KIS4 Cruiser

BUILDERS MANUAL

S/N 4052

FUSELAGE

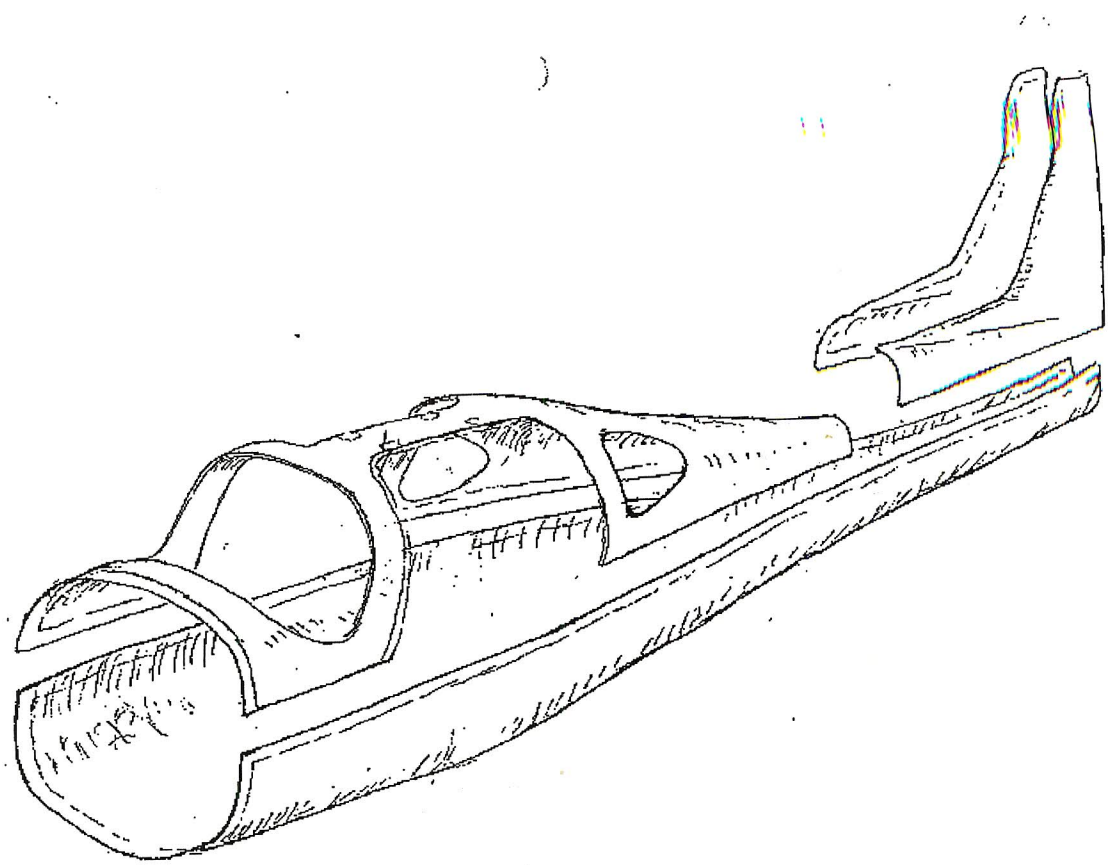
SECTION 1

FOUR PLACE FUSELAGE ASSY

FIRST SECTION (of four)

NOTE : SPAR PREPARATION

If you have not completed the spar preparation steps outlined in the WING section of the assembly instructions, it might be a good idea to accomplish that task at this time. The assembled center section will be required in the fuselage assembly process. The spar assembly operation requires a large clear area to properly align the spar joints. Completing it at this time will prevent having to disturb the fuselage setup halfway through the assembly process.



The figure enclosed shows the major premolded components of the fuselage assembly which includes such associated parts as the cabin doors, and the vertical fin. (figure on opposing page showing the molded components for the fuselage)

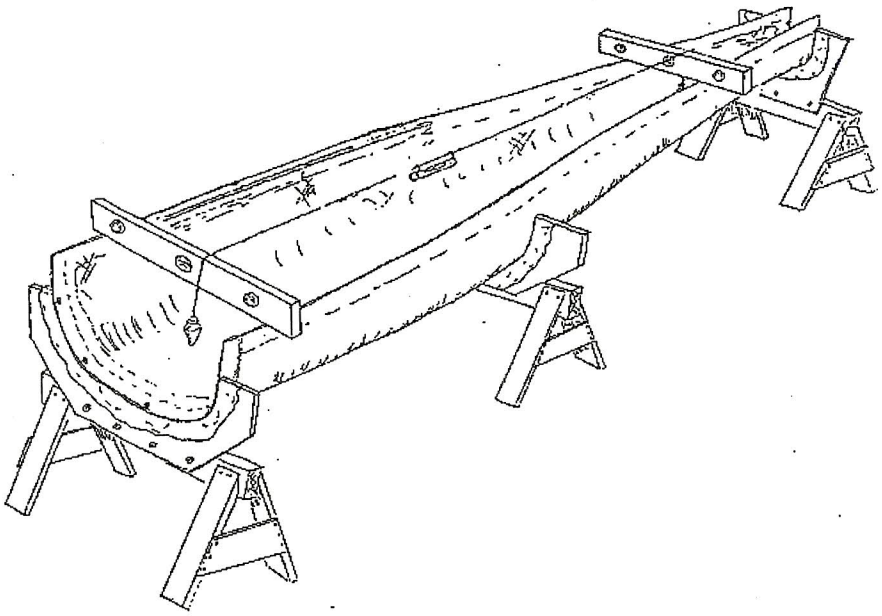
The initial steps will be preparing the lower fuselage section molding and fixturing and leveling. Trim and clean up the horizontal joint line of both the upper and lower fuselage molded parts, sanding any raw edges to minimize any cuts snags or slivers that might result from handling. The lower fuselage trim line
is 1.25 inch above the "joggle". The longitudinal factory "joggle" is located at Waterline -1.25. The trimmed edge 1.25 inch above this is Waterline 0.0. Trim this edge quite carefully since this edge will be used for referencing during the leveling procedure. Waterline dimensions above this trim line are positive numbers and below it are negative numbers.

The upper fuselage section should have the factory trim line scribe from the mold at WL -1.25, (Minus 1.25 inch. Corresponding to the joggle in the lower half, which establishes the bond line overlap) and this is where it should be trimmed. Care fully verify these lines before using them for cutting. Cut accurately to these trim lines to provide properly located edges for leveling and fixturing.

WARNING - THE STRIP OF BLACK MATERIAL ALONG THE FUSELAGE "BELTLINE" IS A CRITICAL CARBON FIBER STRUCTURAL REINFORCEMENT - AND MUST NOT BE CUT INTO FOR ANY REASON . NOTE THE POSITION OF THIS MATERIAL AND MAKE SURE THAT IT IS NOT COMPROMISED IN ANY SUBSEQUENT OPERATIONS !!!!!!!!!

LEVELING AND FIXTURING

Three sturdy saw horses or similar supports should be procured or fabricated to support the fuselage bottom half during subsequent fabrication steps. Two cradles should be cut out of at least half inch plywood or similar panel material. Front and rear cradle contours can be traced from the appropriate ends of the
molded part, and cut out using a saber saw or similar tool. The center support can be flat on top, and located in the recess molded in place for the main gear. Some relatively thin padding material (terry cloth, blanket, thin foam, etc.) should be used on the surface of the cradle where it will contact the fuselage surface. (Reference enclosed figure showing the fuselage on these supports with some of the leveling provisions in place)



Drywall screws or similar self drilling screws will facilitate attaching these cradles to the face of the saw horse top bar and make changes of position during the leveling phases quick and easy. Use a level and string to level the horizontal bond line of the fuselage molding both crosswise and fore and aft (see fig.).

It is suggested that drywall screws or similar fasteners be used at each end to secure the lower molded fuselage section to the cradle in the proper position. Locate the cradles at the very ends of the flanges at each end, to permit access for installing the firewall, and other features into the fuselage. Put the screws through the solid fiberglass in the end "joggles", near the very end of the part. Temporarily remove the screws during bonding operations in these local areas to avoid trapping them in a lamination. Check the set up to make sure that the part will not shift out of position during subsequent operations. If it becomes necessary to move this assembly. repeat the leveling process before any additional work is accomplished on this assembly. Actually straightness and lack of twist is more important than leveling at this time, but the procedure shown is the most trouble free method of assuring a true fuselage

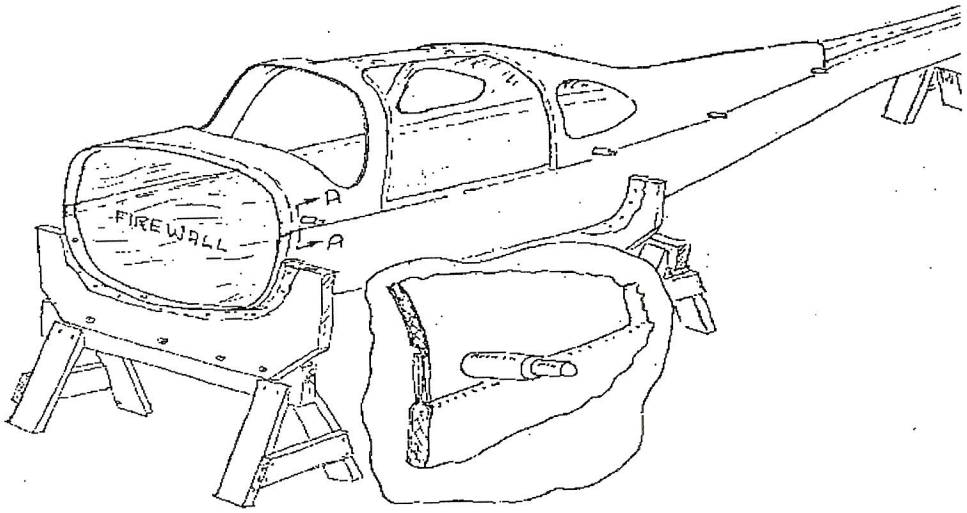
SPREADER STICKS - Spreader sticks should be used to provide the proper width at the appropriate stations, since the molded parts have a tendency to close together in handling and shipping. Fabricate these spreader sticks from nominal 1 X 2 lumber material which is reasonably free of knots and relatively straight. The list of suggested stations and outside fuselage width dimensions at those points are shown below. Station zero is referenced to the back surface of the fire wall and this is a convenient reference to measure axial locations. For convenience in set up the axial dimensions given are beltline measurements around contour rather than true stations. You do not need to make up and install spacers at all these locations but try to use a representative number to hold the shape. It is suggested that you mark the spacers and locations for reference. Remove any spacer which is in the way during any fabrication steps but try to keep enough installed to hold the shape. As bulkheads are installed you may discard spacers.

