

# **KIS4 Cruiser**

**BUILDERS MANUAL**

**S/N 4052**

## **FUSELAGE SECTION 2**

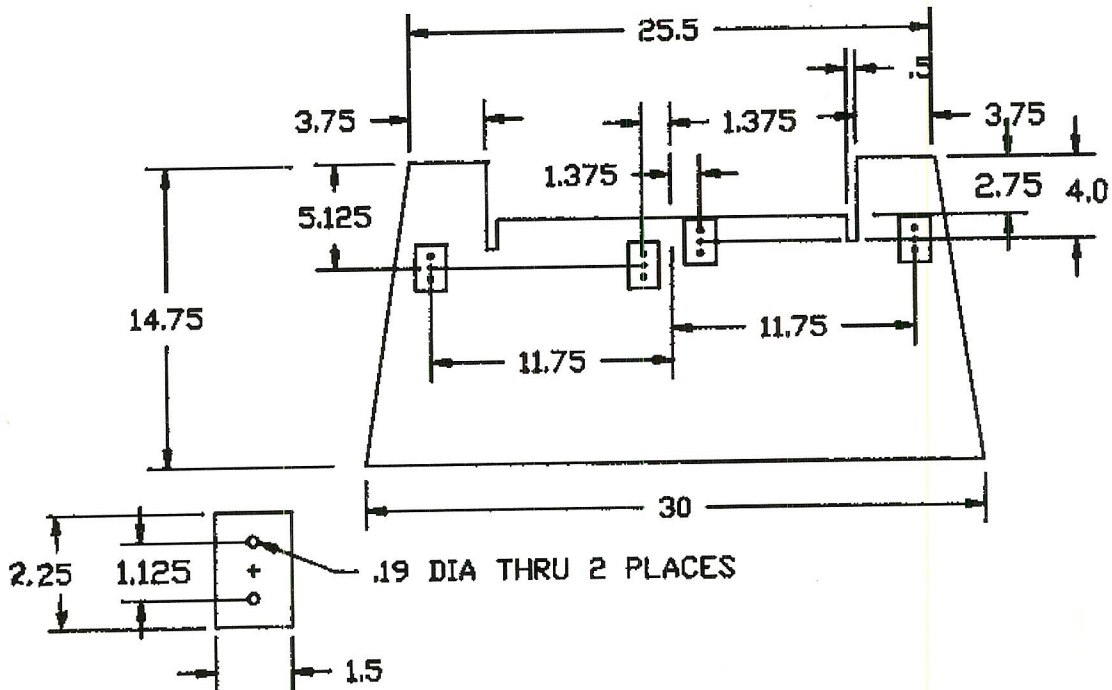
## Four plc FUS ASSY SECOND SECTION (of four)

## FRONT FLOOR ASSEMBLY

Temporarily install some cushions in the seat area , securely support the fuselage assembly and sit in place to verify the location where you will be installing the rudder pedal assembly on the front floor section . About plus or minus 3 inches of adjustment can still be made in rigging after the rudder block positions are set. The floor panel itself is to be installed with the outer ears touching the back of the firewall. Check to be sure that there is 1.5 inch clearance between the upper surface of the floor panel and the hole positions for the lower engine mount bolts. If this value is not attained reduce the forward outer width of the floor panel slightly to lower the panel to permit clearance for the large area washers for these bolts. In general the rudder pedal system should be located as close to the fire wall as the linkage will permit. However, if the intended primary pilot has relatively short legs, it may be beneficial to move this pedal assembly back closer to the seat , and adjust the location of the hard points for the rudder pedal pivot blocks accordingly.

The front floor assembly is fabricated from three pieces of the two ply prepreg honeycomb core panel material supplied. The basic floor panel, and the two end pieces should be cut out and fitted to the fuselage inner contour as shown in the drawing. Before the assembly of these pieces, "hard points" for the rudder pedal assembly are added to the basic floor panel, located as shown in the Figure enclosed and with any adjustments in location dictated by the "sit test".

The configuration shown for the rudder pedal mounting inserts are individual ply wood blocks inserted for a total of four hard points for the four mounting blocks. An alternate configuration is an enlarged rectangle which will encompass all four of the center holes (both center rudder pedal mounting blocks) at some small penalty in weight . Cut out the three (or four) pieces of the 1/4 inch plywood and locate them on the bottom surface of the floor panel in the positions called out in the figure (remember that you are working on the back side and the apparent orientation is reversed). Use the cut pieces as a cutting guide, and cut through the bottom skin of the panel. The figure shows the recommended standard location, revise if required to position the pedals for your requirements. Remove the skin and the core material, and clean the exposed inner surface of the top skin in preparation for bonding. Bond the inserts in this cavity, and fill any gaps between the insert and the core with a relatively "dry FLOX/MICRO" paste. Cover these inserts with two ply BID, with minimum 1/2 inch over lap over the existing bottom skin around the insert.

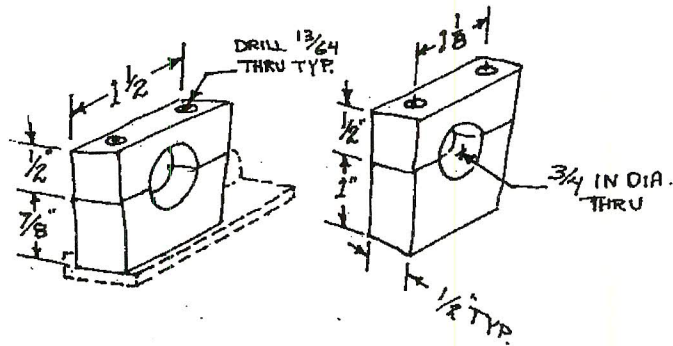


DETAIL OF INSERT 'HARD POINT' 4 PLCS AS SHOWN

FILE 4PFLO2

FIGURE - Dimensions and location for hard points in floor panel

Fabricate the four rudder pedal assembly mounting blocks per the figure attached. Two of these blocks are with the 7/8 inch lower segment, and two with 1 inch high lower segment. The shorter (7/8 inch) rudder blocks will be used in the locations where the blocks are to be installed on the top of

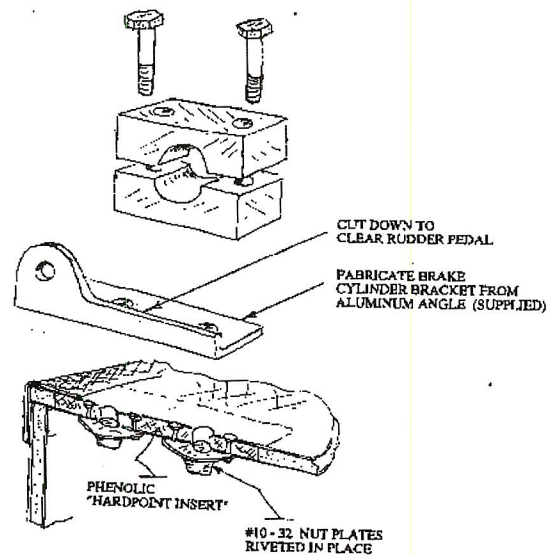


the 1/8th inch thick aluminum angle used for the brake cylinder mounting bracket. The supplied material for all four blocks is the 1/2 inch thick phenolic contained in the kit (other suitable bearing material such as nylon can be substituted). The two center blocks may require some reduction in the 1/2 inch thickness to provide clearance for the flanges on the pedal tubing to allow the rudder pedals to rotate freely. This is most easily accomplished with a belt sander.

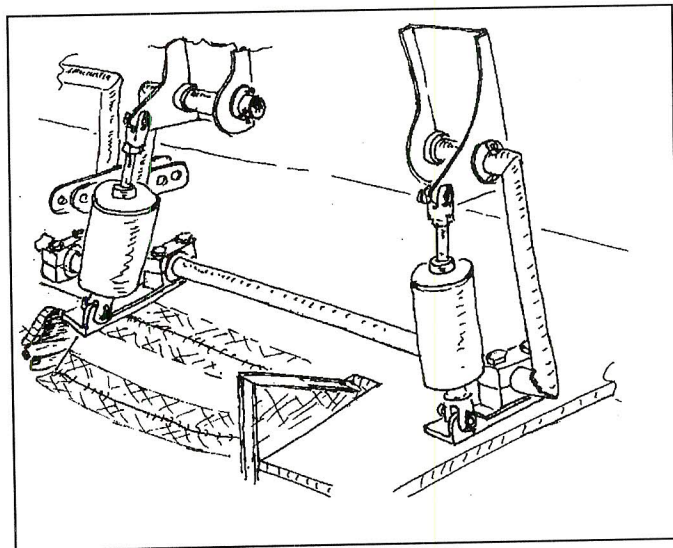
FIGURE- Basic configuration brake master cylinder mounting brackets

The bolts mounting the two blocks on the left (pilot side), will also mount the brackets for the brake master cylinders.

Fabricate these brackets from 1/8 in. thick aluminum angle supplied with the kit. The smaller bracket will be installed on the left side for the left toe brake, and the larger (wider) angle will be used for the right toe brake. Use the drawing below to fabricate the brackets, using the respective rudder mounting blocks as drill jigs to assure proper fit through the bolt holes.



