

CHAPTER 18

CANOPY

OVERVIEW: You have finished most of your airframe now,

Hang in there for one more chapter; your long wouldn't be a very good open cockpit airplane anyway. In this chapter, you have to trim the canopy's edges, make a composite sandwich frame, fit the hinges, latches, locks, and cockpit vent. An excellent quality, formed plexiglass canopy is available through RAF. It is free blown into a 3-dimensional frame to match the fuselage contours while maintaining excellent optical quality. The following prefabricated canopy actuating components are available from a distributor: C1-L handle, C2 arms (2 required), C3 lugs (2 required), C4 block, C5 rods (2 required), and C6 tubes (2 required), CS13(2) SC1 catch, AND C21 HANDLE.

STEP 1

TRIMMING THE PLEXIGLASS

This step should take about one to two hours. Your canopy comes crated to protect it from scratches during shipment. No protective coating is applied, so you can inspect your canopy on receipt. We suggest that you protect your canopy from scratches by spraying or brushing on a "peel coat" or by taping paper or plastic over it for protection while you are building the frame and while you paint the aircraft. Leave this peel coat in place except where the instructions call for its removal. When your canopy is complete and the airplane is painted, this coating will peel off easily, if

IT IS PAINTED ON THICK. IF your peel coat appears thin, PAINT ON AT LEAST 4 coats.

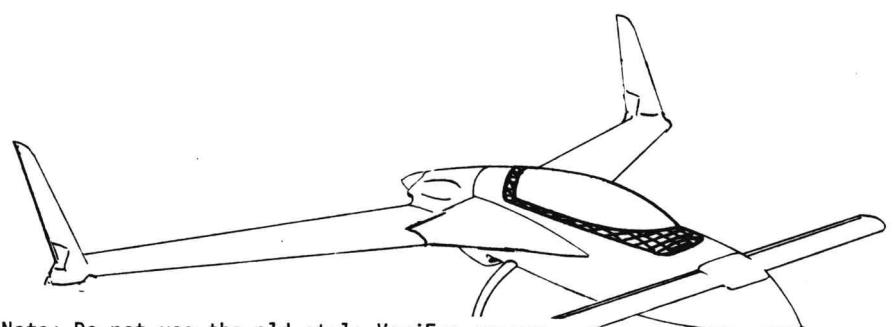
Trim the canopy plexiglass along the lines shown. A band saw, an abrasive cutoff disc in a hand held grinder or skill saw, or a saber saw will do the job, but in any case, go slow or you'll ruin your whole day (not to mention your canopy). We've found the abrasive disc to be the easier method. Another excellent tool is the number 406 steel saw

NOTE: SEE OWNERS MANUAL FOR CARE & REPAIR OF PLEXIGLASS.