BELTLINE MEASUREMENTS FROM STATION 0.0	OUTSIDE FUSELAGE WIDTH
30	43 3/8
40	44 1/2
50	45 3/16
60	45 5/16
70	45 1/16
80	43 7/8
100	39 1/2
120	32 11/16
140	25 9/16

TEMPORARY FITTING OF THE FUSELAGE TOP

The fuselage upper section will be temporarily installed to assist in placing some of the other components. Align the axial position of the two assemblies by matching the joggle line at the forward (firewall) end of both parts. If the parts were properly trimmed, the vertical position will be established by the trimmed edge of the upper part resting on the shoulder of the joggle in the lower part along this "beltline". Verify this fit. Temporarily attach the top section by drilling holes at locations about 2 feet apart and inserting the proper size Cleco's to securely join these assemblies (small bolts or sheet metal screws can be used in place of the Clecos). It may be useful to store the upper fuselage section in this temporary installed position whenever there is no work going on in this assembly. This storage location will help these parts retain

their shape until final bonding. (Reference enclosed figure showing temporary installation of



fuselage top)

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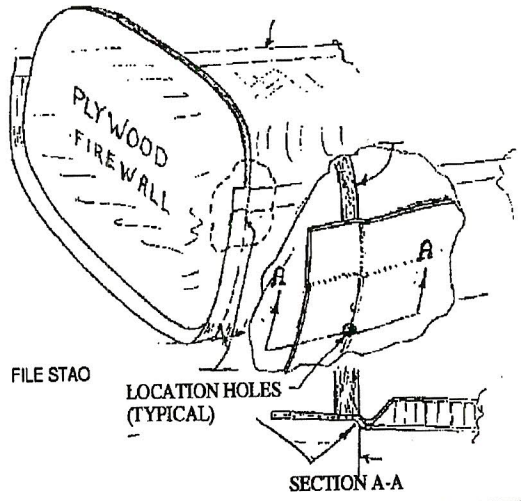
FIREWALL

The firewall will be fabricated from the 1/4 inch plywood piece included in the kit parts. This piece of plywood should have the outline and location of major features (such as engine mount locations) marked on at the factory. Some slight amount of trimming will be required from this line to finally fit it to the fuselage. Some of the plywood may be warped from shipping so some degree of straightening should be performed at this time.. Storing on a flat level spot with weights or clamping with some one by four material should flatten the material. In severe cases temporarily attach some 1 by 4 strips on edge to the engine side of the plywood to hold it flat.



FIRE WALL INSTALLATION AND LOCATION OF STATION ZERO

The firewall cutout should be inserted into

the forward portion of the two fuselage halves and pushed back to the reference location. The back surface of this plywood firewall is to be set at station 0.0, with considerable care and precision, since this will be used as reference for many of the assembly procedures. Station 0.0 is described as the edge of the "joggle" for the cowling rear overlap (see figure).

Four holes about 1/16 in. dia. may be drilled through the edge of this "joggle" to visually determine the location. The plywood may be temporarily spaced with large pins or small nails through these holes, and may be temporarily secured with small nails or pins through small holes drilled to center on the plywood. Assure that the firewall is vertical and square in place. Use the level line on the firewall to assure proper vertical placement relative to the Waterline references on the lower fuselage section (the joggle at WL -1.25 and the trimmed edge at WL 0.0). Also verify the fit with the upper fuselage half before "tacking" the firewall panel to the lower section with five minute epoxy. As mentioned before, when "tacking" in place with five minute epoxy, be careful not to spread the epoxy over a wide area. The fast curing epoxies have significantly lower structural bond strength than that of the slow cure mixes, and any area covered by the fast epoxy will have this "weak link" in the joint. Keep the five minute epoxy "tacks" as small and local as practical, .

FIREWALL FRONT FACE

Prepare the inner surface of the fuselage flange area and several inches back from this zero station in preparation for the bonding operation. As always, remove all peel ply and debris and clean and roughen these areas. Also prepare the forward and aft face of the firewall for bonding. Trim off the forward facing cowl flange on the bottom of the fuselage flush with the front face of the firewall, between LBL 8 and RBL 8 (a total of 16 inches wide) and radius this edge. Prepare any of the remaining inner surface of the flanges and the local bottom surface of the fuselage for bonding.

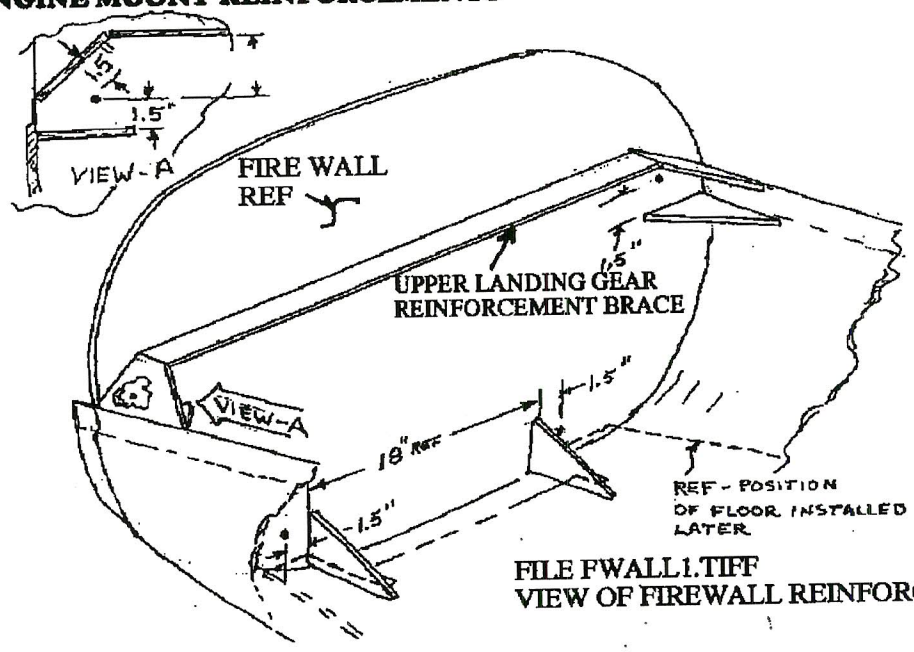
MICRO/FLOX fillet the joint in all areas. Make up enough 3 inch wide two ply PRE-LAM BID tape to apply to the flange/firewall joint on each side and around the firewall to fuselage bottom surface. For the factory quick build assemblies we cover the entire firewall front face with one layer of BID. This step is optional for the builders. This surface will also be covered at a later step with a layer of fireproof fiber sheet and stainless steel in the finished assembly.

ENGINE MOUNT REINFORCEMENTS

The engine mounting points will be marked on the plywood firewall panel. It will be beneficial to drill small pilot holes through the firewall to denote the location of the engine mount bolts. Cut out the triangular shaped gussets and the firewall cross stiffening strip from the same plywood panel that was used for the firewall

. The patterns for these parts should also be factory marked on this panel. Attach these plywood gussets and the firewall cross stiffening strip on the inner surface of the firewall panel and to the lower fuselage section inner wall with dabs of five minute epoxy. The location for these stiffeners is shown on the enclosed
figure.

ENGINE MOUNT REINFORCEMENTS



FILE FWALL1.TIFF
VIEW OF FIREWALL REINFORCEMENTS

The full width stiffener should be tied into the edges of the upper gussets. The lower edge of these upper triangular gussets shall be aligned with the top surface of the upper edge of the fuselage flange (waterline 0.0). These gussets should be angled upward such that the lower surface of the plywood is 1.5 inch from the center of the engine mount bolt hole. This will provide adequate clearance for the washer which will be installed at each of these mounting points. A fillet of dry FLOX should be worked into place on the underside of the joint along the fuselage flange providing proper backing for the subsequent layers of BID. The lower gussets of this upper set will be mounted with 1.5 inch clearance to mounting bolt holes. The gussets for the lower mounting holes shall be installed 1.5 inches on the inboard side of the engine mount bolt center line location as marked on the firewall pattern and shown in the figure below.

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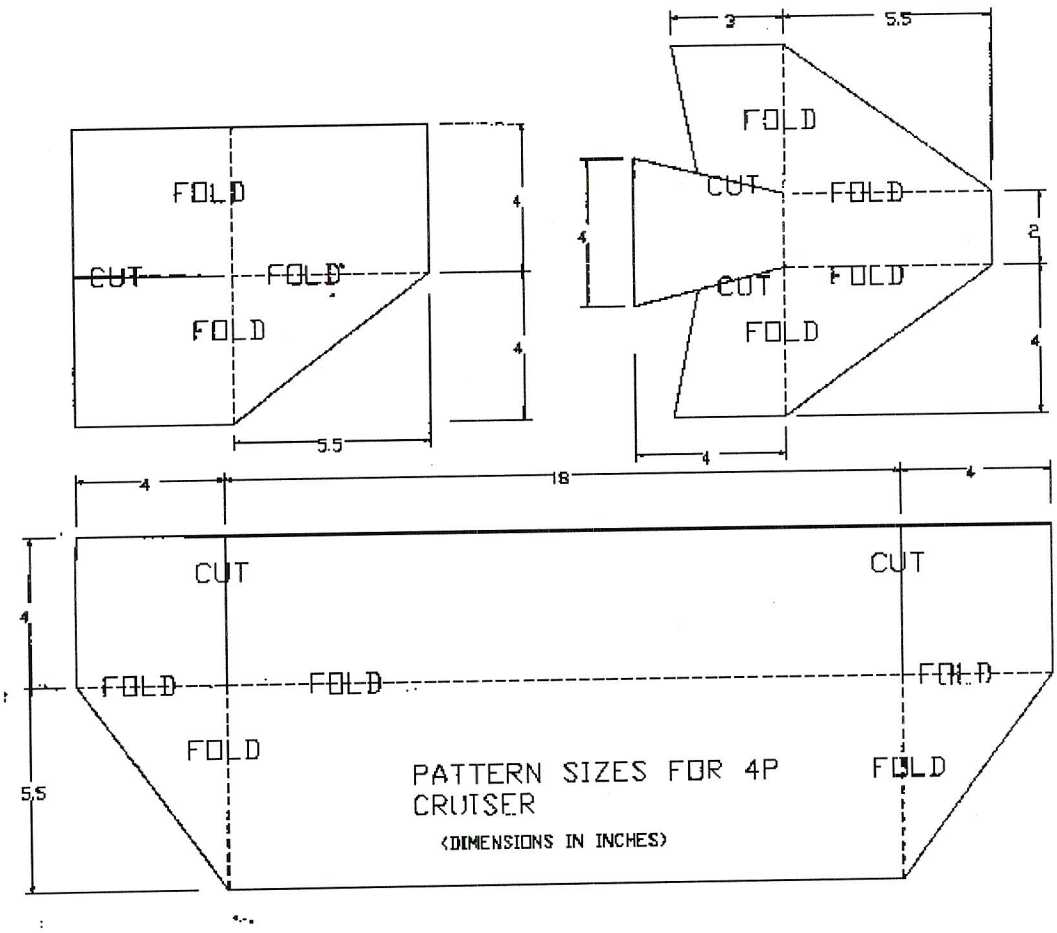
Note all areas which will be covered by the bonding layers of BID, and clean and abrade these areas with coarse sandpaper.