Position the blocks on the floor panel (with the hard points installed), using either the rudder assemblies, or other sections of 3/4 inch tubing, and use the blocks as drill jigs for the eight attach bolts (#10 - 32 hex head screws about 2 1/4 inches long - AN - 3 - 22A). Use the attach bolts to hold the nut plates in position, and drill for the 3/32 in. rivets which will be used to attach the nut plates (K 1000 - 3). Rivet the nut plates in position as shown in the preceding sketch.

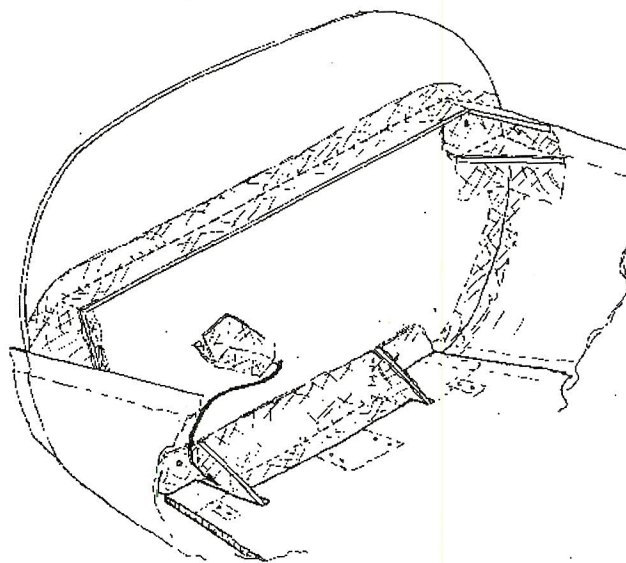


Temporarily install the bearing blocks for the rudder pedal assembly, with the brake cylinder mounting angles on the pilot side, and the pedal assembly for fit and functional testing. The principle of mounting the brake brackets is to

establish the master cylinder pivot line closer to the pedal pivot line than a parallel ogram, such that brake pedal angle changes in a manner most natural for the pilot. This becomes significantly more difficult if brakes are also added to the right side. Study the action of these likages very carefully before making any revisions.

A "U" shaped cutout at least one inch square, must be provided on both the front and rear panels of the floorboard assembly. These cutouts allow for the passage of the fuel, brake, and other lines or wires between the spar area and the fire wall area. Attach the end panels to the floorboard assembly with two inch wide two ply BID at the corners, and fit the assembly to the fuselage inner surface. (tape these openings closed for most operations to avoid the inevitable bolt or nut rollong under the floor)

As mentioned earlier, the location of the rudder pedals shown in the drawing is the nominal value used in the prototype. If the anticipated pilots are taller, or shorter, the location of the rudder pedals can be adjusted to provide the desired distance between seats and the nominal rudder pedal location. The floor panel however, is to be installed with the front, side "ears" up against the fire wall as shown (it thus becomes part of the engine mounting stiffening system).



When located in this position, bond the floor assembly into place with two inch wide two ply BID tape. roughen the surface of the fiberglass on the firewall and the plywood gusset to prepare these surfaces for bonding. Bond the "ears" to the firewall with a two ply pattern with double overlap on the firewall at the engine mount location. This will add four plies to the lower engine mount pads.

.As mentioned previously, attach the front and rear floor closeout panel with 2 ply BID tape to the edge of the floor panel, and to the fuselage bottom. Keep the open notch uncovered at both ends to permit passage of fuel and brake lines, etc. These end panels serve a dual purpose in keeping debris from being trapped beneath the floor, and also stiffen the floor free span against deflection under operating loads.

## TAIL POST

The tail post should be cut to shape from a portion of the included 2 ply prepreg panel. The pattern for this component should be marked on the appropriate panel of prepreg. Use a "dry fit" assembly procedure, and trim the cutout for proper fit with the lower fuselage half at the appropriate location. Monitor the fuselage width at this point, such that there will be sufficient clearance for the elevator bell crank and push rod. Position the part vertically in both planes with the forward face at station 206.75 and fit it into the fuselage end. Fit up a block of wood to hold the fuselage width, and remove the tailpost and set aside for bonding after the horizontal stabilizer is installed.

## HORIZONTAL STABILIZER

The horizontal stabilizer surface of the four place KIS is located above the fuselage horizontal joint line. This means that side pieces will be used to mount the stabilizer above this level. These pieces are a portion of the fin moldings for the respective sides, and the cut lines are scored on the mold, and should be visible on the fin half parts. These score lines should be located and darkened with soft pencil or lacquer type fine line pen (do not use oil or wax based markers in any area where bonding or painting is to occur).

Temporarily mount the fin halves to the fuselage to transfer the exact location for these cut out pieces. Carefully align the trailing edge of the two fin halves with the aft edges of the fuselage top molding, and drill holes for Clecos or small sheet metal screws for securing and aligning these parts (the screws actually work better than clecos for this job, and are a lot cheaper). Locate these attachment devices closely just in front of and behind each of the cut lines. Remove the fin halves, and cut out these marked pieces carefully to size using a saber saw or similar tool.

Clean and prepare the joining surfaces for bonding, and attach these pieces with HI-SOL adhesive or an appropriate FLOX/MICRO slurry mix. Fixture in place using the previously drilled holes, with Cleco's or small screws to prevent shifting during curing. The airfoil shaped portion cut out from these scribe lines is the opening for the horizontal stabilizer, and is not used in the assembly and may be discarded. (see figure for clarification)

This cut is slightly oversized to permit leveling the stabilizer from side to side, and establishing design incidence value. Prepare both the horizontal stabilizer, and the fuselage surfaces adjacent to the cut out, for bonding (clean and roughen those surfaces which will be bonded in with BID tape as described in the procedures section). Optionall, you may use small pieces of wood to shim

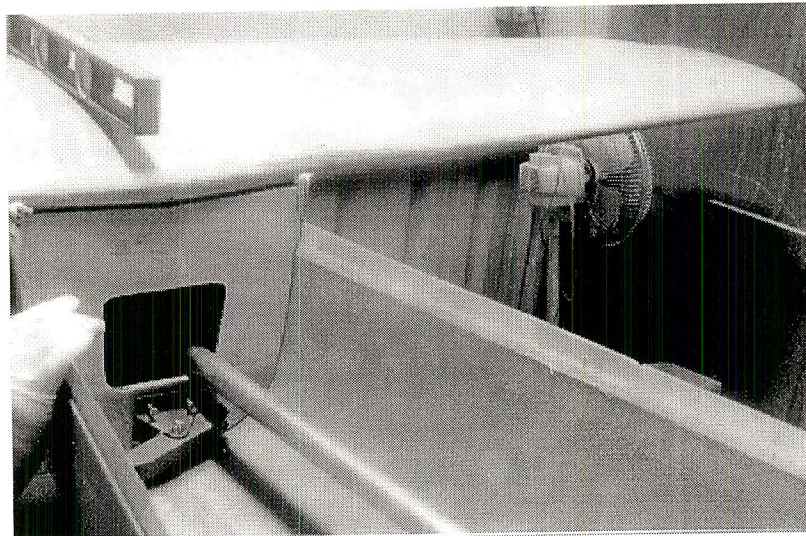
*See p 3 & 4 of sec 3*  
*Top fuselage*  
*or Bottom fuselage*

the stabilizer into desired location which includes setting the hinge line at STA. 203. centering, and leveling from side to side, and setting 0 degrees of incidence relative to the fuselage waterline level. Also set the hinge line carefully square with the fuselage centerline by measuring forward to the firewall from each tip.

The chord line of the symmetrical horizontal airfoil section should nominally be set at the WL 3.5 inch station (the bottom surface just touching the top edge of the bottom fuselage section at the thickest point). this dimension is less critical than the requirement to set the assembly level and square with the fuselage section.

When these measurements are satisfied, fill the major portions of the gap between the stabilizer and the oversized cut out with a relatively dry "MICRO" mix. Allow this MICRO to cure, and then trim away excess (including any ends of wood sticking out).

Prepare the stabilizer surfaces and the inner and outer adjacent fuselage surfaces for bonding. Clean and abrade all areas which will be covered and remove any loose material. Then build a fillet (about 1/4 to 1/2 inch radius.) of relatively dry MICRO between the fuselage sides and the lower surface of the stabilizer.



This bonding will be done both inside and out, so the STA. 180.5 bulkhead should be removed or adjusted for these steps (which is why it was only temporarily tacked in place with 5 minute epoxy).

Apply 4 layers of BID pre-lam on both inside and out of the fuselage and the stabilizer with a minimum of 3 inches of overlap. Stagger the width of the overlap on the outside surfaces (those areas which will be visible and subject to aerodynamic drag in the finished plane) to minimize the amount of smoothing in these areas for the final finishing of the airplane.