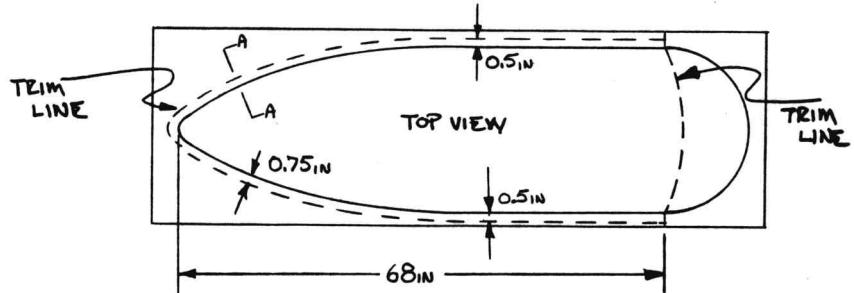
STEP 2

LOCATING THE PLEXIGLASS ON THE FUSELAGE

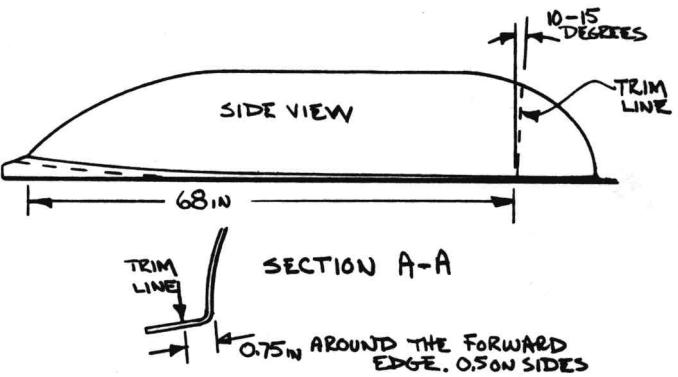
This step should only take 30 minutes or so. Make four blocks from the full-size patterns shown. The blocks are made from 1" lumber. These are temporary supports for your canopy and are discarded later. Tape the plexiglass edges with gray tape and prep the surfaces as shown.



Note: Do not use the old-style VariEze canopy from the original vendor. It does not provide sufficient visibility.



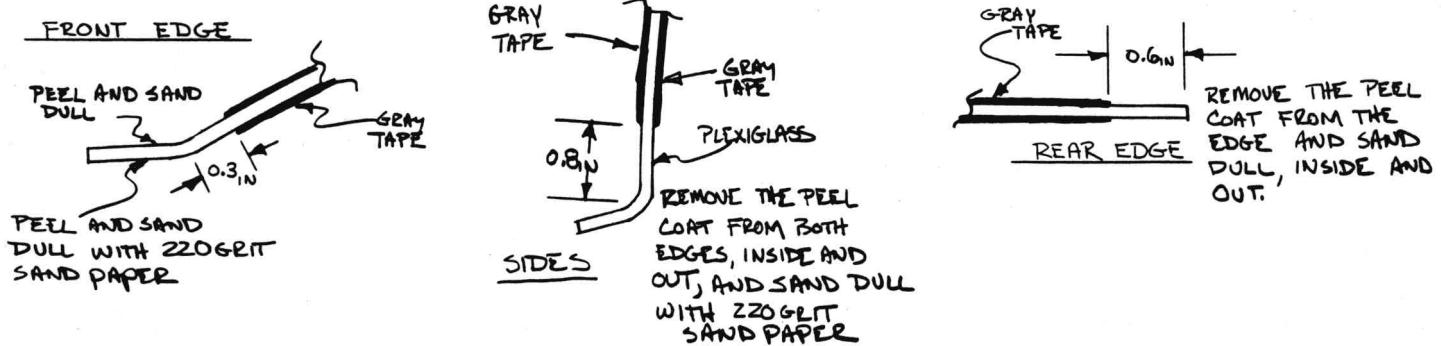
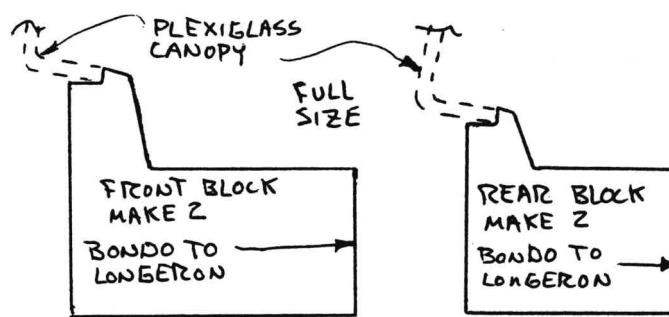
CANOPY PLEXIGLASS TRIMMING