Make paper patterns in roughly the shape and sizes shown in the enclosed drawing . The areas between the upper braces will be the most demanding because of the angle between the gussets. Try to optimize the pattern to

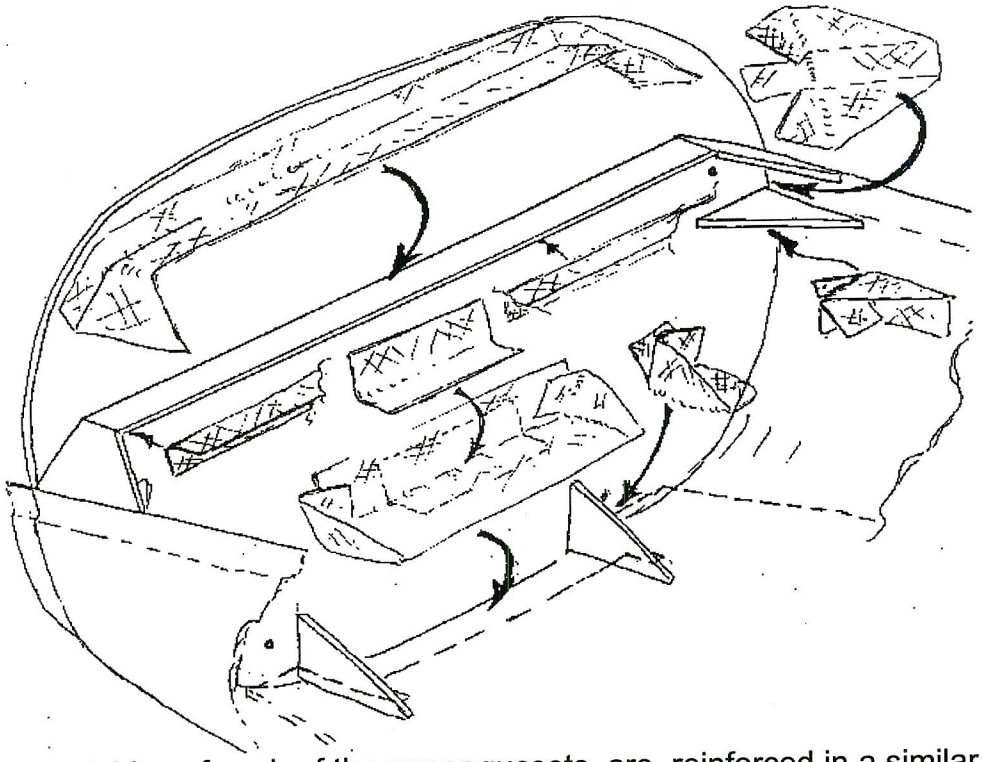
provide full coverage on the firewall in the bolt area with the three layers of each overlap (24 layers total in these mounting bolt areas). Make up two 4 layer BID sections of the required size. NOTE: make the first 4 layer section oversized in order to provide generous added overlap on the firewall surfaces. We recommend that you use the suggested procedure for "pre-lams". Make these sections up on a plastic sheet and wet out the specified number of layers with resin. Apply the top plastic sheet and cut to the pattern developed for the appropriate gusset set. This makes a “pre-lam” that is covered with plastic on each surface for handling and holding it’s shape, and is ready for installation.



The lower engine mount areas have only one plywood angle per hole. Cover the area between these gussets with a total of 8 plies of prelam (this is one of the nose gear mounting area). The fire wall area next to the gusset will have the corner overlapped areas for a total of 16 plies. The other side (bolt hole side) will also get an 8 layer set of plies doubling the overlap at the mounting bolt points for 16 plies at this time (4 added plies will be installed during floor installation). Wet out the surface that the pre-lam BID will cover with a thin coat of brushed on epoxy. This applies to all areas where the prewetted BID is to be applied

and helps to assure a good bond in these areas. An added 6 by 10 inch 4 ply prelam should be bonded between the two bottom engine mount gussets with at 3 inch overlap on each the firewall and fuselage bottom surface as added strength for the lower gear mount.

Remove one layer of plastic and install the 'pre-lam" between each set of gussets with the wet side to the structure. Fold the "ears" of this BID such that there is the required number of overlaps bonded on the back side of the firewall where the holes will be subsequently drilled for the mounts. Remove the plastic backing as you install the glass cloth to avoid having any plastic in the overlap areas. Work any bubbles out of the resin with a brush or squeegee. You should probably do the first of these laminations one assembly at a time to avoid rushing against the time barrier of the resin working time.



The outsides of each of the upper gussets are reinforced in a similar fashion, also with two sets of 4 layer pre wetted BID pattern with the angle cut "wing" on only one side. As indicated above, it is frequently a good idea to make up many of these reinforcements in two stages with decreasing amounts of overlap of about 1 inch in each stage. This will avoid dumping all the concentrated loads on one line. Completing the upper surface of the upper gussets (which will be laminated into the upper fuselage half) will require special treatment and will be delayed until the fuselage top is being permanently installed.

ADDED REINFORCING IN FIREWALL AREA

Any previously cured BID layers which will be bonded to in later steps must be roughened and cleaned prior to applying added layers. This applies to any

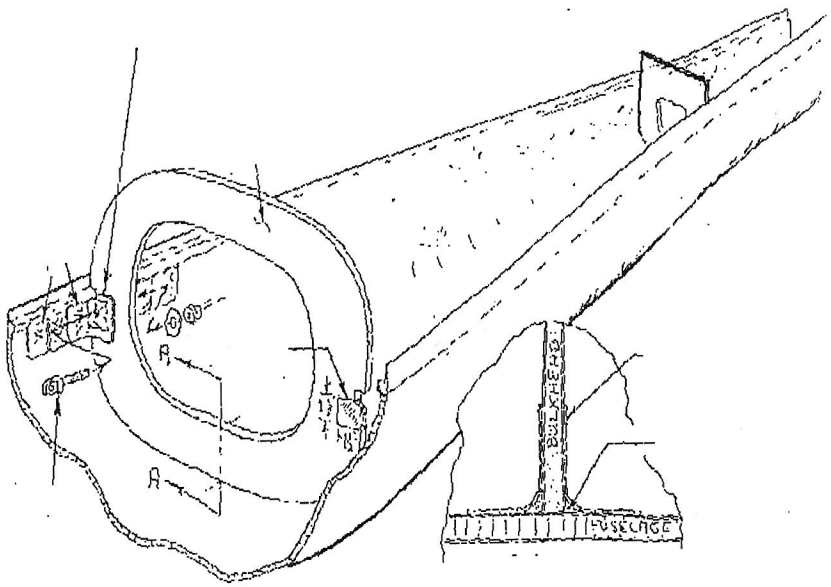
portion of the assembly process, and should be kept in mind when scheduling layup work . What you leave unfinished in one work session will have to be re prepared before continuing at the next work session.

Bond the uncovered upper surface of the cross stiffening strip in place with a 6 layer BID tape. Use roughly a three inch overlap on the plywood firewall, and a piece long enough for a full overlap on the upper engine mount gussets.. (trim this prelam at the fuselage edge - the section will be bonded to the fuselage after the top is installed) Do the same thing with a 3 layer BID tape on the lower surface of the crosswise stiffener but just use a 2 inch overlap with the engine mount BID.. This is the reinforcement for the upper nose gear attach point. The heavy loads on this gear mounting are the reason for the generous number of layers. Green trim the surplus glass cloth overhanging the edge of the plywood parts or grind these edges to shape after curing.

IMPORTANT - Any remaining un bonded perimeter of the firewall and the lower fuselage section, should be taped with a two layer three inch wide BID tape. Reference enclosed figures on facing pages showing engine mount reinforcements

STATION 139.5 BULKHEAD

The mid tail cone bulkhead is located at station 139.5. This bulkhead is located at the joint between the fuselage top section and the right and left hand fin halves. This bulk head is cut from a section of the two ply prepreg panel that has the outline of this part drawn on the panel at the factory. Cut this part out carefully since the station 180.5 bulkhead is outlined in the center cut out from this part. Use a fine tooth saber saw blade or similar tool for this operation. The outline provided is on the generous side so some trimming or block sanding may be required to fit it to the two fuselage halves. Cut out



the center section containing the 180.5 bulkhead and set it aside for the next step. Carefully install and remove the fuselage top half for fitting these components.

The 139.5 station location is to the front face of this bulkhead panel. Remember that the station 0" reference is at the "joggle" where you lined up the firewall and reference these locations from that point. Test fit the bulkhead into the proper position, trimming as required for a good fitted joint, and prepare both the bulkhead surface and the inner fuselage surface or bonding. Mark the upper fuselage edge position (Waterline 0.0) on the bulkhead.

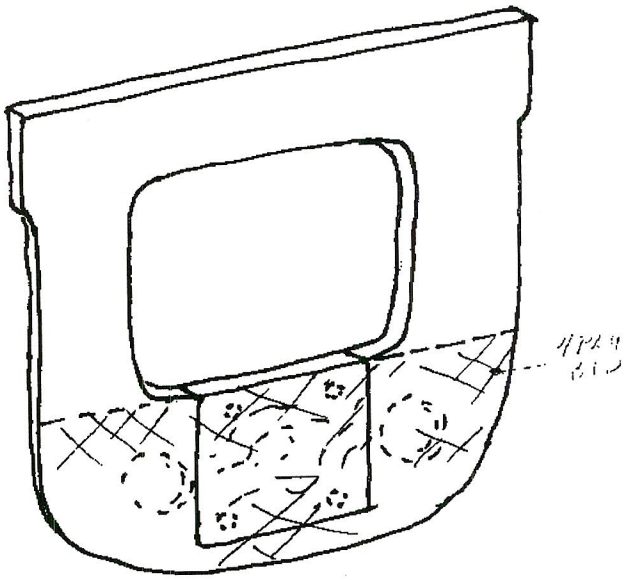
I nsert a plywood or phenolic “hard point” at least 1 inch square , on each side t at the belt line location as shown in the drawing Fit the bulkhead and align it carefully. Secure in place to the bottom fuselage half with some dabs of five minute epoxy. When it is secure enough to work with, bond it to the lower section with two layers of two inch BID tape on both front and back faces. In this location, . Reinforce both sides of the hard points with 2 inch wide BID tape for 4 plies at least 4 inches forward and aft along this beltline. stagger the length of the plies somewhat as shown in the sketch to taper the load distibution.. These are "hard points" for the shoulder harness for the rear seat passengers. As other places where there is an inside angle joint, fill the corner with a small radius MICRO/FLOX fillet and wet out the bonding areas with brushed on epoxy. Provide a uniform one inch overlap on each part.

STATION 180.5 BULKHEAD

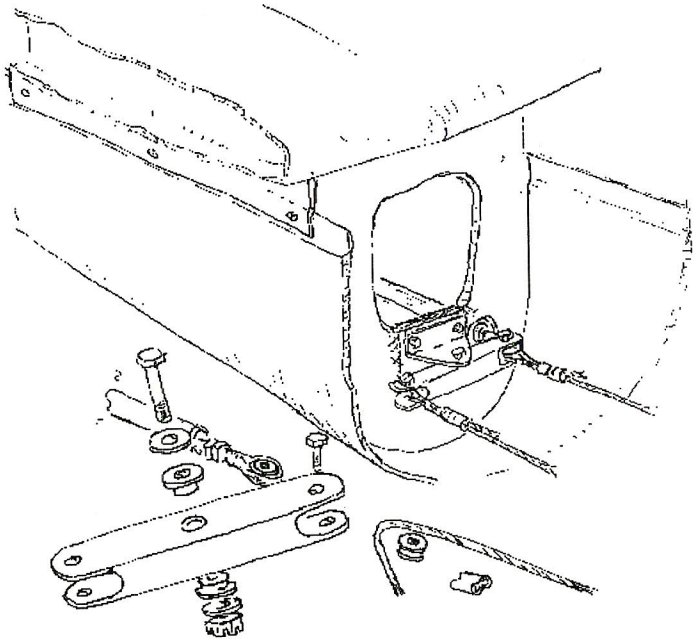
The aft tailcone bulkhead is located at station 180.5 . This bulkhead is located at the leading edge of the horizontal stabilizer. The bulkhead is cut from the premarked two ply prepreg panel (inside the opening of station 139.5 bulkhead). this part also should be cut out carefully with a fine tooth saw and located with the front face at station 180.5 . This also may need to be trimmed for proper fit and should then be tacked into place with five minute epoxy. This bulkhead will have to be removed temporarily during the installation of the horizontal stabilizer, so use a minimum amount of the five minute epoxy in "tacking" it into place..