Replace the STA. 180.5 bulkhead, cleaning away any residue from the other operations. Position this bulkhead carefully, and bond in place with A 4 PLY

PRELAM on the front face covering the insert hard points and overlapping the fuselage by a minimum of 2 inches around it's edge (this is to support the rudder idler loads, reference the 4 ply prelam on previously installed on the aft surface), On the rest of the bulkhead perimeter apply 2 inch wide 2 ply pre-wetted BID, on both sides (work through the hole in the bulkhead and from the rear of the fuselage, to place the back side BID layers

#### INSTALL RUDDER POST

Re-install the rudder post at the station 206.75 (fwd face) and bond it to the lower fuselage molding with 3 ply BID on the front side only (rear side bonding will be accomplished as the vertical fin halves are bonded in place). Proper alignment of this component is critical to the trim and flight characteristics of the completed aircraft, so perform this leveling with care.

#### STICK LINKAGE ASSEMBLY

The stick linkage assembly process is started by temporarily installing the stick assembly mounting brackets (KS -29) to the appropriate clevises of the control cross over (KS-30). Position the control cross over assembly up against the rear face of the front seat forward bulkhead , with the pivot line at WL -11.5, and the stick assembly centered in the fuselage (caution - the elevator push rod clevis is not centered on the control cross over assembly). Using the mounting brackets as templates, mark and drill, the two 3/16 in. dia. bolt holes through the bulkhead material at each position point (local hard points should exist in this bulkhead in these areas). Bolt the two stick pivot brackets to the aft face of this bulkhead, using the previously drilled holes, using four hex head #10- 32 bolts about 3/4 inch long (AN 3-5A), and associated nuts and washers supplied in the kit.



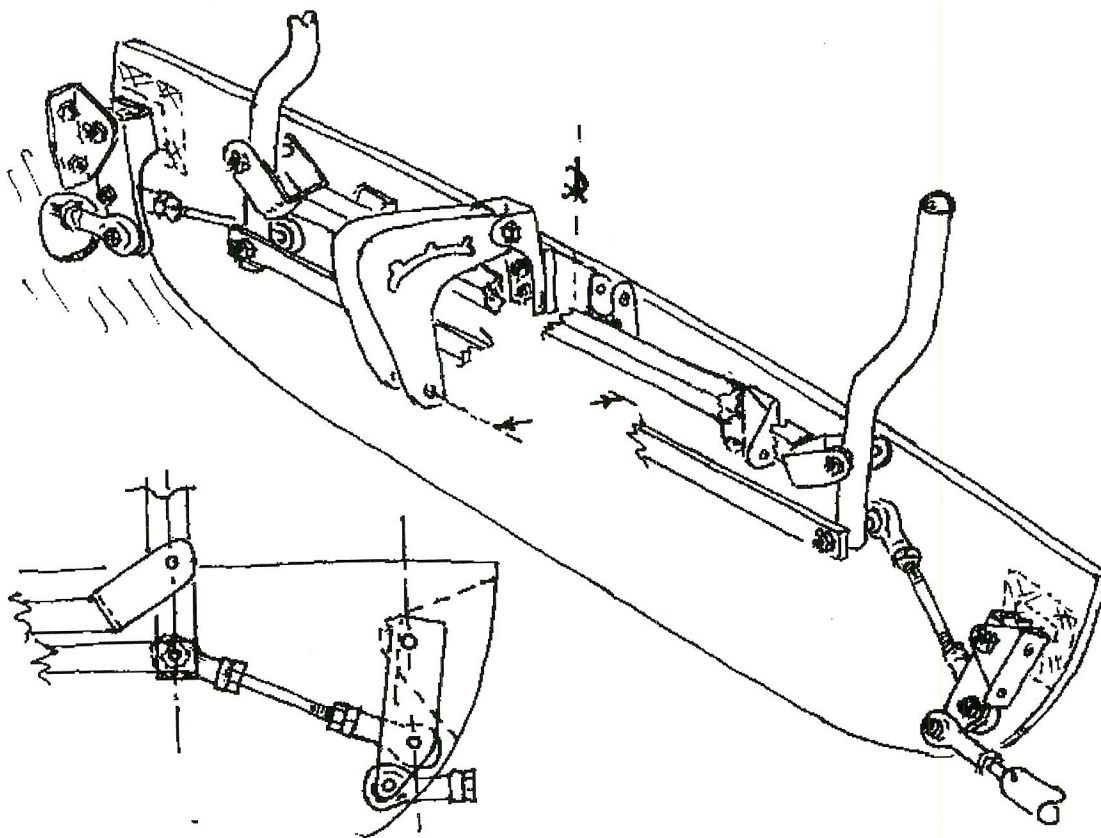
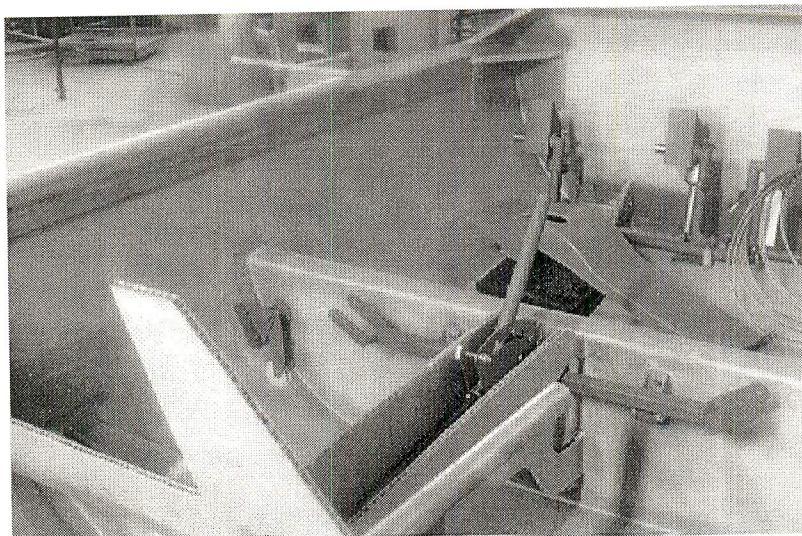


FIGURE - Control linkage and console components

### CONTROL CONSOLE - FRONT SEAT AREA

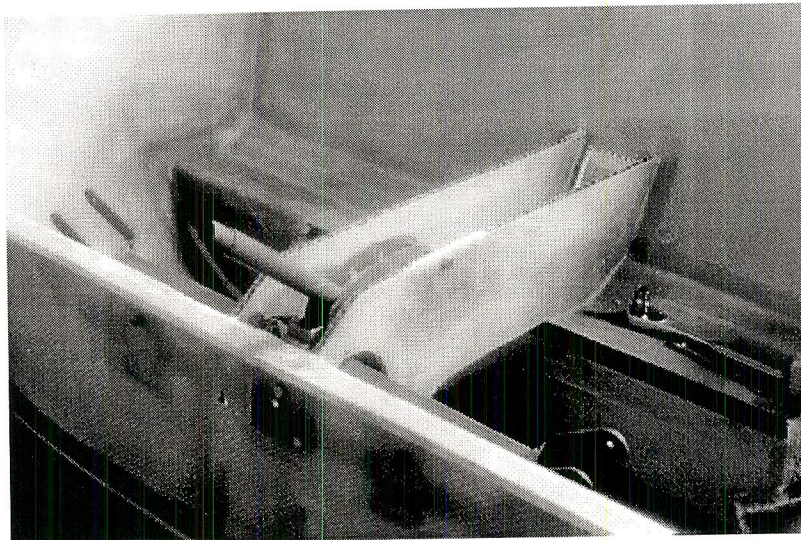
Many of the control functions are mounted to -and/or routed through - the center "console" . The console has the form of a "tunnel" that runs from the front seat forward edge to the rear seat back and is boxed up between the seat areas on each side.

The console sides are made up from 4 pieces of 2 ply prepreg panel. The outlines for these sides are marked on the proper panel section along with the locations for hard points and



other special features. Make up a pattern part from the markings on the panel, since there may be a discrepancy in the location of the front seat front bulkhead (either STA. 30 or 31). Test fit the sample panel section into the location shown and locate any trimming or added material which may be required for a proper fit. When satisfied with the pattern cut out the two panels.

The tunnel width for the front section will be 4 inch outside width at the farea shownn here. The tunnel sections from the back of the front seat rearward will be 3.5 inch outside width.



Several "hard points" should be installed in each panel side. In the forward section, there are two for mounting bolts for the flap lever quadrant, and two more hard points for the inner lap belt attach points for the front seats. Use the process outlined in the procedures section and use segments of the 1/4 inch aircraft plywood for the core fillers. See the previous figure and templates for the size and locations of these "hard points". The hard points on the lower sections of each of the console sides are for one end of a seat belt, and thus is a critical item. These areas should be covered with 8 layers of BID. Make sure that each layer has a minimum overlap on all three surfaces of 2 inches. A tapered overlap will spread the load more evenly and present a better appearance if neatly accomplished. The 2 inch overlap is MINIMUM for any layer.