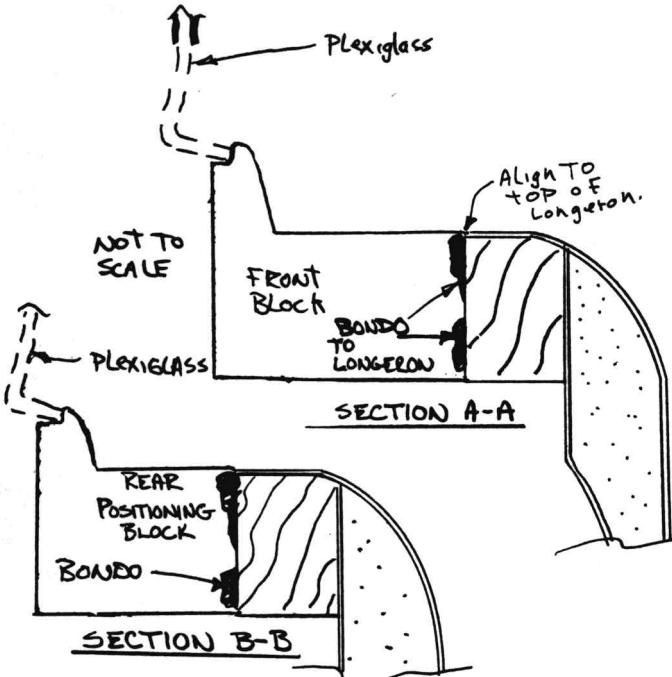
blade (about 1"-dia disc) that's available as an accessory for your dremel hand grinder. Save the end that you cut off; you may be able to trade it to another EAA'er for something you need. It makes an excellent windshield for an open cockpit airplane!

Remove all nicks from the plexiglass edges with a file. Polish the edges with 320-grit sandpaper. Nicks or scratches can start cracks in the plexiglass.

* For "peel coat" you can use Spraylat "A" - you need about 1 qt



Bondo the four wood blocks to inside surface of the top longerons as shown. You can make a small up or down adjustment of the aft blocks, if necessary, to get the canopy top line tangent to fair into the top of the firewall. Don't trim the firewall to accomplish this. If you do, the cowling will not fit.



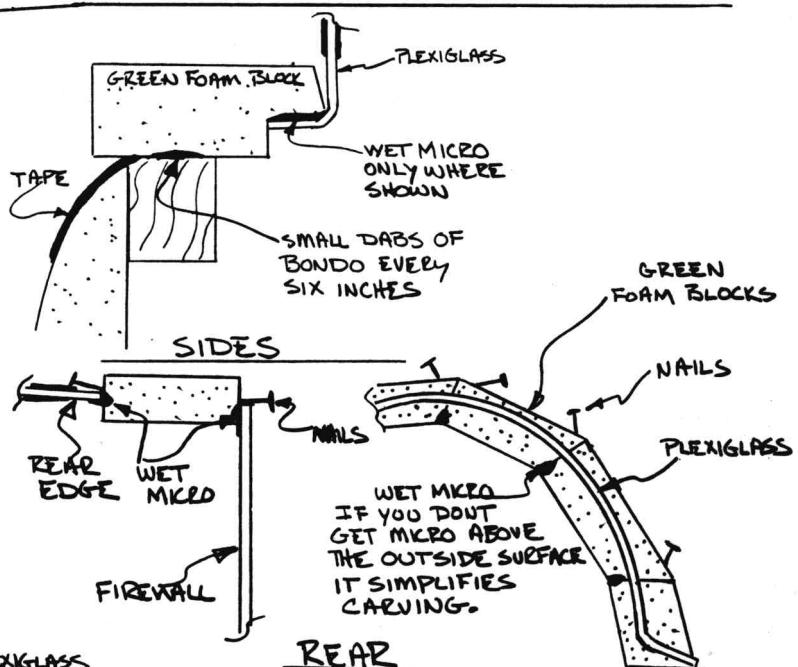
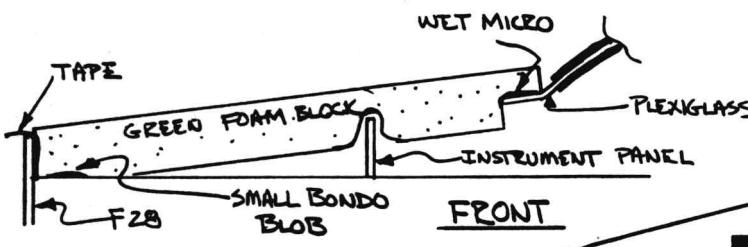
Check that dimension **(A)** measured from the top of longerons (WL 23) to the canopy top is at least 13.5". **(A)** should be measured 6" in front of headrest. If **(A)** is less, forward visibility will be less. Dimension **(B)** at 15" forward of firewall should be 12.3" so the canopy will fair in well with the cowl. Adjust blocks if necessary.

