AN3-10A bolts and lock nuts.

HINGING THE ELEVATOR

Mark the hinge locations on the elevator upper front flange at BL-7 to 14 and BL-38 to 46 L and R and measure aft of the cut line 3/32 inch and cut out. Measure and notch the upper rear flange of the stabilizer in the same manner.

Trim the lower front flange such that roughly 1/2 inch of the recessed joggle is still attached to the skin. This joggle overlap may be used to bond a radiused lip to fair the air flow across the gap between the stabilizer and elevator lower skins. This will work with the plain gap but a curved surface will reduce the drag and minimize the tendency of this gap to whistle in flight. A complex fitted part can be fabricated to geometrically seal this gap at all positions, but a simple radius will work quite well.



Take the pieces of MS 20001P5 (1.75 inch wide) aluminum hinge strip and saw 4 pieces 8 inch long. A hack saw or band saw will do the job. Clean-up the hinges with a file or sanding table disc. The hinge pins must now be trapped so they cannot fall out due to vibration. This can be accomplished by removing the

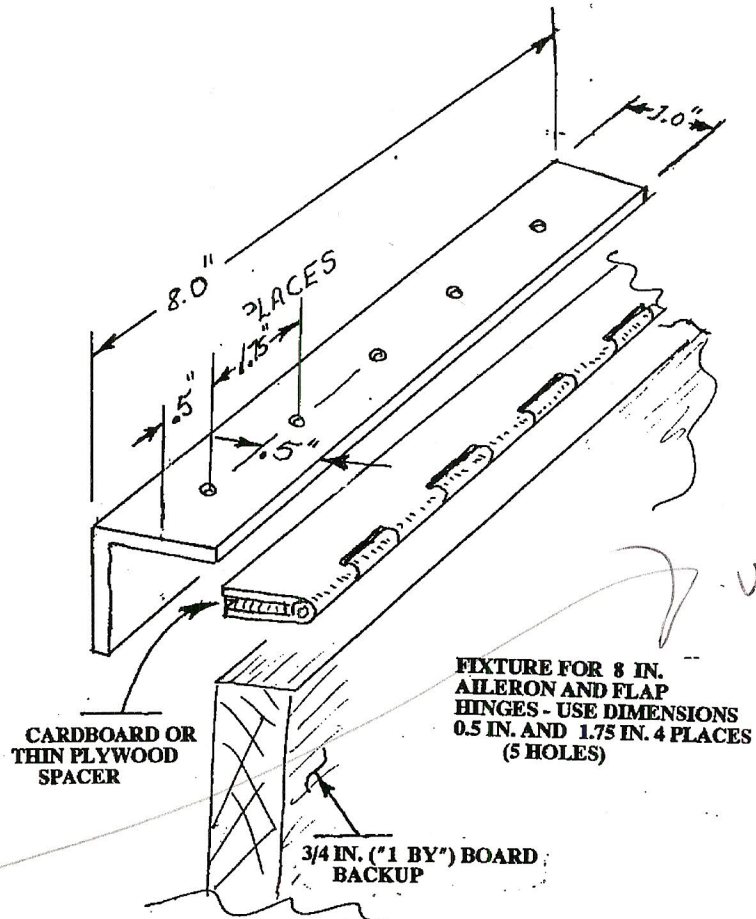
pins, cutting them about 1/4 inch short, replacing them, and crimping the end of the extrusions.

Make a precise drill jig from a scrap piece of aluminum or steel angle which has one leg about 1 inch wide per attached sketch. Drill four hinges for the elevator. Accomplish this by clamping the drill jig angle in a vise. Close the hinge but space it slightly with some tape or thin cardboard or mixing stick. Clamp it in the closed or folded condition in the drill guide with one or two "C" clamps. Drill the holes with a #28 drill bit. Drill all 4 hinges.

The next step is to install the four hinges in their proper positions on the top stabilizer skin. Place the hinges on the trailing edge of the upper skin with their pins centered over the recessed edge. Mark their hole locations. Check with a long straight edge to assure that all the hinge pin centerlines fall on a straight line. If they do not the elevator will not hinge properly and the problem must be corrected.

Drill #28 holes through the stabilizer flange for the hinge mount screws, using the hinge as a drill jig.