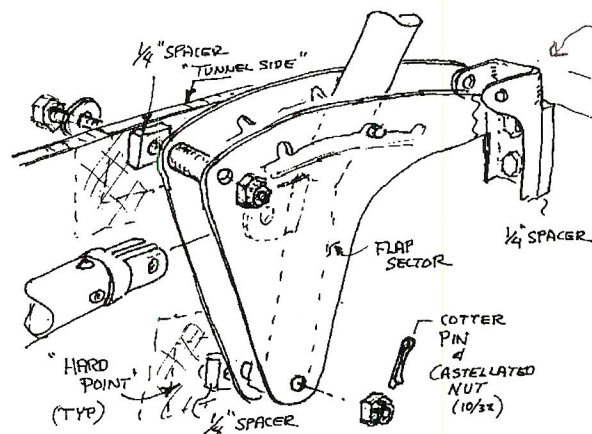
#### FLAP HANDLE ASSEMBLY BRACKET

This would also be a good time to install the other bracket for the flap actuation linkage and lever sector plate assembly (KS- 26). Use the flap sector stampings to mock up the vertical location for this bracket. With the control crossover assembly installed to it's mounting brackets, cycle this assembly to determine clearance with the flap sector. The recommended position is to mount this bracket on a 1/4 inch plywood spacer and center the

upper hole in the flap sector mounting bracket on the upper edge of the bulkhead (this hole is not used in mounting). The vertical centerline for these two holes is to be 1 inch to the left of centerline to position the left surface of the flap actuation handle assembly 1/4 inch from the inner wall of the "tunnel" section. Use the lower hole as a jig and drill the lower bolt hole in the front seat front bulkhead for initial mounting. With the bracket mounted by this bolt verify the uppermost position for the second bolt and drill through both the bracket and the seat panel with a clearance diameter for a #10-32 bolt (13/64 or similar size). Mount the bracket with the two hex head #10-32 bolts about 1 in. long AN3-7A or similar, and required nuts and washers.

Select the flap sector sides, and the flap handle assembly and position using the just completed bracket. Select the left side console "tunnel" section and temporarily mount it in place.

Using one of the flap sector sides as a tooling jig, locate and mark the location of the bottom mounting hole through the side of the console approximately 4 1/2 inch aft of the bulkhead aft surface.



*is top of  
Flash with top  
of seat front  
bulk head*

Check the resulting location of the rear mounting hole in the flap sector, and verify free travel of the control stick assembly. If the upper rear hole will fall safely on the upper hard pint, and the stick linkage crossbar clears the sector during full travel - drill a clearance hole for a #10 32 bolt through the side of the tunnel.

Temporarily bolt this bottom mounting hole using a 1/4 inch spacer between the flap sector assembly and the inner console wall. Using the flap sector as a drill jig, drill the hole in the console side wall for the aft upper flap sector bolt. Assure that any of these mounting holes have a previously installed hard point. If the hard point is not installed install it at this time

Using the supplied nuts, bolts, washers, and spacers, install the flap actuation assembly of handle and the two sector panels. The bottom pivot bolt for the flap handle will use a castellated nut and cotter pin, since it will only be lightly tightened to permit freem movement of the handle. The upper rear mounting bolt should employ a roughly 7/8 inch long spacer between sector sides, and a 1/4 inch spacer with at least as much bearing area as a standard 3/16 washer between the sector and inner wall of the tunnel. This bolt will use a self locking nut and should be torqued tightly to hold the assembly in position.

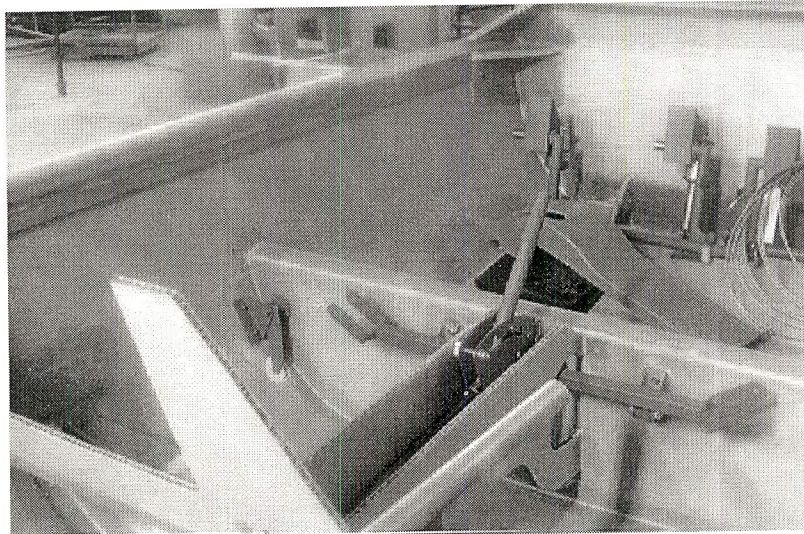
At the forward sector mounting, the sector sides should go on the outside of the ears of the mounting bracket. The bolt should utilize a self locking nut, and not too much torque which would collapse the bracket. There is a close clearance between this bolt end, and the elevator actuation. It might be a good idea to trim any surplus bolt length from either or both these bolts.

The push rods for the elevator and the flap actuation will be installed at a later time.

Install the other console side and permanently bond both sides into place. Two ply bid tape will suffice for most mounting areas, except the front seat inner lap belt mounting points, which should have a minimum of 6 plies each side.

### RUDDER CABLE ROUTING

The rudder cables will be routed inside these tunnel sections at a later step. The cables will be routed within a plastic tubing, close to each side of the tunnel walls. Be aware of this requirement in installing and routing other features within the tunnel sections.



### AILERON IDLER INSTALLATION

The aileron idler, two pieces, left and right are to be fabricated from a section of the 1 by 1 inch .125 wall aluminum channel furnished in the kit using the attached drawing

Fabrication should be easily accomplished using simple hand tools such as hacksaw, files, and drill. Locate the pivot point for this link by positioning a KS-3 bracket face against the aft surface of the seat front bulkhead, base against the inner fuselage wall with the hole 2 5/8 inches below the top of the seat front bulkhead (see sketch).

*see p 21 sec 1*

4PFUS2SE

PART OF REVISION 1 - FEB, 1998 SUPPLEMENT TO FUS2 FOR ELEVATOR ACTUATOR TUBE MID-SPAN SUPPORT

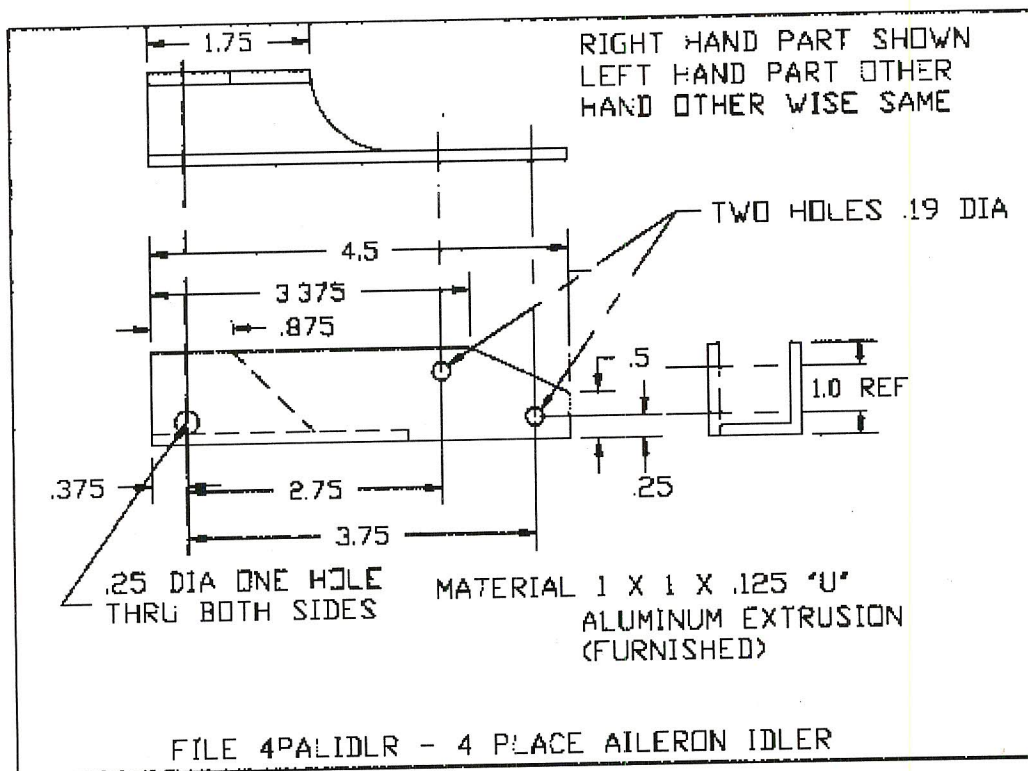
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ELEVATOR ACTUATOR MID SPAN SUPPORT

You may have been puzzled by the strange rectangle of 1/4 inch thick black plastic included in your kit. This will be used at this time to provide a mid span support for the elevator actuation tube to stiffen it against side wise deflection and potential buckling in the unlikely event of compressive overload. Prepare this part by cutting a 1 3/4 inch dia hole through the face centered near one end, and radius the edges of this hole such that the actuator tube can slide freely through this hole with no possibility of binding. Drill two holes near the other end for mounting with 2 #10 32 hex head bolts.