STEP 3

ASSEMBLING THE CANOPY FRAME FOAM CORE

This step should take two to three hours. This step involves mounting some over-size urethane foam blocks all around the canopy. These are later carved to the shape of the canopy frame. Round up your box of 2"-thick urethane foam scraps. Fit pieces of 2" urethane to the canopy plexiglass and fuselage sides as shown. Working with 1 to 2-foot long pieces at a time is fairly easy.

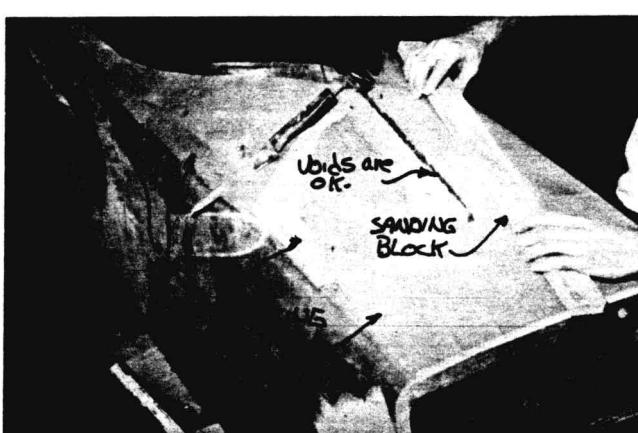
Bondo and micro the blocks as shown. The micro and Bondo are applied to the foam block, then it is held in place while the Bondo sets. Where foam blocks join, keep the micro joint low (no squeeze-out on surface) to make later carving easier.



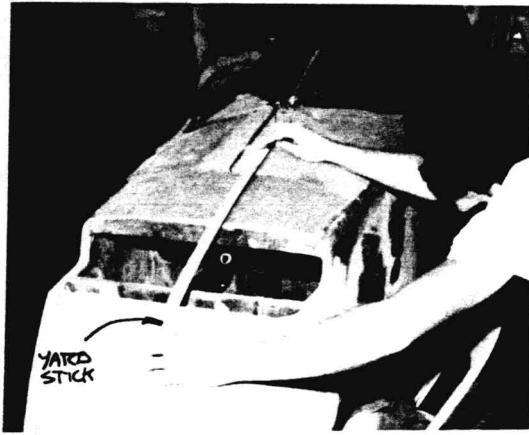
STEP 4

CARVING THE OUTSIDE TO SHAPE

This step should take about two to three hours. Use your foam shaping tools to carve the outside to shape, as shown in the photos and sketches.

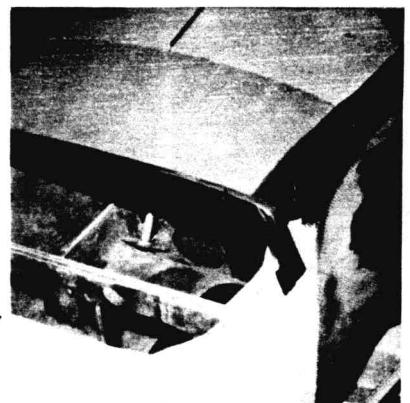
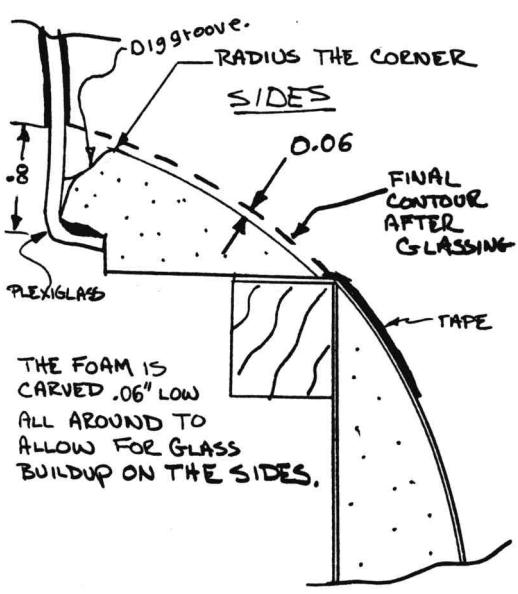


Note: Photos in this chapter are VariEze. Ignore presence of fuel tank and any dimensional reference.