180.5
139.5
41.0

This bulkhead will also require a hard point for mounting the rudder idler bell crank. Cut a 3 inch square of the 1/4 plywood, and cut away an equal size skin on the aft face of this bulkhead as shown in the figure. Inset the plywood with MICRO slurrey, and cover both sides with 4 plies of BID large enough for a full overlap around the patch and extending outwards to the edge of the bulkhead as shown in the sketch (this hard point supports the rudder idler which can have a high load applied at times by the pilot's feet). Mock up the idler assembly with the two KIS-3 brackets, and locate the mounting holes. Lightly "tack" this bulkhead into place at the stated location - it will be removed and permanently installed during the horizontal tail installation.



Second figure shows final location of this bulkhead and associated linkage.



MAIN SPAR AND OUTBOARD SPAR PRE ASSEMBLY

NOTE: IF THE SPAR SUB ASSEMBLIES HAVE NOT BEEN PREVIOUSLY PREPARED AT THIS TIME, REFERENCE THE WING ASSEMBLY SECTION AND COMPLETE THE REQUIRED SPAR SUB ASSEMBLY.

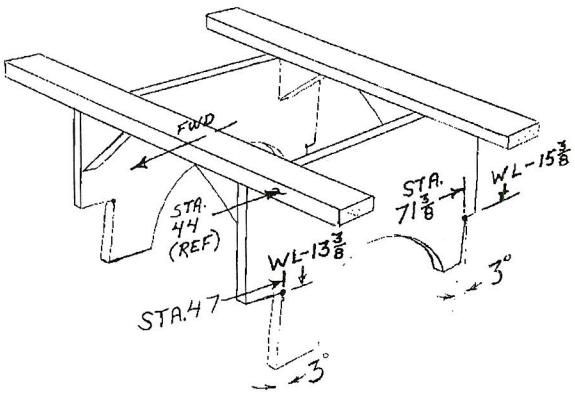
REAR SPAR

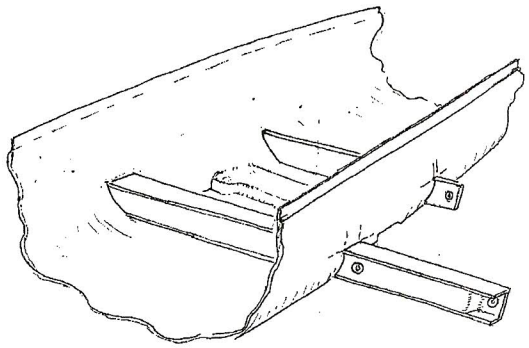
The rear spar is fabricated from a strip cut from the same 1/4 inch aircraft plywood as used for the firewall. Cut a strip 3 1/4 inches wide by 48 inches long. Apply a 6 ply BID on both faces of the plywood spar, holding the strip flat with no bend or twist during the resin cure. "Green trim" the edges, and grind any overhang flush with the edges when the resin cures.

MAIN SPAR LOCATION AND INSTALLATION

POSITIONING - The position of the main and rear spar cut outs is located either by using the spar locating jig shown in the attached figures, or by laying out lines in the fuselage using these same dimensions, or using the scribe lines on the exterior of the fuselage. The spar locating jig method has been used with good results by the builders of the two place KIS. Kits later than serial no. 7 have the critical layout lines scribed in the mold which transfers to the outside of the fuselage, and most of the following steps may BE Ignored..

If you intend to use the jig fabricate it from materials with good dimensional stability such as plywood or high density fiberboard. Cut out the two sides using the template drawing supplied. Cut carefully noting that the aligning surfaces are at three degrees to set the angle of incidence for the wing. Support the two panels from selected straight two by fours or similar boards about four feet long. Space the panels at least two feet apart (Test fit the potential jig parts to see how far you can space them apart. The wider these sides can be spaced without interference to the inside of the fuselage - the more accurate the final installation will be.) parallel to each other and at right angles to these top boards. Brace the panels as required to keep them straight and parallel.





Locate station 44 and carefully position the fixture, centered and square with the fuselage centerline(remember that a 1/8th inch error here can multiply to a couple of inches at the wing tips). Transfer the position of the spar from the jig to the fuselage wall, projecting the critical corner locations with a straight edge, out to the inner surface. Carefully cut away the marked area with a saber saw and a small grinding wheel for truing up the edges. The bottom edge of the cut out is on a steeply curved surface so cut in straight towards the center, to allow the spar section to be slipped into place. If using the jig the openings can be cut as much as 1/4 oversize to permit easy installation. SOME OVERSIZE IS REQUIRED FOR THE TOP EDGE OF THE HOLE TO PERMIT THE ANGLED SPAR TO BE INSTALLED.

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Another alternate method if you have an early un marked fuselage bottom, is to use layout dimensions in the figure below. These dimensions are taken over the outer contour of the surface, and the axial measurements are minimum length streamlines over the outer surface. You may also use these dimensions to double check either the jig method or the pre marked fuselage locations

If you have the available manpower and othe facilities required, some of the spar installation operations will be facilitated by having the fuselage inverted. However in this case, be very vigilant such that no twist nor other distortion is introduced This is especially true if any bonding operations are completed in this position.

If the fuselage is inverted, the following spar bonding operations may best be changed in order, doing the outside layups first. (tape may be used on the interior to prevent resin run through into the interior, and to back up the FLOX/MICRO fillets)

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Revision 2/1/98 1 of 1

4PFUS1S

PART OF REVISION 1 - FEB. 98 TO CLARIFY SPAR CUT OUT POSITIONING
INSERT AFTER PAGE 14 4PFUS1 DATED JUNE 18. 1997

4 PLACE SPAR CUT OUT LOCATIONS

The recommended position for spar cut outs in the fuselage is to use the scribe lines you will find on the fuselage outer surface. Some early fuselage moldings did not have these scribe lines, and they can be recreated by using the dimensions given below. These dimensions can also be used in a "belt and suspenders" fashion to assure that the proper scribe lines are used, and possibly make minor corrections. Previous reference dimensions used the upper cut edge of the fuselage sides as a locating plane, but these dimensions reference the molded in "joggle line as a more repeatable feature of the fuselage dimensions. Local portions of this line may be obscured by minor surface resin voids, but the position can be interpolated from adjacent sections. Dimensions given are "great circle type" wrapped on the surface of the part, and will be a bit longer than "station" or "waterline" measurements which are harder to make. For practical reasons these dimensions are rounded to the closest 1/8 inch, and may not "Trig" out to the stated angles. The "wrap" of the lower fuselage surface also enters into these measurements noticing that the apparent cut out heights are about 10 inches, where the heights of the respective spars are a bit over 5 inches for the main and 3 ¼ inches for the rear.

Dimensions are:

Primary position	main	upper rear corner	47 ¼ by 12 7/8
Incidence angle	main	lower rear corner	47 by 23 1/2
Front edge height	main	upper front corner	44 by 12 5/8
Spar width	main		3 ¼
Primary position	rear	upper front corner	71 5/8 by 14 1/8
Incidence angle	rear	lower front corner	71 ½ by 22 ½
Spar width (thickness)	rear		½

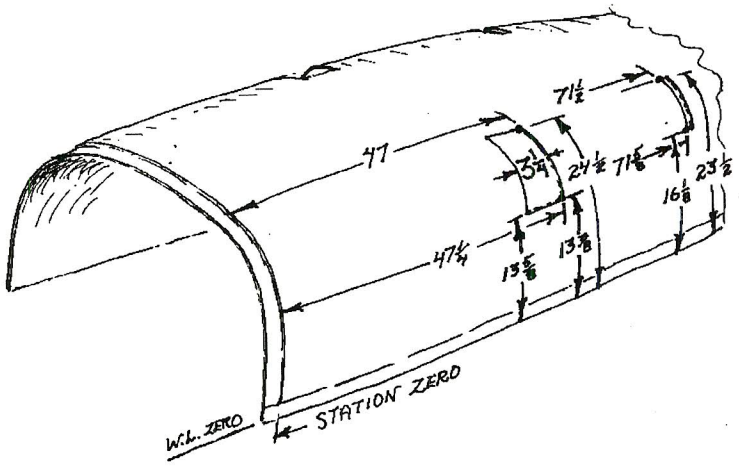
The actual placement of the wing is less critical than establishing that it be square and at the design value of 3 degrees incidence angle. Aircraft are amazingly insensitive to even large errors in many of these measurements as evidenced by the scissors wing research aircraft, and several deliberately non symmetric designs that have successfully flown without major problems. An important exception to this is the fact that the two sides must be at the same angle of incidence within a close tolerance or large roll moments may be induced.

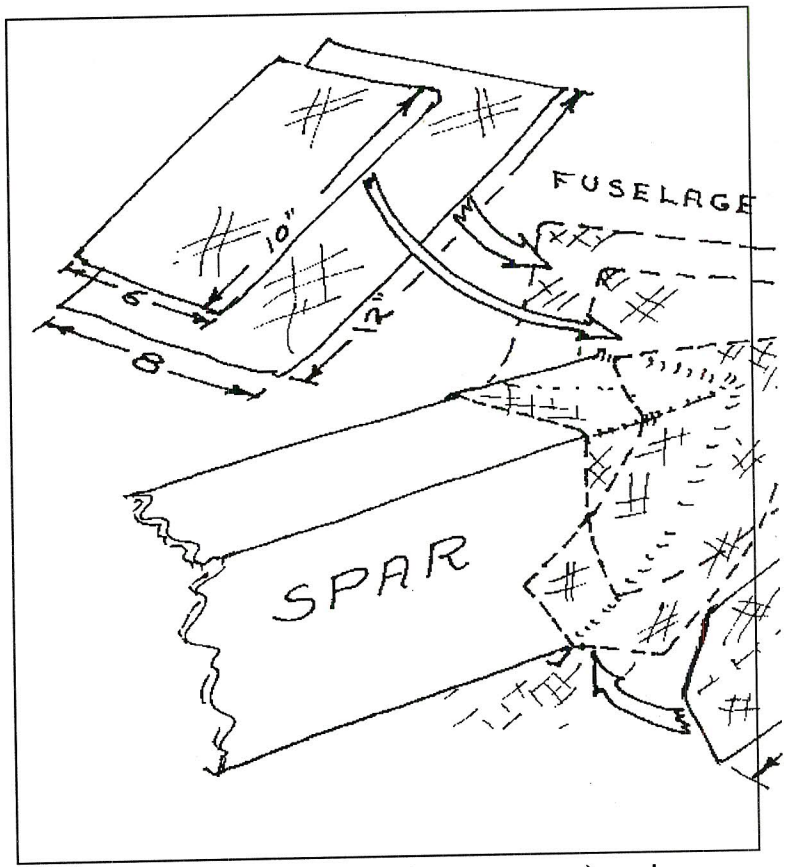
If you are using this layout method, or the scribed lines on the fuselage, make the main spar cut out oversize by cutting about 1/2 inch above the top line and about 1/8 inch forward of the front line. Install the spar through the oversize cut out , and recreate the upper edge of the hole by temporarily bonding a stick to each of the fuselage sides in the proper location and the proper angle for the upper surface of the spar (about 5 degrees). Drywall screws may also be used to secure this stick, as the resulting holes in the fuselage wall are easily filled in later finishing operations.

