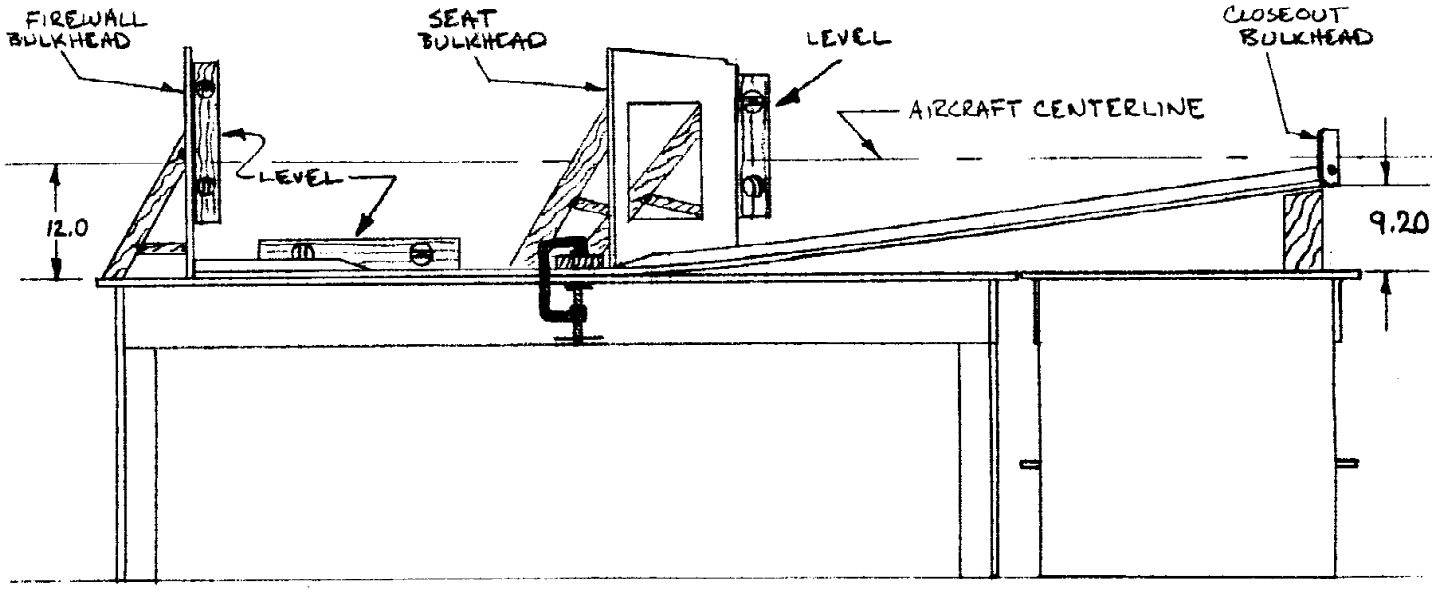
Side Panel and Bulkhead Assembly

The assembly of the side panels and the bulkheads determines the basic shape of the fuselage. It will pay off to take a bit of extra care in fit checking and aligning the sides and bulkheads before bonding them together. Any foul-ups made in alignment here will haunt you throughout the rest of construction. Strangely enough, the fuselage structure is beefy by nature of its geometry and is consequently more tolerant of laminating defects and mismatch of components than are the wings or tail.

So let's press on. Try to shim your work table's surface flat within 1/16 inch over 36 inches length. Don't panic over local defects just the general trend. Obliterate any epoxy blobs, spills, micro dabs or other local high spots on the table's surface with your sanding disc.

Lay out one side panel on the table(s) with the top edge very slightly overhanging the edge of the table its full length (1/2 inch at most) cut a chunk of 1 x 4 or 2 x 4 lumber that will bridge across the inside glass surface along F.S. 69 (42.5 in aft of the front edge) to the far table edge. Use shims and clamp the long board across the side panel to the table keeping F.S. 69 flat against the table top.

Fit the seat bulkhead into position as marked on the side panel and 5 min/micro bond masonite or other wooden props to the bulkhead to keep it positioned at 90° to the side panel. Note: The fit of the side panel to the bulkhead edge is not critical at all. Local gaps of 1/8 inch are acceptable but the bulkhead should contact the side panel well at top and bottom edges.