Once you have temporarily hung and exercised the rear actuation tube for the elevator system you can slip this section over the tube and position it on the STA. 139 bulkhead. Locate and drill two holes for mounting in the selected bulkhead. Enlarge these holes on one side of the bulkhead to about 3/4 inch diameter and fill with thick FLOX and cover with 2 ply BID at least 1/2 inch larger than the cut out. When this is sufficiently cured, redrill the mounting holes and bolt the support panel in place with #10 bolts and appropriate lock nuts and washers.

Other methods could be used to stabilize this tube, but this appears to be the most simple and fool proof system.



Mark the hole location in the seat front bulkhead. Insert a 2 in. square hard point in this position (if this was not accomplished at an earlier time), and drill a 1/4 inch hole. Space the KS-3 bracket with the idler link and two washers and mark the mounting holes in the fuselage wall. Insert a hard point on the inner wall (if this was not accomplished previously) to make a flat spot for the bracket (the insert piece to be about 1/16 inch less tall than the span of the bracket but 2 inches wide. Close with 2 ply BID with at least 1/2 inch overlap all around. drill holes and mount KS-3 bracket with counter sink #10-32 bolts.

Install the idler with 1/4 inch bolt (AN4-16 or similar) and castellated nut and washers. Assemble the stick to idler push rod with two rod end assemblies and a section of 1/4 inch threaded rod and the required nuts. Rig the length of this rod to set the indicated idler holes in a vertical plane when the stick is neutralized. (see sketch) Repeat this procedure on the other side with the other hand idler.

*see p 8 sec 2*

ELEVATOR AND PUSH PULL ROD INSTALLATION

When the bonding of the horizontal stabilizer is secure, trim away just enough material aft of the horizontal to allow assembly of and free travel of the elevator. On the right side use the elevator half and mock it up to the hinge. Angle the section through the travel range, and mark the fuselage side for the cut out. The cut out should be a compromise between access and free travel versus the unfavorable aerodynamic effects of too much open area.

Bolt the elevator actuation arm plate to this half of the elevator and trim the cut out carefully to let you install the actuator through this hole while attached to the elevator.

copy the cutout area from the right side, and repeat that cut out shape on the other side. Additional access will be required for hook up of the actuation push rod, so an added hole area with a flush bolt on cover should be added below the clearance cut out (do this in the same manner as the wing access panels building up a flange area with nut plates

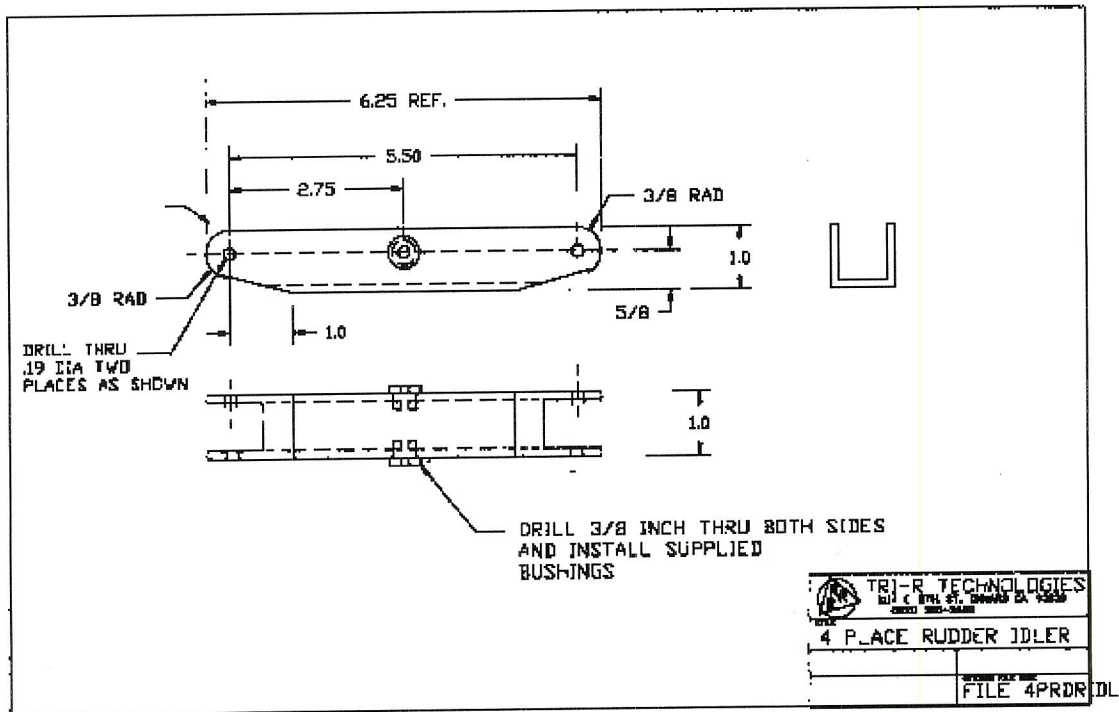
On the other (left) elevator half, install nut plates for the actuator arm plate to aid in the final installation of the actuator arm which will occur after both elevator halves are in place.

install the elevator, and hook up the long push rod (tube) to the elevator horn on one end, and the upper position of the idler bell crank (on the back of the rear seat) for the other end. Adjust push rod length as required to result in a vertical position of the idler arm, when the elevator is in a horizontal position. Cycle the elevator beyond the desired range of travel (about 30 degrees up and 20 degrees down), and verify that there is no interference nor impediment to this travel. Trim away any interfering material in the bulkhead center holes. Select the forward, shorter push pull tube components and set length such that the stick assembly will be in the neutral position when the elevator is trimmed to level trail, and the idler is vertical.

#### RUDDER IDLER LEVER INSTALLATION

This aircraft uses a rudder idler arm mounted on the station 180.5 bulkhead, connected to the rudder cables, and transferring actuation force to the rudder push/pull actuator "rod". This cleans up the aircraft aerodynamically by eliminating the external cables to the usual rudder actuator bar.

This idler arm is fabricated from a section of the 1 inch aluminum "U" channel section furnished in the kit. Reference the enclosed figure for dimensions and configuration of this idler (it is likely that this idler has been fabricated in an earlier step for trial assembly during the preparation of bulkhead 180.5).

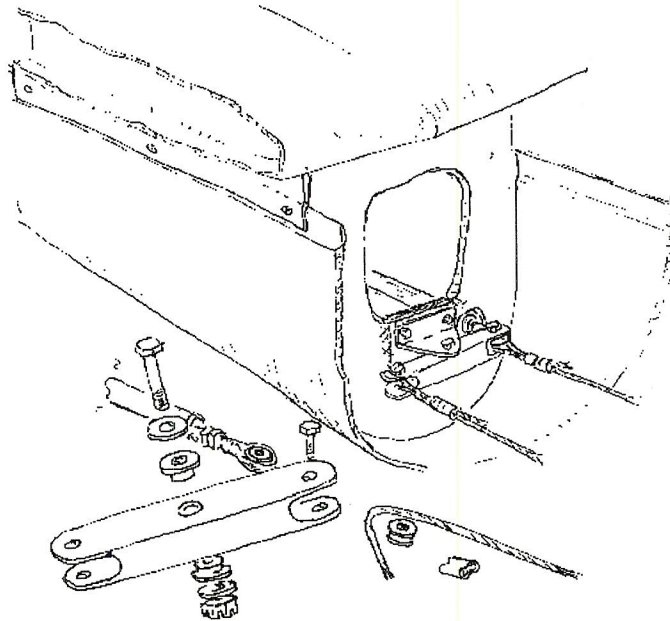


This idler rotates on the supplied hat shaped oilite bushings provided. If the bushings are not a tight fit in the hole, a drop of epoxy or one of the "Locktite" compounds will secure them in place. Assemble the idler to the two support angles (KIS -3 ) with a #10 bolt with a washer between all rubbing surfaces, and secured with a castellated nut to provide freedom of movement with a minimum of clearance. Position the assembly on the 180.5 bulkhead at the leading edge of the horizontal stabilizer (as shown in attached figure).



If the hard point on this bulkhead has not been previously installed complete that operation at this time installing a 3 by 3 section of 1/4 inch plywood and a 4 ply BID cover as mentioned before. Drill and mount with #10 bolts and lock nuts. Locate and cut holes in the bulkhead to allow full movement of the idler arm and allow installation of the rudder push pull tube.

Verify operation and fill the edge of the holes with dry MICRO. The most correct geometry will be assured if the rudder cables are crossed forward of this idler, and the push rod installed on the left side in a straight line to the rudder actuation arm. There is sufficient room in this idler link to install both the rod end and the cable thimble. Use sufficient washers to avoid interference between the two. and a large number of washers on the other end to keep the cable thimble roughly centered.



#### FLAP ACTUATION TORQUE TUBE INSTALLATION

The flap actuation torque tube is a one piece assembly for the 4 place plane, and it mounts on the aft face of the wing rear spar carry through section. This rear spar should be 48 inches long (if it has been trimmed to final size) . Mount one of the three torque tube mounting brackets (CS-23) at each end of the spar, located 3/8 inch below the top edge, and 1 inch inboard of the outer edge (Reference sketch). Mount these with only the top bolt at this time such that they can align with the assembly. The bolts are #10-32 flat head counter sunk bolts (MS-24 694-S56 ), counter sink the front face of the spar such that the bolt head does not protrude above the surface (the wing rear spar surface will be bolted up tight to this surface) . Using the bracket as a guide, mark and cut at least a 1.25 inch dia. hole with a hole saw or Dremel in the fuselage side, to allow the tube to protrude through the fuselage surface and operate freely without binding. Repeat this step on the opposite side.