Using this temporary top edge, keep the upper rear corner , and the rear face of the main spar cut out "dead on" , and the other surfaces can be relieved for clearance. For the front (main) spar the reference points is the upper rear corner, and the aft edge of the cut out for control of the 3 degrees. The rear spar reference is the upper forward corner and the front face of this cut out for the 3 degree requirement.

For the main center spar, it is worth noting that the the spar flanges are not at right angles to the spar face, and about a 5 degree angle is required for the top cut out to permit the rear upper corner to index properly into position. Some of the earlier marked fuselages do not have sufficient relief angle on this top line. Using a system of elastic bungees and/or clamps, secure the spar sections in position (pulled into the upper rear corner for the main and upper front corner for the rear spar) and check for any error in positioning. Center carefully, and measure leveling and fore and aft dimensions from the firewall joggle (station 0.0) to the outer corners of the spar. Make minor cuts or shimming to “zero” in the positioning prior to bonding into place. Temporary “tack” bonding may assist in these operations.

If you are using the layout method, or the scribed lines on the fuselage, make the main spar cut out oversize by cutting about 1/2 inch above the top line and about 1/8 inch forward of the front line. Install the spar through the oversize cut out , and recreate the upper edge of the hole by temporarily bonding a stick to each of the fuselage sides in the proper location and the proper angle for the upper surface of the spar. Using this temporary top edge, keep the upper rear corner , and the two adjacent edges "dead on" , and the other surfaces can be relieved for clearance. For the front (main) spar the reference points is the upper rear corner, and the aft edge of the cut out for control of the 3 degrees. The rear spar reference is the upper forward corner and the front face of this cut out for the 3 degree requirement.





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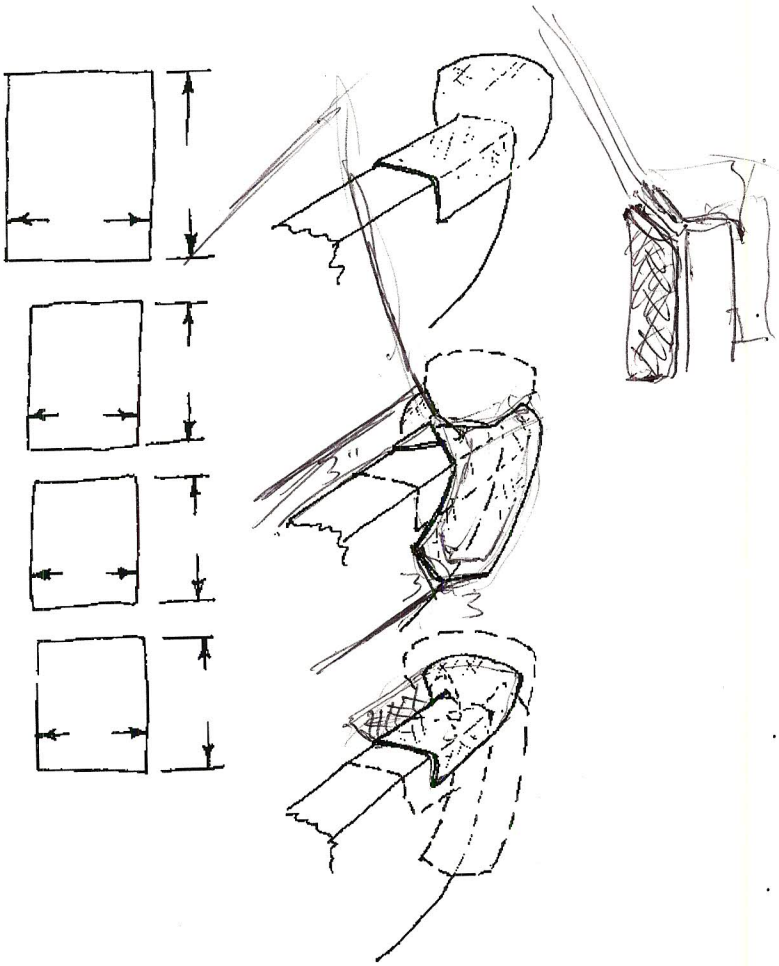
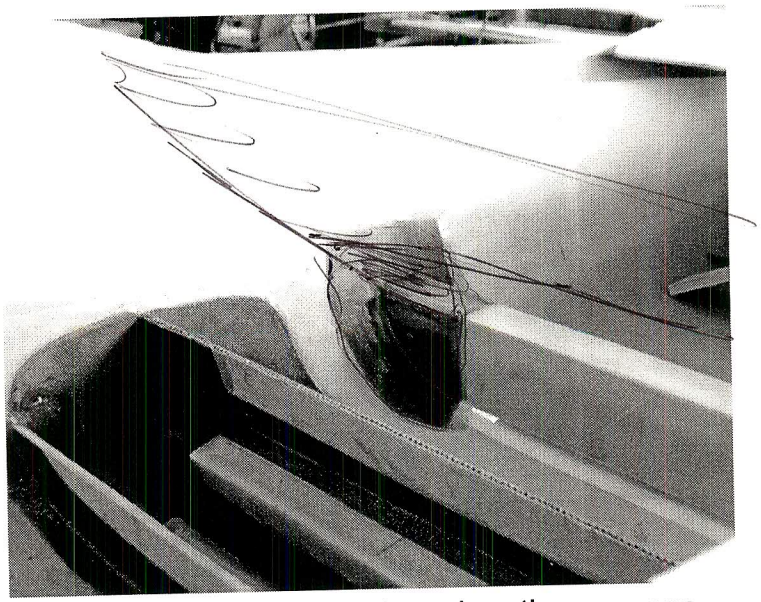


dimensions from both ends of the fuselage to assure "square " positioning. Use shims if required to average out all these measurements.

SPAR MOUNTING LAMINATIONS

Once you are satisfied with positioning, you can install the inner wet "Prelams" to mount the spar. Thoroughly clean and roughen all surfaces to be bonded with coarse sandpaper. Tape the outside of the fuselage to the spar surfaces to bridge the gap from the oversize cut out . Fillet all inside corners with dry FLOX where the laminations will be applied. Wet out these surfaces by brushing on a layer of epoxy.



For the main spar , prepare the BID wet layups on plastic sheet as described in the procedures chapter (Pre-lam's). Make dry glass cloth patterns to test the shape of the pre wetted BID patches. For each side of the fuselage, make a total of four, four layer "prelams" one of 8 by 12 inches,, another of 6 by 10 inches, and two more, also of 6 by 10 inches for the sides . Apply the largest pre lam cut out, (8 by 12), centered on top of the spar with 6 inches overlap up and the same overlap inboard on the spar cap (as shown below). Work the edges around the spar sides. Apply the side pre-lams on the front and back sides of the spar with about 1 and 1/2 inches

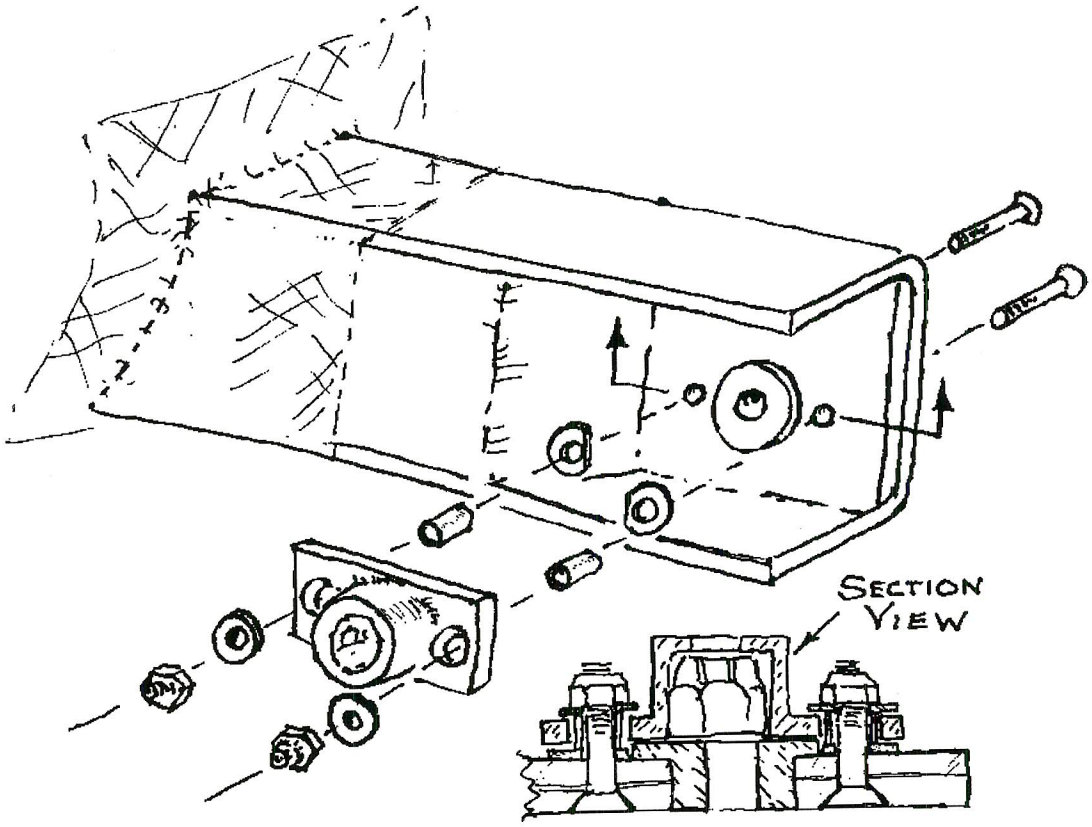
overlapping the top of the spar (see sketch) . Apply the remaining (6 by 10) four ply pre lam on the top of the spar and up the fuselage like the first pre lam, covering all the previous layers. This should result in a minimum of 8 plies across the top and 4 plies along each side, and at least 12 plies in the overlap areas of the top corners (much stronger than required). Allow all these inner layups to cure before removing any clamping or fixturing.

FILE - 4PFUS1AS - FOUR PLACE FUSELAGE ASSY SECTION 1A SUPPLEMENT - INSTALL SPAR BOLT CAPTURED NUTS

The sequence of this operation is not critical so long as it is accomplished before the wing is assembled.

Find the 2 captured nut assemblies for the main spar bolts among your parts. These are characterized as a hat shaped aluminum machined part with a 5/8 National fine thread, lock nut enclosed. These will be mounted to the outer stub spar ends to allow the installation of the outer spar mounting bolt, when this spar end is inaccessible inside the wing assembly.