5 min/micro board supports to the firewall bulkhead and position it with its edge on the table butted against the front end of the side panel. Use foam scraps to fixture the tail closeout bulkhead in position. A 24 inch framing square can be used to set the aft bulkhead 90° to the table (assuming that it is level with the forward end of the side panel). At this stage the props are bonded to the bulkheads but not to the table or side panels. You will be faced with removing the props, later on, without damaging the bulkheads or fuselage sides so plan accordingly. Notice that the jigging arrangement shown above establishes the aircraft centerline reference 12 inches above the table top. If your work table is level (both ways) you can make a quick accurate check for twist in the assembly by using a carpenter's bubble level on the vertical edges

(top and bottom) of the bulkheads. When everything is in proper alignment the top and bottom edges of both the firewall bulkhead and the seat bulkhead will be level as well as the side panel. You should check the bulkhead top and bottom edges with the level on the forward and aft edges of the bulkhead (as shown above) and with the level on the bottom face and top face of the same corner. Check the alignment of the three bulkhead's B.L.O. reference lines to be sure the seat back isn't higher than it should be above the table top.

Once you have everything set properly you can make a quick over all check by gently resting the other fuselage side on top of your bulkheads for an eyeball of the soon to be permanent assembly. Get a quick look to see if anything outrageous jumps out at you then put the second side panel away. You self confident types can skip this operation, it just gives us error prone guys a second chance to save ourselves.

Remove the peel ply from the rear side of the firewall, both sides of the seat, and forward face of the closeout bulkhead where the adjoin the fixtured fuselage side panel. Remove the corresponding peel ply from the side panel. Prepare a small flox corner at the front edge of the side panel where it butts up to the firewall. Prepare small flox corners along the front and back glass skins of the seat bulkhead where it butts against the side panel. Prepare a small flox corner at the rear end of the side panel where it butts against the closeout bulkhead. Go cut four 30 inch lengths, and two 24 inch lengths of 0-90^{0} BID tape 2 inches wide. Six 2 x 2 peel ply patches will save a modest amount of sanding later on, but they are optional.

Mix flox and stuff all of the prepared corners slightly over full. Paint a coat of epoxy on the mating surfaces (restrain yourself, don't slop it all over) and squish (squash, plop, etc.) the bulkheads into position. About this time, you'll start cussing because you didn't slip a sheet of wax paper under the front end of the side panel to keep the flox from bonding it to the table. Now lay up a two ply BID tape in the corners formed by the firewall and seat with the side panel. Peel ply the corners at the top and bottom edges or plan on sanding them for bonding later. Knife trim and cure. A quick, last second alignment check is probably a waste of time, but . . .

After the flox has cured at least 12 hours you can carve away the foam fixture block at the side panel to aft bulkhead corner and lay up a two ply BID corner tape (2 pieces 2 inches wide x 8 long 0-90^{0} BID). (If the obvious didn't occur to you, these 2 inch wide tapes should lap onto both the side and bulkhead equally). Resist the urge to take the side panel and bulkheads out of the jig until the second side panel has been bonded in place.

Fit the other side panel into position on top of the bulkheads just bonded. Put a straight 2 x 4 or 1 x 4 board on top that is aligned on F.S. 69. Tie the top board to the board clamped against the table with safety wire so that the upper (bare foam) surface of the side panel is parallel to the table top. Drill a few #40 holes through the firewall's upper edge and nail through the holes into the side panel foam core to hold the edges in alignment. Spring the upper side panel's aft edge down to align with the closeout bulkhead. If much force is required to position the aft edge of the side panel, you will probably need to use weights or boards and 5 min dabs to keep the side panel forward of F.S. 69 flat. Check alignment again and do your best to avoid a skewed fuselage side. When ready, prepare flox corners as before, remove peel ply, cut 0-90^{0} BID tapes (2 each 8 inches, 2 each 24 inches, and 4 each 30 inches long), and bond.

Cure 24 hours before removing from the table. When you handle the newly assembled fuselage treat it kindly. The outside foam surfaces are easily banged up. Next set the fuselage assembly right side up on the work bench, wake Mom and the kids up, get your camera ready, carefully climb inside and get your grinning-idiot-sits in-blue-box photograph. Send a copy to Jack Cox at F.A.A. headquarters with a progress report for Sport Aviation magazine. Get out of your new fuselage carefully and stay out until the outside has been glassed.