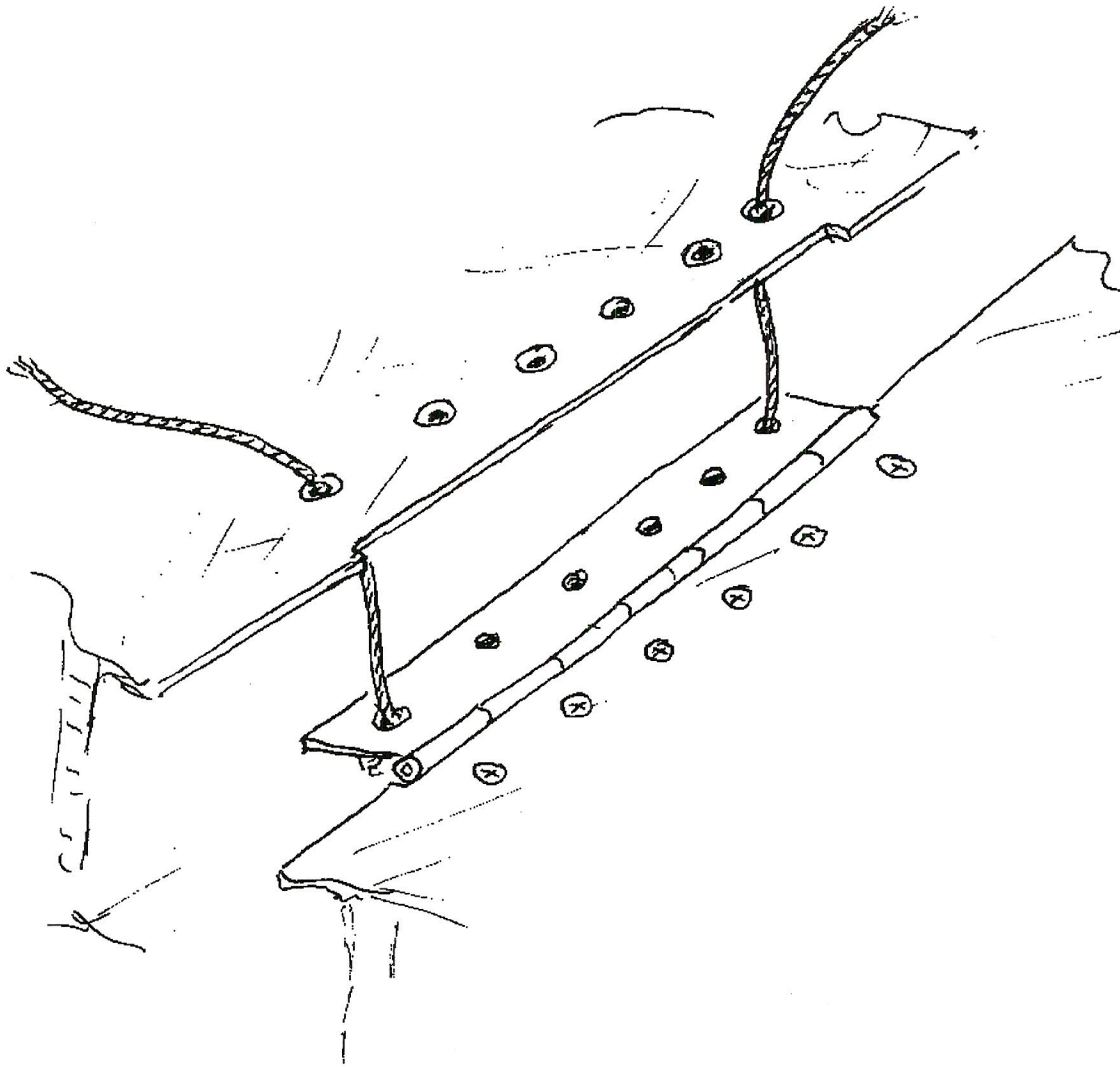
Countersink from the stabilizer outer surface with a 100 degree countersink just deep enough that the AN MS24694-S5 mount screws sit properly. With the screws in place secure the hinges to the stabilizer with AN364-832A thin elastic stop nuts over AN960-10 washers.



ELEVATOR HINGE DRILLING JIG

It is suggested that one leg of each hinge be fitted with nut plates (such as K1000-10 32) for ease in assembly. dis assembly at later stages. Access to the loose nuts will be quite difficult if the curved gap fairings are utilized.

A method which can be used to assemble control surfaces when access to the hinge is limited is illustrated below. Feeding a string through the end holes of each part will allow quick line up of the bolt holes, and hold the part up in place while the first bolts are started.