Use one of the spar bolts as an assembly aid, inserting it through the outer bushing with the threaded end facing forward. Loosely thread the captured nut on the end of the bolt (during all temporary assembly procedures, do not engage the locking portion of the nut - either just partially insert it, or if you desire to temporarily tighten the assembly use a stack of washers under the head of the bolt - this will reduce wear on the locking section to assure that you do not use up the allowable re-use limits, and have to replace either this nut or the bolt) . Align the aluminum housing roughly parallel with the spar transverse centerline, and drill two pilot holes (about 1/8 inch diameter) outside the flange of the bushing, roughly on this centerline.

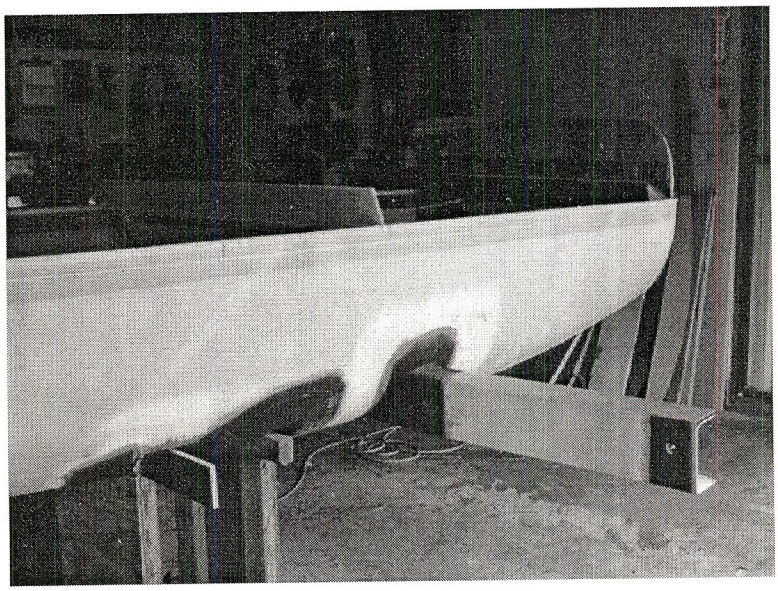


You could just rigidly mount the nut assembly in its position with flat head machine screws, or rivets, but it is strongly suggested that you set it up with just a bit of float. This can be accomplished by enlarging the holes in the aluminum flanges, and using a tubing spacer and washers to retain the nut assembly with a bit of loose float (see sketch). The washers next to the flange of the bushing may have to be trimmed to allow the mounting holes to be positioned properly. Number 10 size flat head, machine screws are suggested, and 1/4 inch steel brake tubing will work quite well.

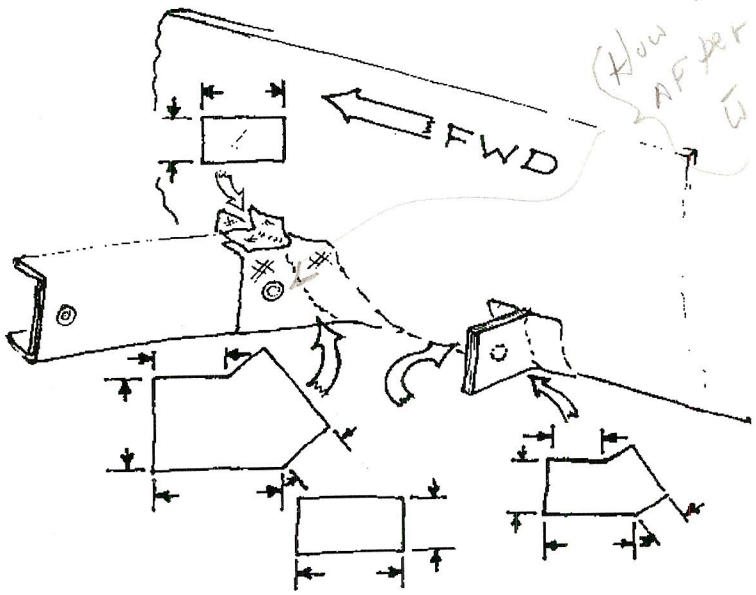
Follow the same basic procedure for the rear spar, using either the jig, or the dimensional layout procedure. Also clamp and use elastic straps to position the spar, and check dimensional integrity and square and level from as many reference points as practical. Shim if required, and tape the outer fuselage so you can apply the dry FLOX fillets.

The inner laminates for the rear spar section are 4 by 6 1/2 inch rectangles of four ply BID with the long edge set flush with the spar top edge. The rectangle will splay out when fitted into the corner and provide the desired overlap

pattern on the inner surface of the fuselage. The outer laminate should be precut to the pattern shown in the figure , also with 4 plies per each pattern a total of four places . Cut out a dry pattern and test assemble the lamination to refine the pattern for optimum fit.



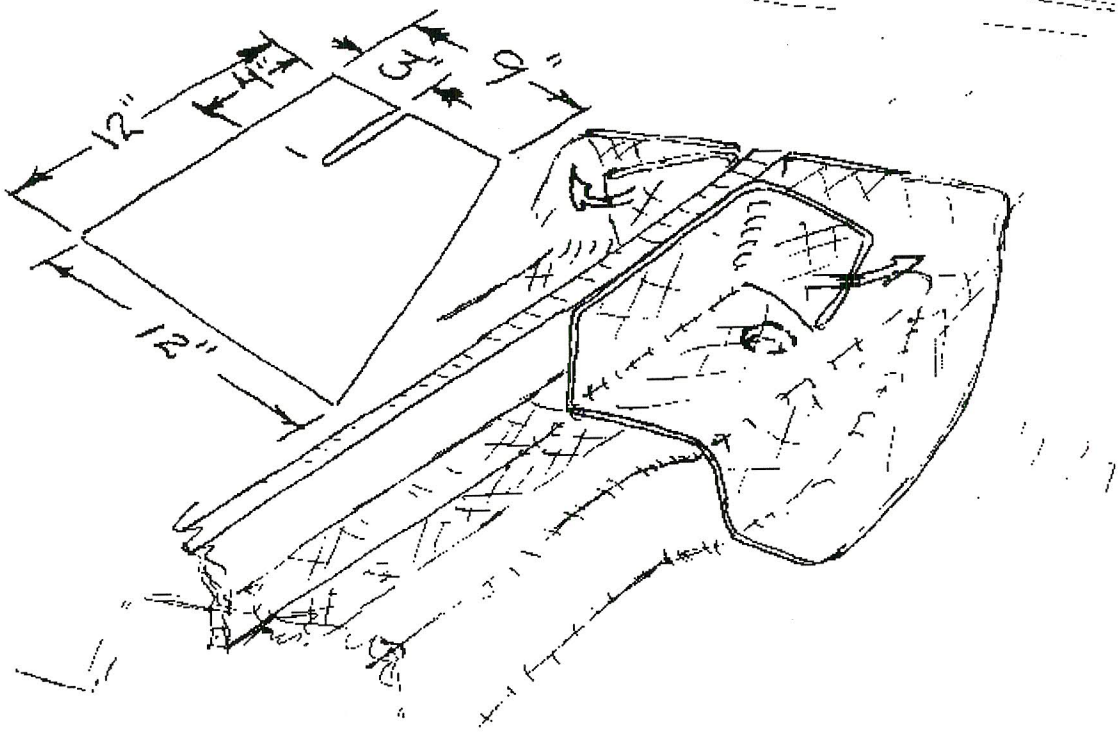
The figure above shows the basic concept of the outer prelam layups for both the main and rear spars. As stated previously, make up dry glass patterns of each of the layups, and confirm fit and get some feel for the placement when the prelams are wet. The main spar side layers , 8 plies each side, are added first, making sure that the rear face main spar patterns extend 2 inches past the butt line 22 mounting bolt areas. The right number of plies must be used in these spar clamping areas to assure that the wing will be installed in the proper position. It may be a good idea to sketch out the boundaries of the wing fillet to be sure that non of these layers will end up outside the covered area.

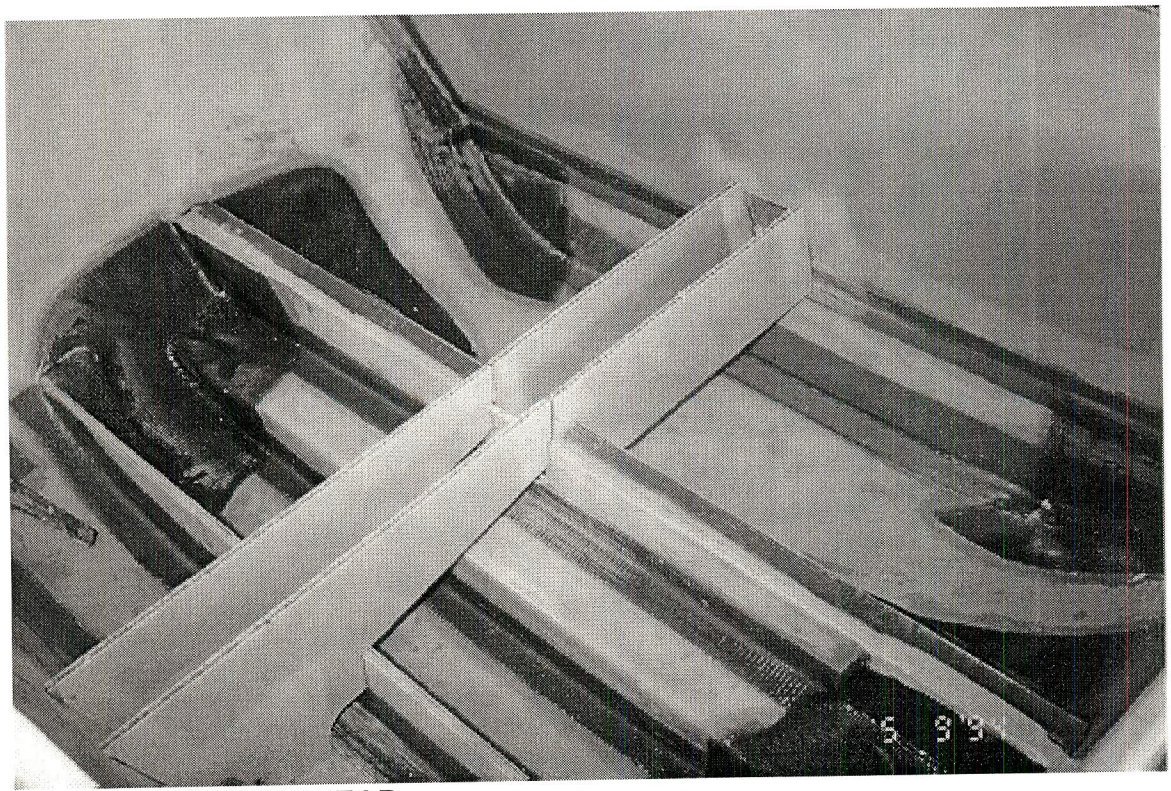


MAIN GEAR BOX REINFORCEMENT

Install the rear seat forward bulkhead from the premarked panel supplied. The primary reinforcement of the landing gear "box" area is the multiple layers of BID applied in the high load areas . These are integrated into the rear seat front bulkhead which is bonded to the center of the main gear box with 2 inch 2 ply BID tape on each side. Apply 10 layers (two sets of 5 ply) in the area for the gear mounting bolts, overlapping up the sides of the fuselage wall and the faces of the seat bulkhead as shown