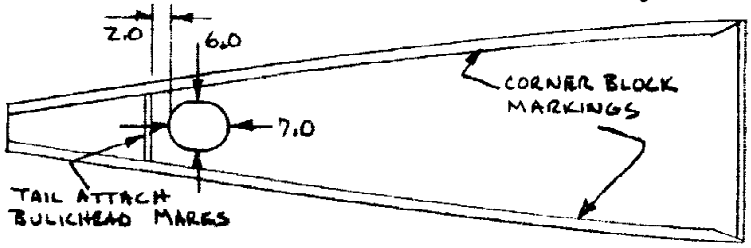
Drag out your completed vertical stabilizer and your tail attach bulkhead. Slip the bulkhead into position in the fuselage assembly (file to fit if necessary). Clamp the rear spar of the stabilizer to the closeout bulkhead (front side of spar to aft side of bulkhead). The end of the rear spar extension should be 1.3 inches up from the bottom edge of the bulkhead. The spar should be centered up on the B.L.O. reference mark. Slip the tail attach bulkhead in behind the front spar, center the spar up on the B.L.O. marks and clamp together.This exercise provides a custom fit between the stabilizer spars and the bulkheads. Back off and sight the stabilizer in relative to the fuselage. If something looks wierd, try and find out why before bonding the front bulkhead in place. Route out foam from the bulkhead sides for flox bonding the edges to the fuselage.

Remove peel ply from the joint areas, flox bond to the sides then lay up 2 ply BID corner tapes in all four corners (8 each 2 x 16 inch 0-90^0 BID tape). Knife trim and cure.

Aft Bottom Panel

Turn your fuselage upside down on two low saw horses or blocks so it is supported along the top edge (W.L. 24). Round up a piece of 1/2 inch thick blue foam (Dow I.B. styrofoam) 24 inches by 78 inches. Lay the 1/2 inch foam over the bottom of the tailcone from the closeout bulkhead to one inch forward of the seat bulkhead. Wegiht the foam core material down against the side panel edges so the foam conforms to the curvature. Mark the foam all along the seat bulkhead front edge and the side panel outside edges all around with a bold watercolor marker. Crawl underneath the fuselage and mark the foam along the corner block edges, tail attach bulkhead edges and seat bulkhead edges. Remove the foam from the fuselage and lay it out, marked side up, on your work bench. Use your trim knife to cut the bottom panel foam core out of the 24 x 78 blank. Cut the foam 1/2 inch inside the outside (foam edge) edge markings. This cut need not be terribly precise, most of the corner material will be sanded away in the carving of the corners later on.

Cut an oval shaped hole in the foam panel as shown in the sketch. Sand the edges of the hole to provide a smooth transition from the inside foam surface to the table at the bottom of the hole. Cut a piece of cardboard large enough to cover the hole, cover the cardboard with tape and wax with automobile paste wax. Let the wax dry then tape the protected cardboard securely over the outside of the hole.



Lay masking tape along the edges of the foam about 1/2 inch outboard of the corner block line you marked on the foam. Cut two 50 inch long 37 wide (full width) pieces of 0^{o} UNI and one 12 x 12 piece of 45^{o} BID. Cut pieces of 2 inch wide peel ply to cover the edges of the panel, bulkhead joint areas and one oval patch for the hole. Lay up over the foam with two crossing plies of UNI which are 45 degrees to the center line and add the 45^{o} BID patch over the hole. It requires three butt joints in each UNI ply to get the maximum use of your cloth. The edges of the cloth should be scissor trimmed about 1/4 inch shy of the tape edge (that's halfway between the tape and the corner block line) not allowed to overlap. Peel ply the edges and bulkhead joint areas. Scissor trim the rear edge which mates to the closure bulkhead shy of the foam edge and keep the peel ply with the edge. Let the lay up cure for about 2 hours only while you tape saran wrap over the bottom edges of the fuselage assembly where it contacts the panel just layed up. After 2 hours, carefully remove the masking tape from the bottom panel, place it on the fuselage assembly, weight in position and allow to cure! Knife trim only along the leading edge of the seat bulkhead.

After an over night cure, remove the bottom panel. Prepare a small flox corner all along the sides of the fuselage where it mates to the bottom panel and along the bottom of the tail attach bulkhead. Remove any peel ply from the mating edges of bulkheads, side panels, and the bottom panel. Over fill the corners slightly with flox, stack a bead of flox along the bottom edge of the seat bulkhead and plop the bottom panel into position permanently. Weight the edges of the panel in position. Crawl under the fuselage assembly and clean any squeeze-out off of the inside surfaces. Cure.

After curing flip the assembly right side up and lay up a 2 ply $0\text{-}90^{o}$ BID tape in each corner (sides to bottom and bulkheads to bottom). This operation requires about 11.5 yards of the BID tape. Cut the center 5 x 6 out of the 6 x 7 inch hole area leaving a 1/2 inch glass lip all around the edges of the hole.