#### CRUISER FLAP ACTUATION PIVOT HANGERS

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REVISION 1 JAN 1998 SUPPLMENT TO FUS2 FOR FLAP ACTUATOR TUBE BEARINGS

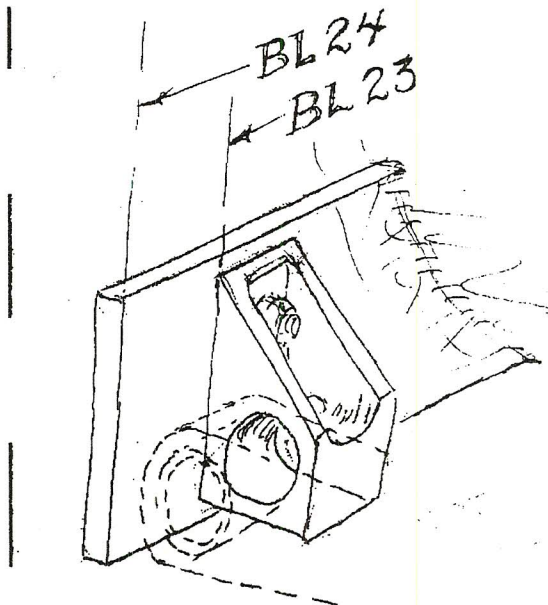
INSERT THESE 2 PAGES, AND STRIKE OUT CORRESPONDING SECTIONS ON PAGES 15 AND 16 OF THE JUNE 28, 1997 FUS2 SECTION OF THE ASSY MANUAL.

### FLAP ACTUATION TORQUE TUBE INSTALLATION

The flap actuation torque tube is an assembly on a one piece 48 inch length of 1 inch OD tubing, and it mounts on the aft face of the rear wing spar carry through section. It is supported by three machined aluminum bearing bracket (CS 23)

#### CRUISER FLAP ACTUATION BEARING HANGERS

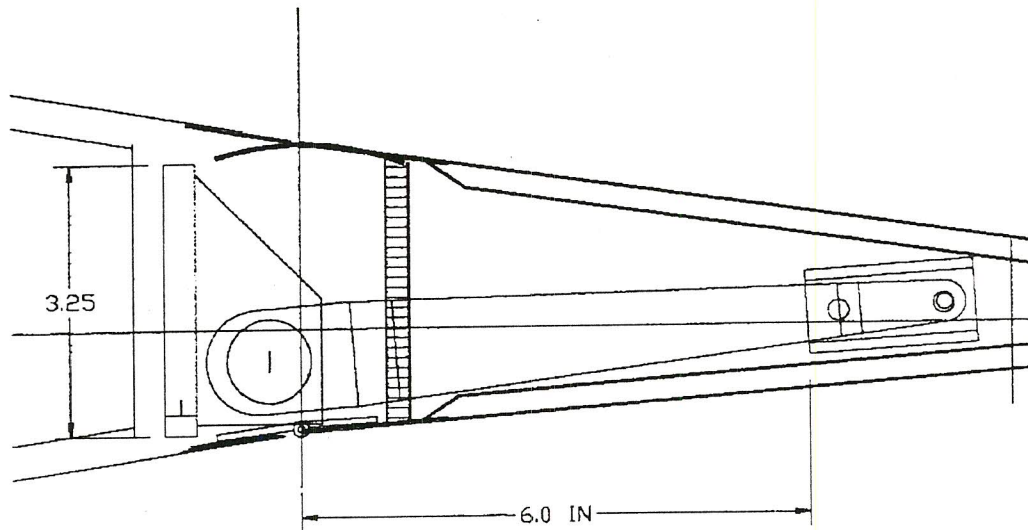
Mount one of the bearing hangers (CS 23) 1 inch in from each end of the rear spar carry through. The outer face of each of these hangers will be at the respective Butt Line 23. The nominal height of these hangers is 1/8<sup>th</sup> inch down from the upper edge of this spar (see sketch).



The actual vertical position of this bracket is not extremely critical, but it IS imperative that it be the same at each end of the spar to avoid eccentric deployment of the two flap segments on each side.

There has been considerable confusion concerning this vertical location in previous versions of the assembly instructions. Setting the top edge flush with the upper edge of the spar may actually provide some improvement in the geometric relationship of the actuation elements. However, this would require setting the rear spar bolt bushing ( at BL21) above the spar centerline, which is no problem.

The drawing below shows the nominal relationship of the flap actuation components. Some versions of the assembly instructions may have resulted in mounting the bearing hanger flush with the bottom edge of the spar. This would result in some minor interference with the edge of the bottom flap skin, requiring some trimming, and adjustment of the lower fairing pieces. This also can be accommodated without serious problems.



75 PERCENT LINE

When you initially mount the outboard flap tube bearing angles, drill and install the upper bolt first to allow alignment adjustment when the tube is first fitted into place. The bolts are flat head #10 – 32 screws (MS-24 694- S56). Countersink the forward face of the spar to set the heads of these bolts flush to avoid interference when the wing aft spar is bolted into place.

Using the bearing location, and the tube, as a guide mark and cut out a clearance hole for the 1 inch OD actuation torque tube. Verify free rotation of the tube in the two original hangers.

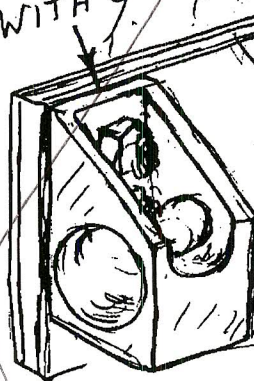
Prepare the torque tube assembly by installing an actuator arm (CS 32) on each end of the tube. Verify that the tube is 48 inches long, and that the location of the arms on each end will still allow sufficient clearance to the outer faces of the bearing hangers for free rotation. The arms shall be installed with the flat surface outboard, and the two arms carefully parallel. This can be best assured by assembling them on a very flat surface.

Fasten one end first, drilling in place and temporarily installing each bolt ( a single AN3-15A inboard and two AN3-4A's outboard, all facing down, and self locking nuts) as soon as the hole is drilled to hold alignment. Holding the assembly on the flat surface, drill the holes and assemble the other arm. Mark the arms and tube ends to assure proper re assembly.

Remove the right side arm, and lightly deburr the holes to prepare for the following steps.

The location called out for mounting the flap actuation bearing assemblies on the rear spar will result in some interference with the lower flap skin and lower wing skin in this area. This material can be trimmed away, but a better solution is to mount these parts flush with the upper edge of the aft spar (and the center one aligned with this location of course).

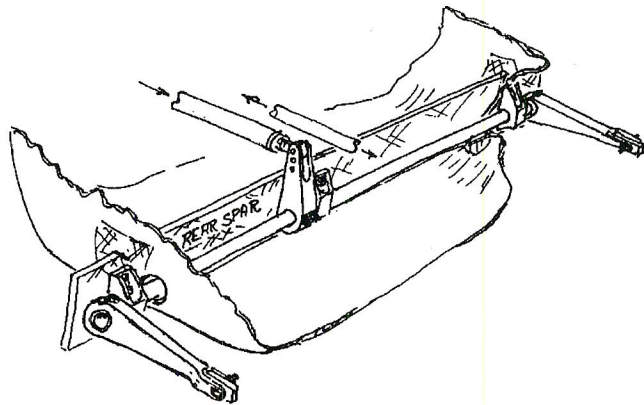
FLUSH  
WITH UPPER EDGE



→ ← 1" ? See p 15

Prepare the torque tube assembly by installing the actuation arm (CS-32) on each end of the torque tube. These must be installed as precisely parallel as possible to avoid dangerous eccentric flight loads when the flaps are deployed. Carefully coordinate the distance between the flap tube supports (CS-23) such that the actuation arms will move freely but without excessive end play. The recommended way to accomplish this is to work on a flat level surface and install first one actuation arm at one end, drilling through both the arm and the tube with a 3/16th in. dia. 2 places as close together as 2 #10-32 hex head bolts can be spaced. install each bolt as soon as the hole is drilled. Align the other arm using the flat surface as a guide, and drill and install the bolts in the same manner. Mark the actuation tube and the arms such that they will not be switched when reassembled. Remove the right side arm to prepare for the following steps.

Slip the torque tube through the mounting bracket and fuselage hole on the left side. Slip the flap actuation input lever arm, and the remaining mounting bracket on the inboard end of the long torque tube, and pass the end of the tube through the other fuselage wall, and the hanger bracket on the far side..



Position the actuation arm on the torque tube assembly, such that it is in line with the flap actuation lever assembly in the center console (not centered in the console but aligned to the left side to permit room for the elevator push pull rod assembly on the right side). Locate the loose (central) flap hanger bracket adjacent to the actuation arm, and drill the top mounting hole for the middle mounting bracket (this bracket location should be near the airplane centerline if the assembly is proper). This center mounting bracket may be mounted with hex head #10-32 bolts since the flush surface is not required, and access will be better for a wrench than a screwdriver.