Now place the stabilizer and elevator right side up on the bench. Determine where the hinge mount holes should go in the elevator so that the hinge gap between the two surfaces is minimal. A 1/16 inch clearance is acceptable. Proceed and mount the hinges to the elevator using the same procedure as with the stabilizer .

The elevator must be able to travel at least 20 degrees down. It will probably be necessary to relieve the stabilizer lower hinge channel lip where the elevator horn strikes it. Do not remove material forward of the vertical web as this will make the stabilizer structurally unsound.

This is the time to close the forward end of the elevator balances. First remove any excess skin that prohibits proper movement of the elevator. Cut two end pieces of 1/4 inch thick foam to match the ends of the counterbalance. Bond the 1/4 foam to the front end of each balance with 5 minute epoxy. Shape the foam removing some glass skin for corner radius. Allow plenty of clearance where the elevator balance swings past the stabilizer.

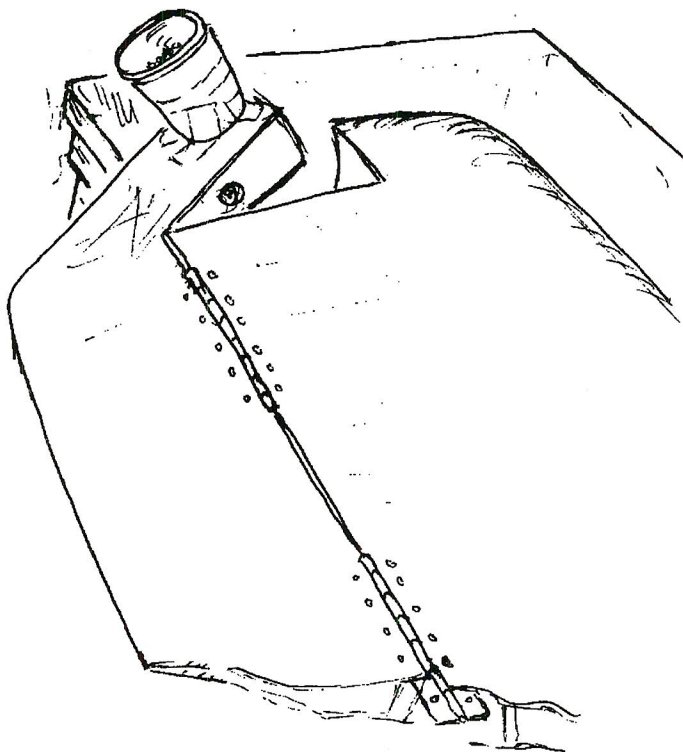
Take a sharp knife and remove foam for flox joints all around the forward ends. These flox joints must be strong because they will structurally secure the front end closures and thereby retain the mass balance weight. If they were to come loose in flight they could jam the controls. Add the flox and cover the ends with two layers of BID. Knife trim any overlapping glass when the resin is cured to a rubbery state.

MASS BALANCING - You are now ready to mass balance the elevators. Make 3/4 inch diameter holes in the exposed faces of the outboard ribs. The holes should be about 2.5 inches back from the leading edge of the balance, but forward of the little bulkheads. The weight will be poured through these holes.

Place the stabilizer flat on the edge of a bench and weight it down. The elevator should hang down about 20 degrees under its own weight. Tape a cup on one or both balances. Fill the cups with lead shot until the elevator surface balances. You will be adding resin so about 5% of the shot may be removed.

See p 11

Mix the shot with some resin. Stir just a little flox into the mixture that results. Pour the mixture equally distributed into the left and right balance areas using the rib holes. Seal the rib holes with tape. Prop the horizontal tail so that the balances are down and the resin impregnated weight will cure in the very forward end of the balance structures.



After the weight cures in place check again for balance. The elevator should be a little overbalanced to allow for paint. If the overbalance is extreme, excess weight may be drill out after painting. If the balance is light add additional shot, resin and flox.

Remove the screws that hold the hinges to the stabilizer. Remove the elevator. Remove the eight bolts that hold the horn. Clearly mark the center line. Using a hack saw or band saw cut through the center line creating separate left and right elevator pieces. When the aircraft tail section is complete you will see that the elevator needs to be split in order to install or remove.

Construction of the horizontal tail assembly is complete.

Lead Shot
Trim Tab - Access Down, Hinge, push rods etc
Close trim tab ends