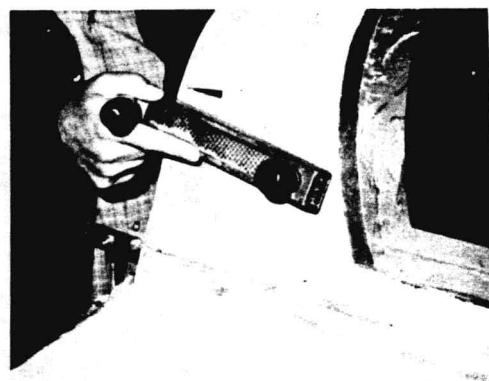


CHECKING THE FOAM CONTOUR

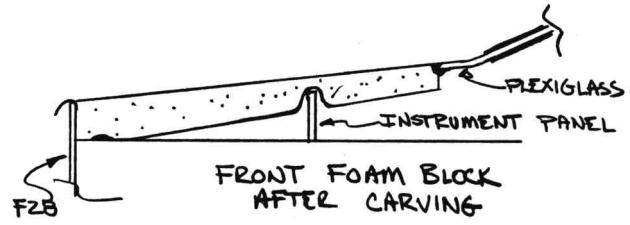
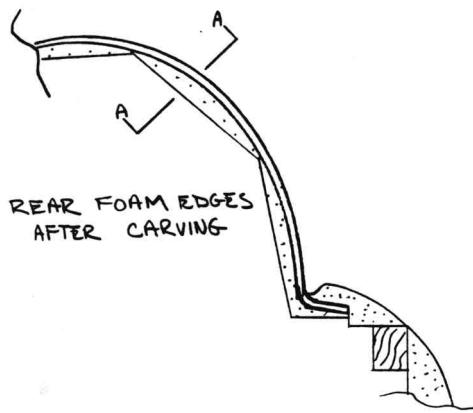
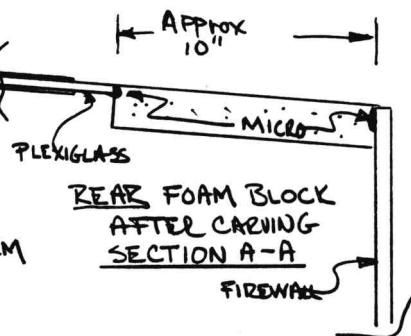
CARVING THE OUTSIDE



FORWARD CARVING DETAIL



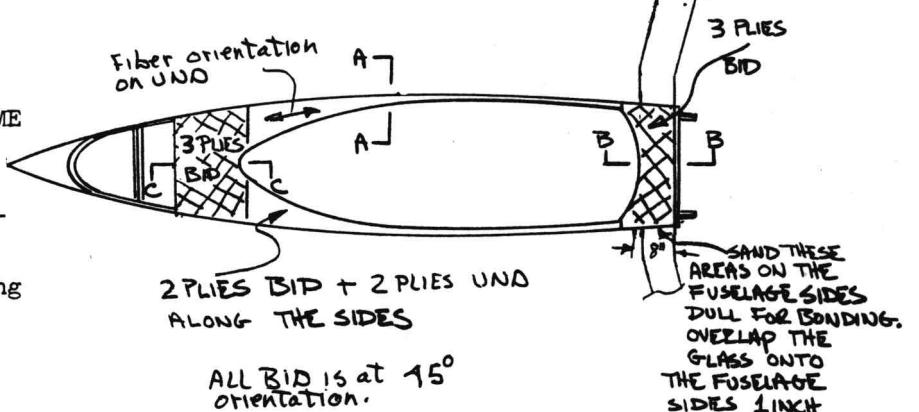
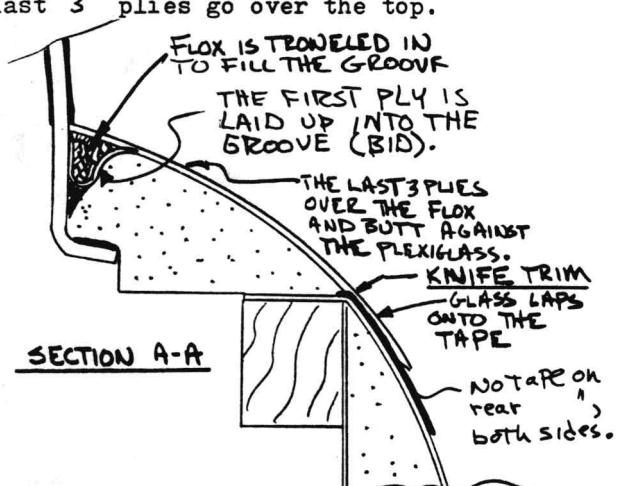
ROUGH CARVING WITH THE SURFORM