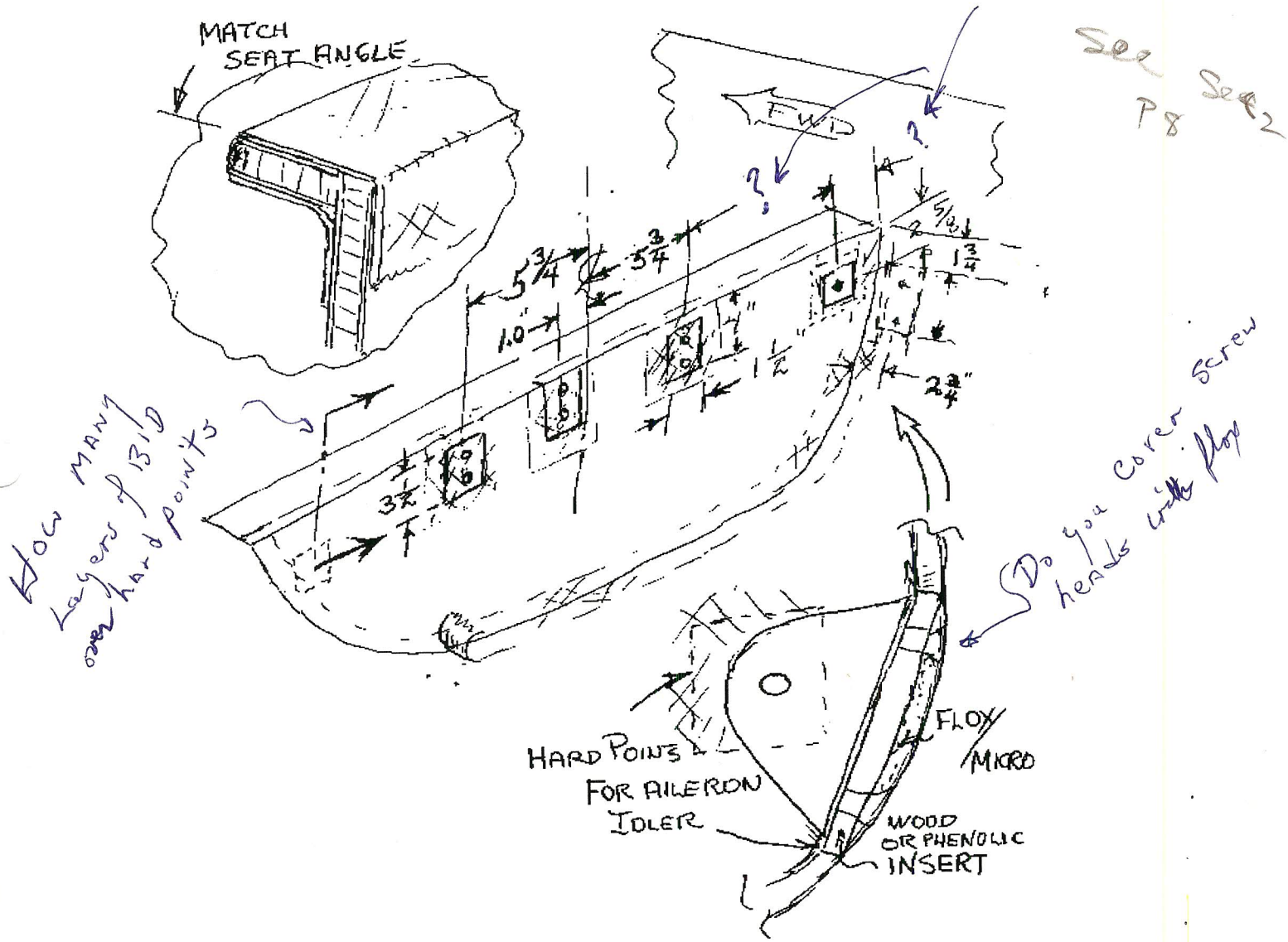
on the figure. Stagger the overlaps of these two sets of plies slightly to taper the edges. Radius all inside corners with dry MICRO before laminating.





SEAT FRONT BULKHEAD

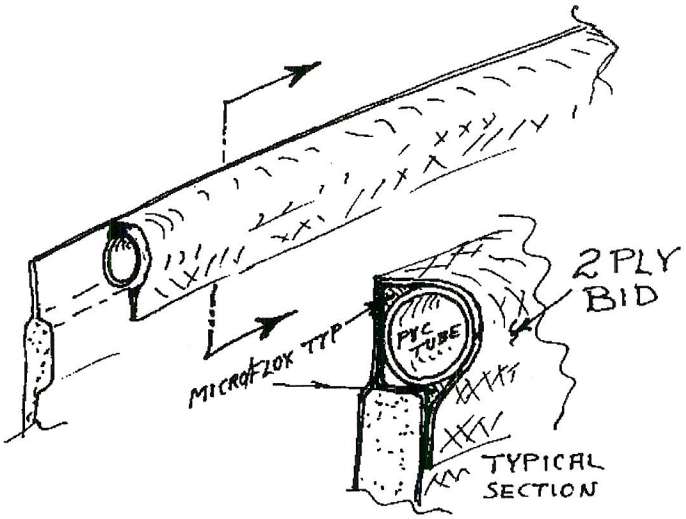
Cut the front seat forward bulkhead from the supplied flat panel material, cutting to the outline provided. Review the sketch below and locate and install hard pints for the control linkages. This is easiest to do with the part laid flat on the bench, although later installation is possible. Initial instructions called for the location of this panel at station 31. This is OK, but installation one inch further forward at station 30 will allow extra seat room and better stick clearance. Bond in place with 2 ply BID on both sides at the selected station.



Establish a line from the seat rear bottom (the top front edge of the center main spar) across this bulkhead to establish the angle for stiffening flange on the forward edge of this bulkhead. Make a 2 inches wide flange of a section of prepreg panel for the front of the seat panel to sit upon, and bond it in place with 2 plies of BID tape.

FUSELAGE BELTLINE CONDUITS

Two sections of plastic tubing shall be bonded to the fuselage in the "beltline" area providing a conduit for antenna coax and electric lines. This also provides added stiffness along the edge of the cockpit opening. The actual length and position of this tube is non critical. However, we suggest for appearance and function that it start out of sight forward of the instrument panel location, and extend beyond the baggage back cover Use the supplied PVC tubing and tack in place from approximately station 24 to about station 95 with dabs of 5 minute epoxy. When the tubing is secured in the desired location, fill in the edges on each side of the tube with dry MICRO paste and overlay with 4 ply BID tape full length. Allow a generous overlap in the bonding areas, 1 inch if possible. Green trim any overhanging BID in areas where it might interfere with mounting the top skin. Review sketch for approximate location of tubing and bonding BID. This tubing should be installed before any other structural bonding will limit access to this location. Check the tubing to ensure that it has not become blocked with any resins, and clean out if required,



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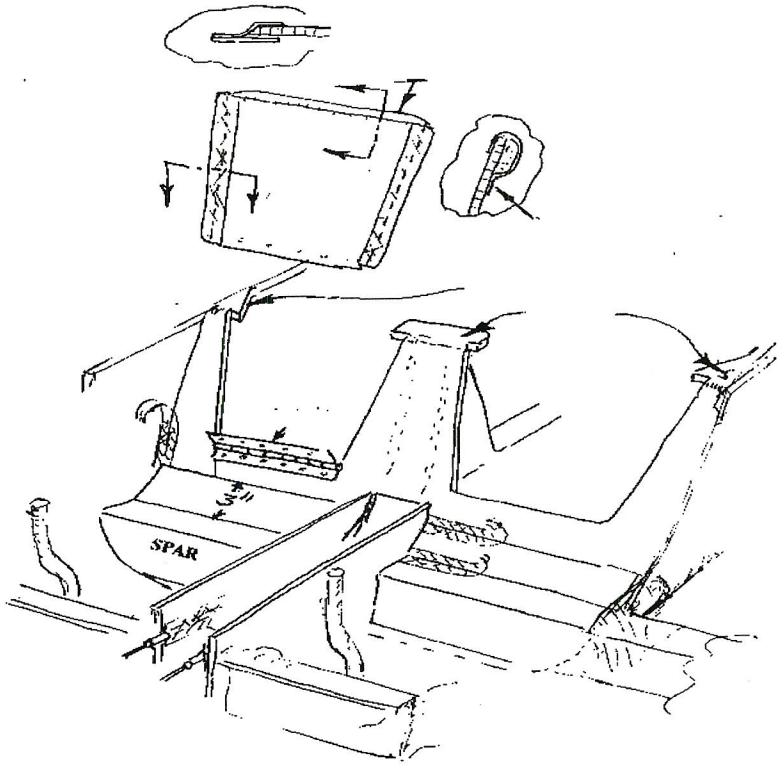
28 1/2
71 1/4

FRONT SEAT BACK ASSEMBLY.



The lower end of the back of the front seat assembly is mounted roughly two inches back from the rear edge of the center section of the main spar. Consult the attached figure for the correct technique. First cut a 3 inch wide strip of the standard panel and bond it on the back edge of the center main spar at about a 45 degree angle upward. Tie this section to the main spar center section with a 2 inch wide 2 ply pre wetted BID strip. The front seat back will be installed to the back edge of this strip, and angled back to where the seat back joins the upper side rail at station 55. Cut the seat pack panel to fit from the proper section of standard honeycomb panel and fit it into position . Tack into place with dabs of quick curing epoxy micro paste. Bond the lower edge to the 3 inch wide angled section bonded to the center main spar with two ply 2 inch wide wetted BID on each side. Likewise bond the seat edges to the fuselage inner wall with 2 inch wide BID both sides.

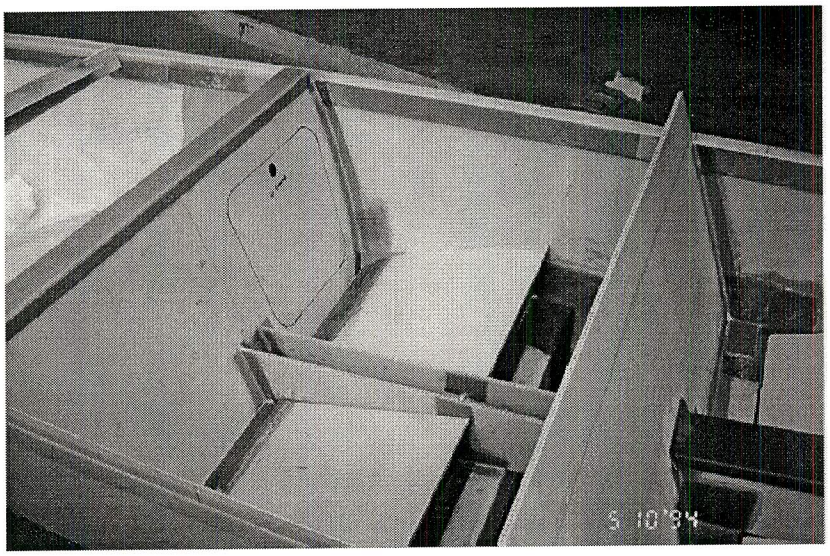
It is optional but recommended that this seat back have cut out panels to permit a section of the seat to move forward for loading back seat passengers.. A continuous panel would be lighter and more rigid, but access to the rear seat would be limited. The sketch shows how this was accomplished for the prototype, and similar procedures should be used to preserve fuselage rigidity.