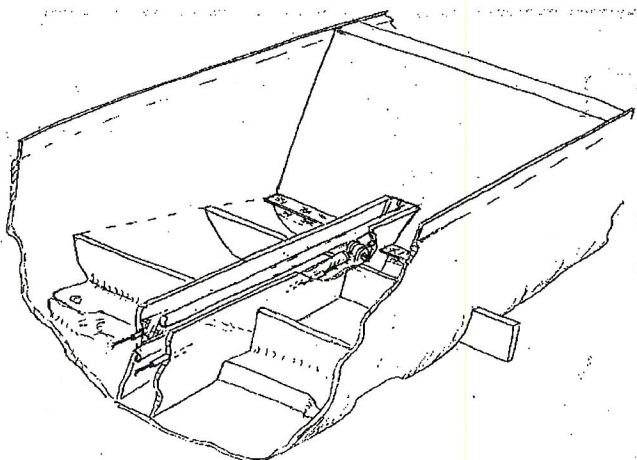
Center the actuation tube in the aircraft, and assure that sufficient free end is available at each end for mounting the flap driver arms.. Level the flap actuation arms that are on the outside of the fuselage, with the ends of the arms facing aft. Set the center input actuation arm vertical, and drill through the flap actuator arm, and the tube for two #10-32 bolts. Space the bolts just enough to provide wrench access. Locate holes and install the bolts such that the head ends will be toward the spar surface when the actuation arm is vertical, to permit free rotation during flap actuation. With the torque tube assembled, pivot it several times to clear up any interference and binding, and locate and drill for the second mounting bolt in each bearing bracket. The outer bolts are also the flat head #10-32 countersunk bolts, installed as before, and the second mounting bolt for the center bracket is another hex head #10-32..

Select the flap actuator push rod assembly ( part CS- 24 ) from the included parts, and trim the open tube end such that the nominal length of the assembly will hold the torque tube actuation arm vertical in the flap retracted (forward) lever position. Complete this assembly by installing the AN 490HT8P adapter (rivet in place) and MW-3M8/F34-14 rod end, and install in place. Cycle the assembly through the flap positions to assure free movement and no interference with structure or other control components.

## RUDDER CABLE ROUTING AND INSTALLATION

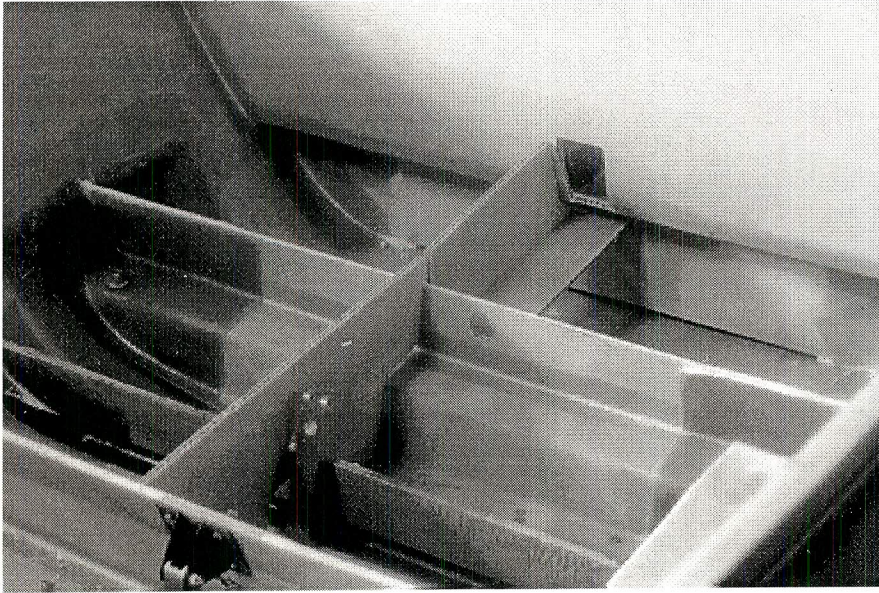
Measure the cable lengths to provide the desired rudder pedal position in the neutral rudder position. Install cable thimbles and cable bushings to assure against cable wear, and crimp all cable joints with Nicopress clamps in the desired position. Using strips of metal with spaced holes, as shown in the sketches, will allow a degree of rudder pedal adjustment for pilots of various length legs, as required at some future time. As mentioned before, the rudder cables will be crossed between the seat back and the rudder idler. Use some hard nylon tubing to sleeve the cables in the cross over area to avoid friction and wear. Bolt the cables to one end of these strips, and attach the strip using the appropriate holes, to the tabs on the rudder pedals with bolts and bushings supplied. Save the cut off cable for use with the shoulder harness later.

The rudder cables will be routed against the walls of this tunnel section to minimize friction and avoid interference or conflict with any of the other function in the tunnel. To accomplish this, the cables will be run inside hard nylon tubing attached to these walls. In the front section the nylon tubing shall be held straight by appropriate means while the nylon tube is bonded in position on the inner wall with an overlay FLOX or 2 ply prewetted BID tape (Extend roughly 3 inches of free end of this tube forward of the panel, through the seat forward bulkhead .



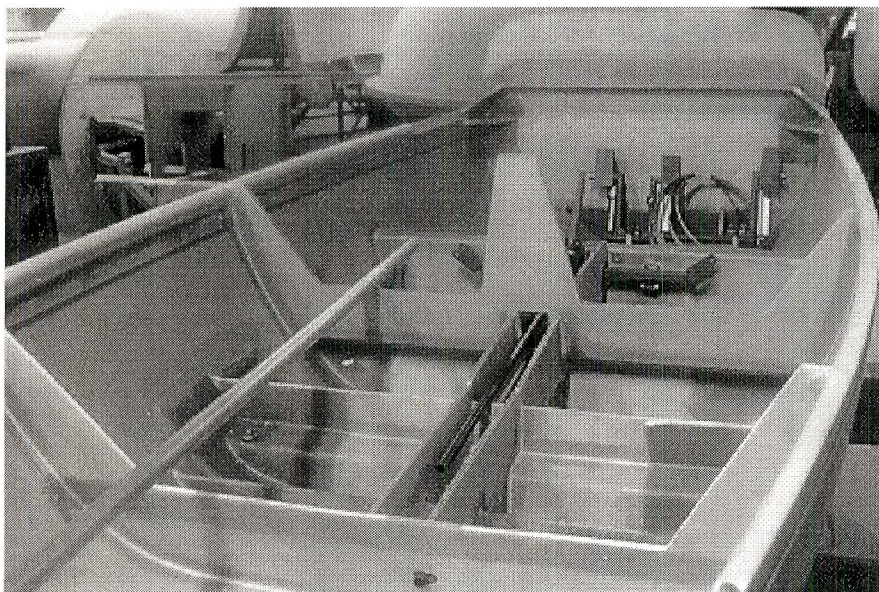
In the rear portion of the tunnel the plastic enclosed rudder cables will be treated in a similar manner, bonding them to the sides at strategic locations to avoid binding of any controls. . Verify that this line is continuous and relatively straight, and will just clear the upper surface of the center main spar cut out, and the cutout for the main gear box. The right side line will be directed through the rear seat back just above the elevator idler link, and the left one at a similar height just inside the left tunnel wall. Also check that the line is directed in a straight line which will project aft to the level of the rudder bellcrank. Fit the supplied lengths of nylon tubing into it's proper path, and bond in place with

thick MICRO paste.



The picture above shows one side of the rear control tunnel assembly. It is suggested that this "tunnel" be constructed in two sections, and a "floor" be provided in the section between the back of the front seat to the front of the rear seat. The function of this floor is to assure that the control functions be enclosed against the incursion of any loose objects which might jam the controls. The rearmost section of this "tunnel" (under the seat area) should use full height sides to prevent any items from interfering with safe operation of the flap and elevator.

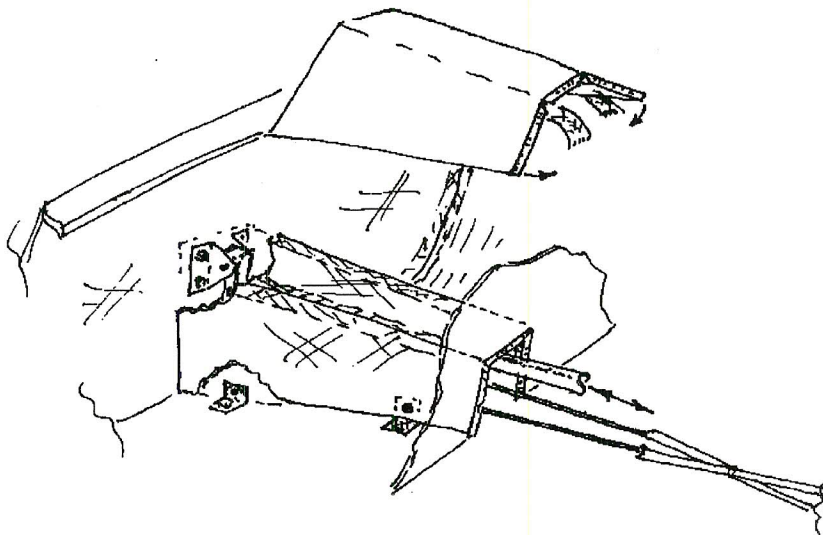
The photo below shows a view from the rear looking forward at the rear seat tunnel section. This plane has an optional rear seat back fold down cut out for better access to the baggage area, and/or transporting bulky loads in the back seat area. The extra plies for replacing the stiffness lost in the cut out had not yet been added



CONTROL TUNNEL - BAGGAGE AREA.