STEP 5

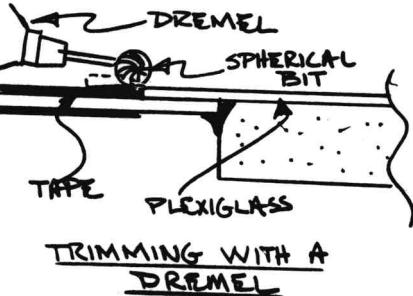
GLASSING THE OUTSIDE OF THE CANOPY FRAME

This step should take two hours. The fuselage sides within 8 inches of the firewall should be sanded dull for bonding. Micro slurry all foam surfaces and lay up BID plies & UND plies, fiber orientation as shown. Note that along the sides, the first ply is laid down into the groove. The groove is then filled level with flox and the last 3 plies go over the top.

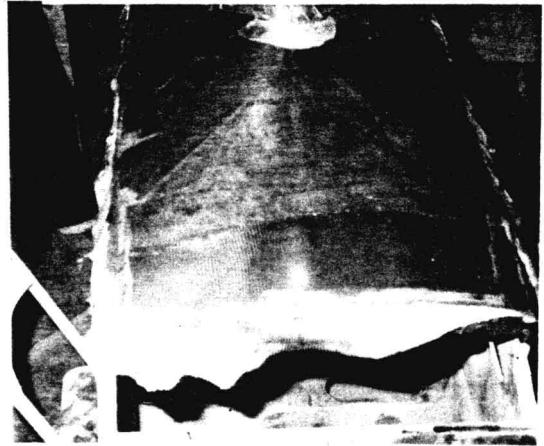


| LAVUP SCHEDULE | |
|---------------------------------------|-----------------------|
| 1 | BID OVERALL |
| 2 | BID OVERALL |
| 3 | UND SIDES ONLY |
| 4 | BID FRONT & REAR ONLY |
| 5 | UND SIDES ONLY |
| LAP THE SIDE UND 3" ONTO FRONT & REAR | |

Knife trim around the taped longeron areas and firewall. Do not knife trim into the plexiglass! The scratches from this would give cracks a place to begin. If trimming is required along the taped plexiglass edges, it is done after a full cure, using a round bit in your dremel (grind down just to the tape edge as shown). Be careful to cut the fiberglass and not into the plexiglass under the tape. Let the layup cure for 48 hours.



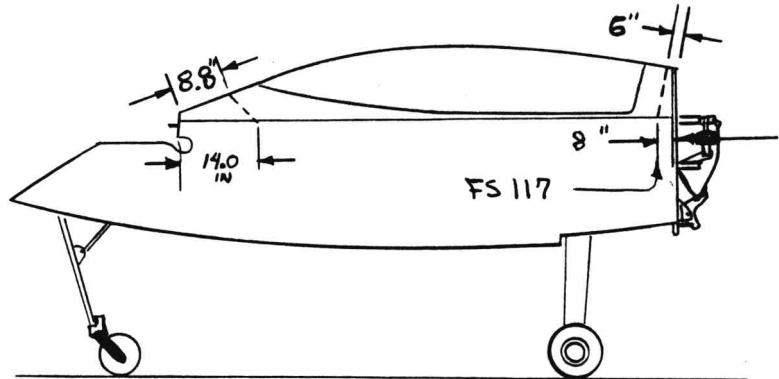
TAPE prevents GLASS FROM BONDING TO FUSELAGE.