Cut the panels away to the configuration shown on the sketch, and fill the raw edges of the honeycomb panel with a dry MICRO paste. To replace some of the stiffness lost by these cutouts bond 2 inch wide 4 ply tape to both sides of the seat back along the outer "cut out" edge, running down to the spar edge.

Use clear tape to secure the panels back in place, and to provide a "parting" surface for the flanges which will be added to seat and panels.. The flanges shall be a minimum of 3 plies thick with about 1/2 inch overlap to prevent the seat panel from swinging back under seating load The top edge of the seats

shall be stiffened with some carved foam, overlaid with prewetted BID. The load bearing points of top edge of the seat back shall be reinforced with a gusset of plywood covered with at least 3 layers BID both sides, to keep the backs supported under heavy seating loads. The center section shall be reinforced with a similar section of plywood with BID on both surfaces (see sketch). With the stop flanges on both sides of the folding seat backs, fasten the folding seat backs at the bottom with a strip of locally procured hinge on each panel using #8-32 flat head screws

BACK SEAT BACK INSTALLATION

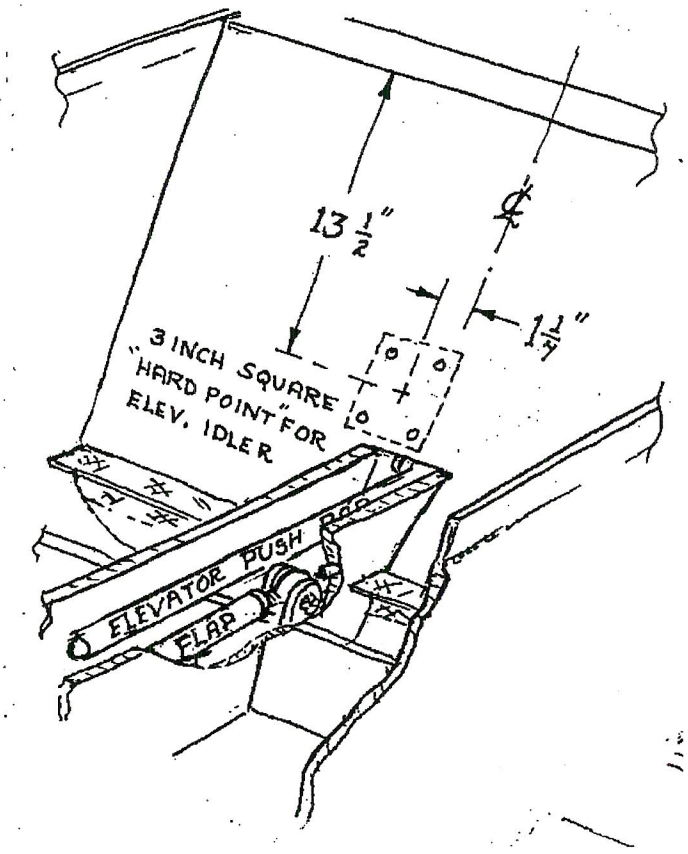


Cut the back seat, seat back panel from the panel material furnished in the kit using the proper pattern, and install it in position behind the rear spar center section. Add reinforcement for the elevator idler bracket in the location shown on the drawing. Use 1/4 inch plywood, cutting away one surface of the panel and inserting the wood section. Close out with a four layer BID patch with at least a one inch overlap around the perimeter of the patch.. Install this seat back panel with the bottom edge at station 78 and the top edge at sta. 86. "Tack" the seat back in place with 5-minute epoxy, and verify the location while the epoxy cures.

← Just one side?

Hinged seat back stiffener?

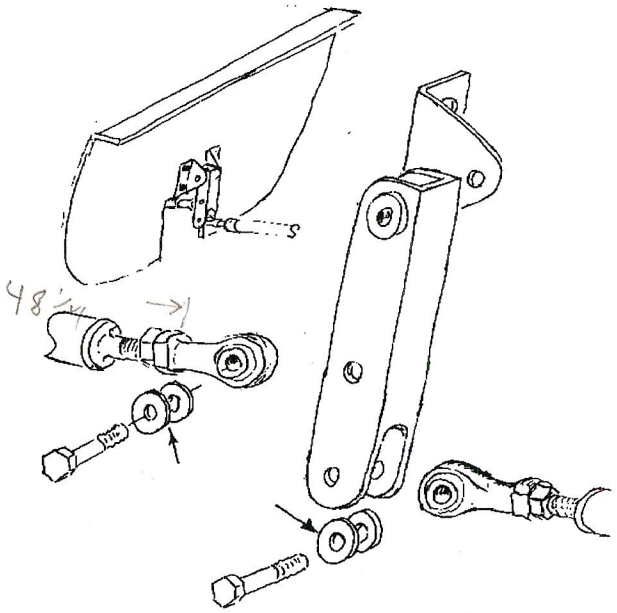
When the position has been established to your satisfaction, insert a 1 1/2 inch square hard point on each side in front of and near the bottom of the seat back on the outside fuselage skin, for the rear seat lap belt attach points. Bond the seat back assembly in place with 3 inch wide 2 ply BID. (see figure), and apply 4 ply BID on the outside with at least a 1 inch extra overlap over the seat belt hard point . Cut a 3 inch wide strip of the same pre preg panel as used for the seat back, and install it to stiffen the upper edge of the seat back (see picture). Use 2 inch wide 2 ply BID tape around the perimeter on both sides of both parts for joining between parts and to the fuselage inner wall. The final bonding of the top surface must be delayed until the fuselage top is attached, since these plies will overlap onto that assembly.

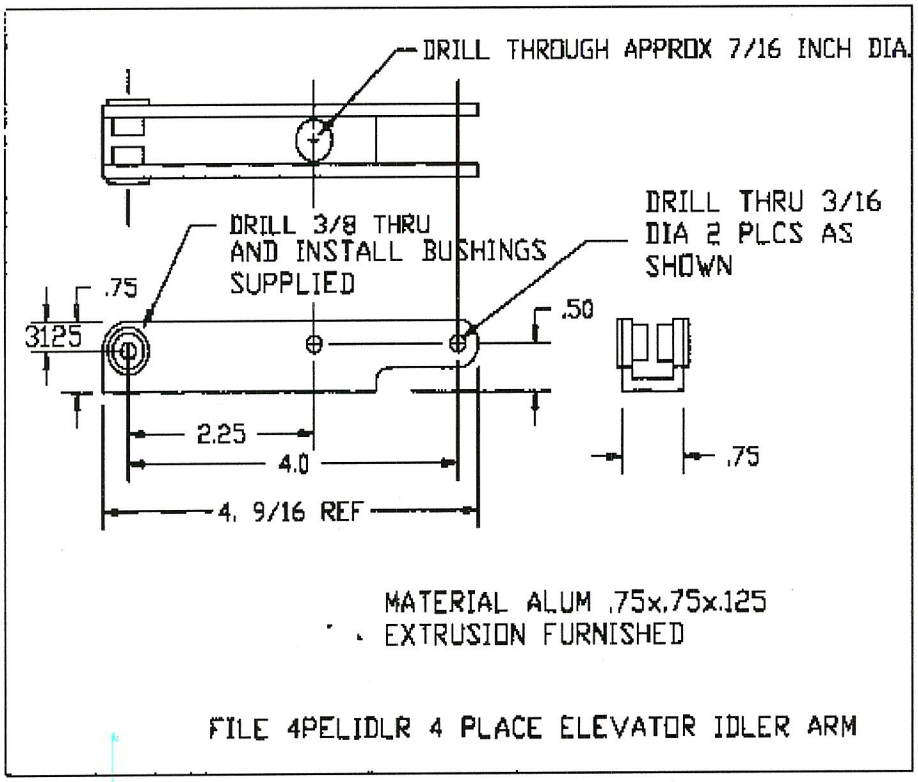


Make up a roughly 1 inch wide angle of 4 ply BID to serve as the rear support for the removable seat bottom panels. Lay out a straight line from the seat forward edge, over the rear spar, to establish the height for attachment of this angle to the seat back, and bond the prefabricated angle into position onto the seat back front surface

ELEVATOR IDLER BELL CRANK

The desired routing of the elevator push-pull rod, and the rather extreme length of this rod assembly suggests the value of a two piece push-pull rod assembly, with an idler bellcrank located behind the seat assembly . This idler assembly will stabilize the long push-pull rod, and allow the path to be broken into two sections with a good stabilizing point near mid span. This idler bellcrank also establishes the desired ratio of elevator travel relative to stick travel. The bell crank slightly amplifies the travel by setting the shorter leg of the idler on the forward side hooking into the stick push rod. The longer, aft arm of the linkage hooks to the push rod leading to the elevator control arm. The kit supplies high quality rod ends for these joints to minimize friction and end play in the linkage .





Use the attached figure as a guide, and fabricate the elevator idler lever from a piece of the furnished aluminum "U" section. Use the rod ends from the push rods to establish the number of washers to provide a good fit in the channel sections . Insert the bushings in the pivot end of the idler lever, and use the assembly, with the mounting angles (part KS-3) to aid in drilling the mounting holes (4) for this assembly. Countersink these holes from the forward surface of the rear seat back and install the assembly using the 4 flat head #10 - 32 screws supplied (MS24694-S56). (See figure as guide for these operations.). Four countersunk washers (A315-017-24A) are also supplied for the flat head bolts selected for the idler mounting area to minimize "fretting erosion" of the composite material.

An alternate location is possible with the idler pivoted from a hard point added to the floor. This may be required if hinging the rear seat back is planned. Check with the factory for further advice and details if this location is selected.

SEAT BOTTOM ASSEMBLY

The seat bottom can be tailored to individual requirements, but the enclosed instructions describe the method which has worked well on the factory airplane. The seat panels should be fabricated from the 1/4 inch standard panel material supplied, or any other similar core material desired.

FRONT - The front seat bottom panel position is established as a straight line between the top edge of the panel which forms the front of the seat "box", back to the top surface of the center main spar. The left and right seat bottom panels will be separated by the control tunnel between the two front seats, Draw the line on the outer faces of this tunnel, and the fuselage inner walls, and add seat support in the form of "glass" angles formed from about 3 layers of prelam tape.

Make the seat bottom core section a little oversize, and trim to fit. Cut through one skin of the panel in two places. one place about 3 inches forward of the aft line so this part of the seat can set flat on the spar, and again along the edge of the forward support panel so the seat can be bent flat under the passenger knees. Reinforce with one ply BID overall on each surface and an extra ply of BID tape at the bends.. Cut a generous opening to allow full control stick travel, and dress the edges of the opening with FLOX. Trim the edges of the panel to fit closely into place against the tunnel sides in the center, and the curved fuselage sides on the outer edges, to keep it from shifting position in use. It is desirable to hinge these seat bottom panels at the rear edge to provide access to the control mechanism, and to provide storage space beneath the seat . Reference the enclosed figure to clarify any questions.

REAR SEATS - The rear seat bottom placement is also somewhat controlled by the height of the panel installed for the seat front (on top of the gear "box"), and the location of the "glass" angle mounted to the seat back. The location of this seat bottom panel is rather non critical since there is a surplus of head room in the rear seating position. A higher seat bottom will provide more storage space beneath the seat, and also provide better visibility over the pilot and front seat passenger. The fabrication of this panel should closely follow the procedure used for the front seat, With a higher seat placement, a bench configuration could be used in the back seat as long as adequate seat belt provisions are supplied, and total back seat loading does not exceed 340 lbs.