FIGURE - Protective "Tunnel" for baggage area.

The area established behind the seat back up to the just installed baggage bulkhead will become the baggage area, and it is particularly desirable to avoid any items carried in this area interfering with the control components which pass through this zone. The primary components of concern in this area is the elevator push-pull tube assembly, and the associated idler on the seat back, and the rudder cables which should be exiting from the seat back at the edges of the console assembly. Jamming any one of these items with a carelessly tossed item of clothing or luggage could be a major flight safety issue.



Fabricate an inverted "U" shaped "tunnel" for this area which is just a bit wider than the console, to clear the cables, and just a bit higher than the push rod idler



at the forward end ( height can be reduced as you go aft if desired). Unless you have sufficient panel stock remaining, select a suitable section of locally procured material such as light plywood or fiberboard. Layout the pattern as shown to protect the appropriate control linkages. Cut a pair of grooves along the "fold" lines on the inner surface of the panel and fold it into a "U" shape. Bond the inside corners with wet micro and tape the inside and outside of the corners with a single 2 inch wide strip of BID at each location (see figure).

Make four "L" brackets out of 3 ply bid laid up as an angle strip (using an aluminum angle or a strip of wood covered with plastic tape as a mold will simplify this procedure). Bond these to the floor such that they will sit inside the tunnel. Install the "tunnel" over the control components, fasten it to these "L"s with self tapping screws so it can be readily removed for any required maintenance on these components.

#### MAIN GEAR INSTALLATION

The main gear should be prepared for installation by locating and drilling for the two "roll" pins that prevent sideways movement of the main gear. The location for these pins is on the back edge of the center gear section located vertically on the section centerline and 15.75 inches each side of the gear/aircraft centerline (LBL and RBL 15.75). Drill 1/4 inch diameter for 1/2 inch depth parallel to aircraft centerline. (The forward edge of the gear is the straight edge.) Break (round) the edges of these holes to avoid stress concentrations. The gear legs and center sections should be dressed smooth before the roll pins are installed. Do this smoothing in a direction parallel to the length of the gear legs, being especially diligent in smoothing out any cross wise defects in the surface area, to preclude any future cracking. This operation is both for cosmetic and structural reasons. Drive the roll pins into place after these operations are complete, and test fit to the gear recess and trim off any excess length of the roll pins which might interfere with the fuselage material. (the roll pins need only

extend past the rear bolt centerlines for proper retention of gear position).

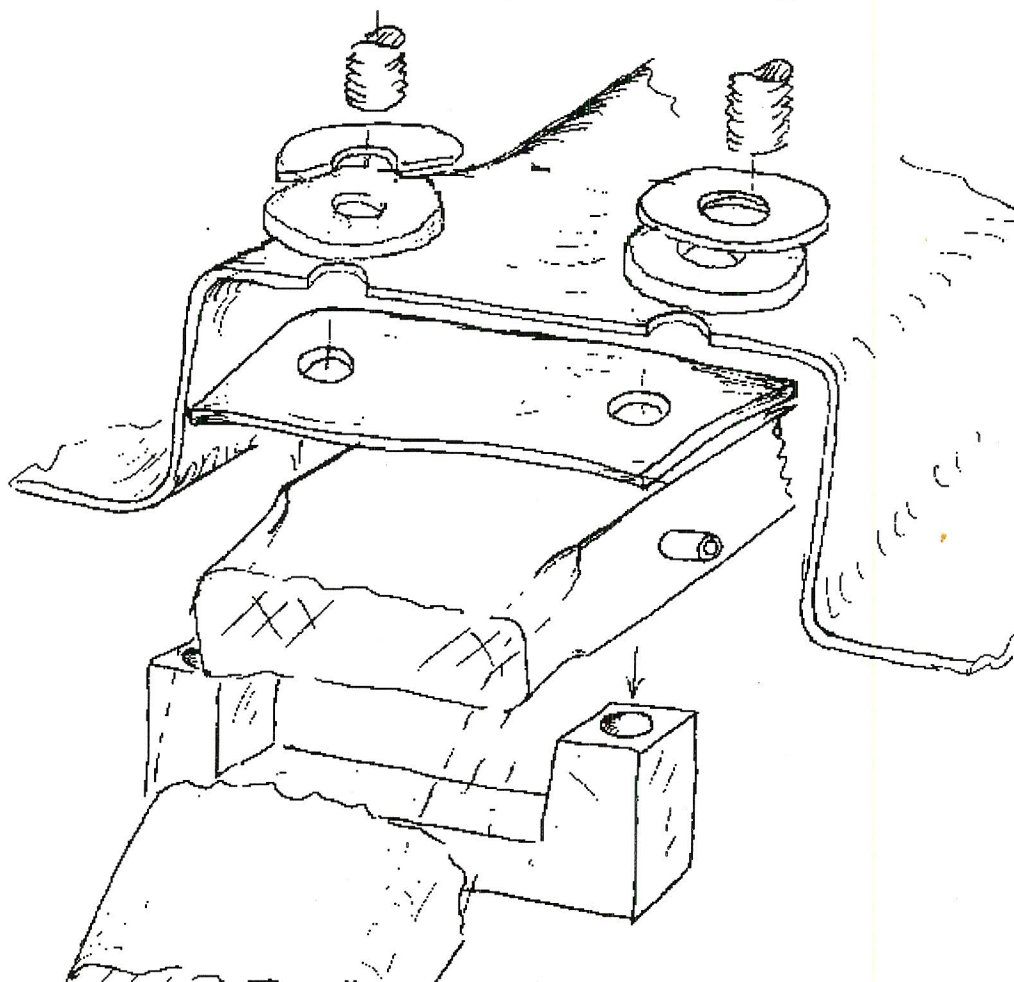


FIGURE - Main gear assembly operation

The mounting bolts will be located 16.5 inches either side of the aircraft centerline (RBL and LBL 16.5), and are 5.5 inches center to center (fore and aft), centered in the molded recess.. The center gear section should be 5 inches wide at this point., providing a little over 1/16 inch clearance between the gear and the attachment bolts. Using the large bearing washers and the 1/4 inch rubber material provided in the kit on the inner fuselage side of the mounting holes, the machined aluminum "U" clamp, and supplied bolts ( 9AN6-30A or similar), trial assemble the gear legs to the fuselage (use minimum torque on the nuts to close up gaps but not deflect structure). Check that the assembly is square to the aircraft centerline, the legs are level on each side, and the axle centerline will be located at STA 58 . Use thin wood shims tacked in place with 5 minute epoxy to correct any noted misalignment. If significant shimming is required, build up the mounting surface in the gear "box "local mounting area with 3 inch wide pre-lam BID. Lightly torque the bolts holding the gear in place,

and correct any positioning before the BID cures. Clean away surplus resin or glass before it becomes fully cured.

Final mounting will employ a strip of the 1/4 inch supplied rubber (about 2 inches wide) both on top of the gear leg, and either as a strip or large washers on the other side (inside the fuselage) of the composite gear "box "to avoid local concentrated loading of the composite. . The rubber should provide for ease in separation of the gear from the recess, as well as providing cushioning against the destructive effects of point loads into the composite.

The gear legs are supplied predrilled for the stub axles. Trim away surplus material from the ends of the gear legs for a finished appearance, and also to provide clearance for proper installation and operation of the brake mounting plate, which may have to be drilled for the mounting bolts (drill the matching positions and sizes ). Select the appropriate bolts to complete this assembly (note that with many axle sets the lower bolts are larger than the top bolts) .

It may be convenient at this point to install a temporary substitute nose gear to allow wheeling the fuselage about, This can be as simple as a section of two by four clamped to the firewall, or you may put a caster on the bottom if you like. Ballast will be required to hold the nose down .

#### BRAKE LINE INSTALLATION

This is probably a good time to install the brake lines from the main gear wheel assembly to the master cylinders in the rudder pedal area. Pre measure the proposed routing of the brake lines, and cut appropriate lengths of the hard nylon tubing supplied for the hydraulic lines (leave a little surplus length for possible trimming and refitting operations in the future). Grooves have been cut in the trailing edge of the gear legs. Press the nylon tubing down into this groove. Plastic tie wraps can be used to secure the brake line at the ends of these grooves to

the rear edge of the main gear legs, although bonding them in place with a trailing edge fairing makes a classier job with less aerodynamic drag. Route over the spar and along the fuselage wall. Bond in place with little dabs of silicon adhesive, using tape to hold in place while curing.