STEP 6

TRIMMING, JIGGING, AND REMOVING THE CANOPY

This step should take two hours. Use your hacksaw to cut the canopy front and rear as shown. Don't cut into the longeron! or the instrument panel! or your finger!



CUTTING THE FRONT AND REAR COVERS



LUMBER BONDOED TO THE CANOPY FRAME FOR SUPPORT WHILE WORKING ON THE INSIDE



CUTTING THE CANOPY LOOSE.

Bondo BLOBS

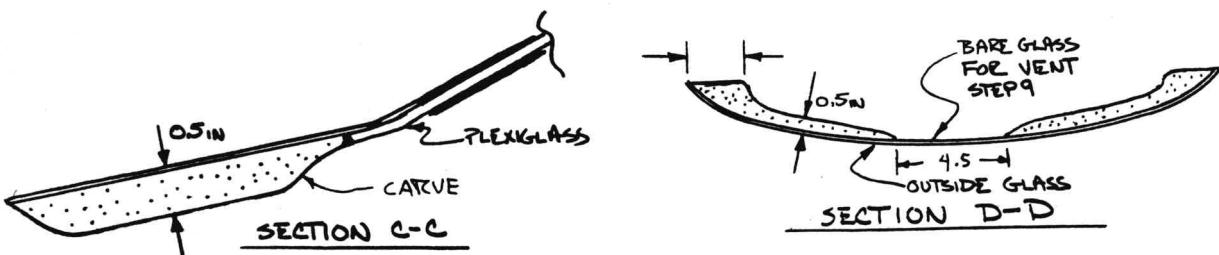
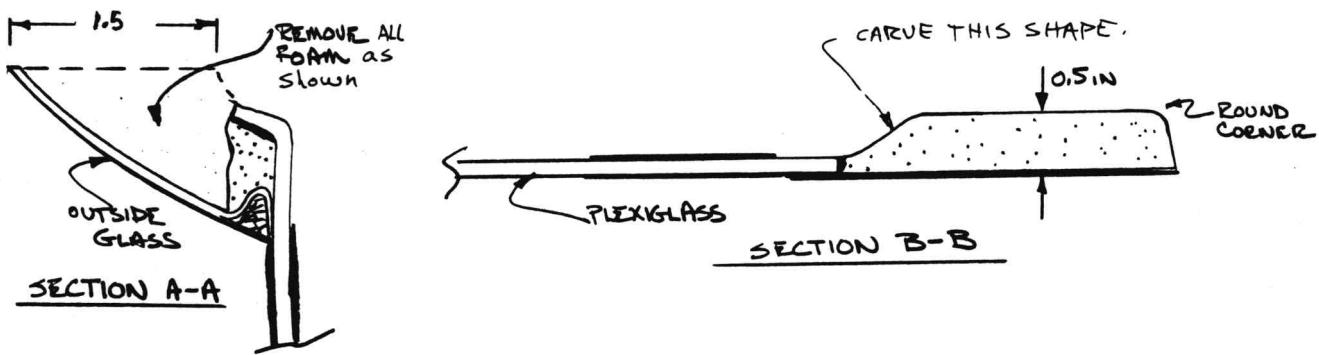
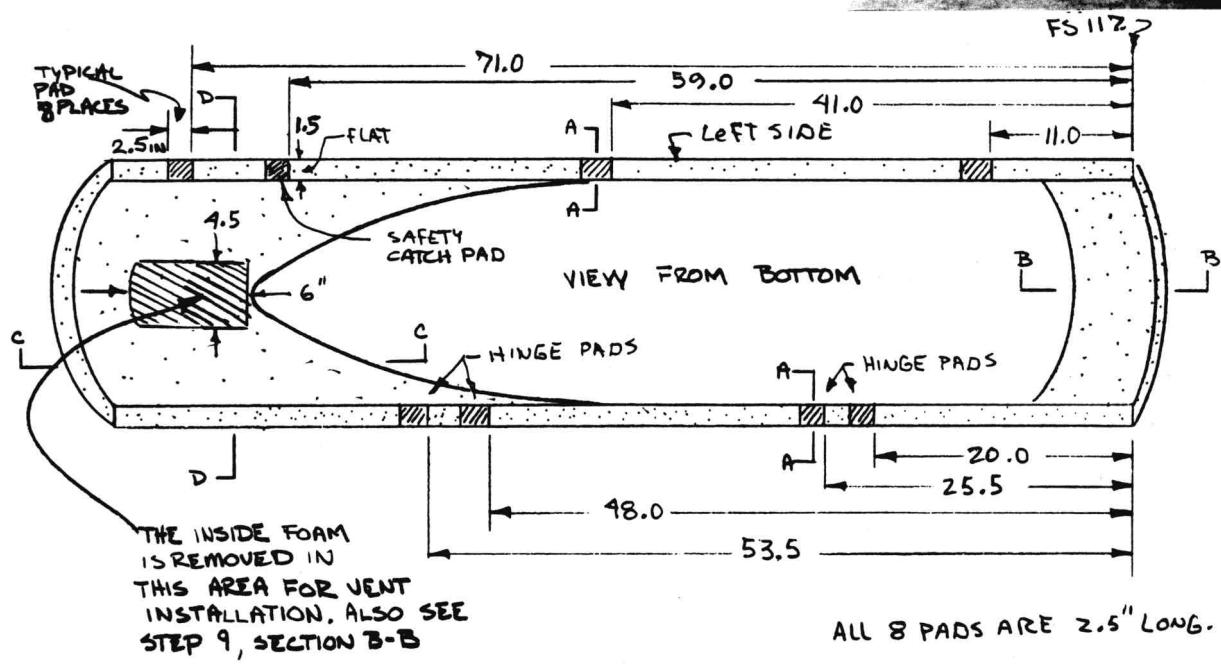
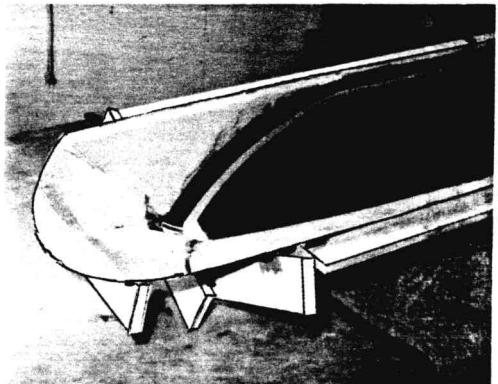
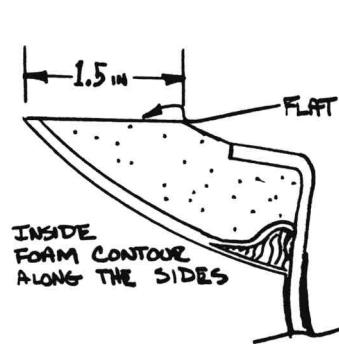
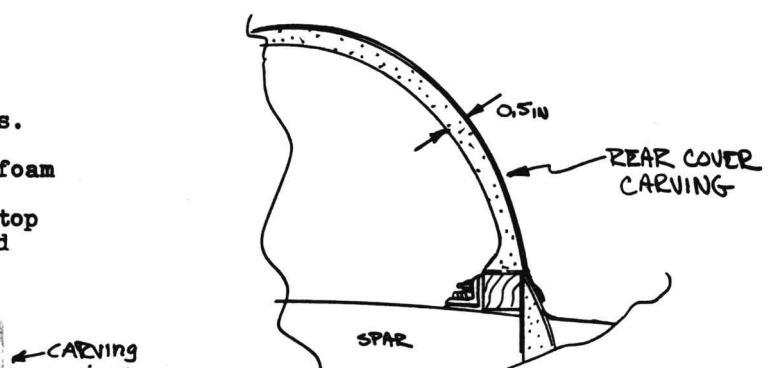
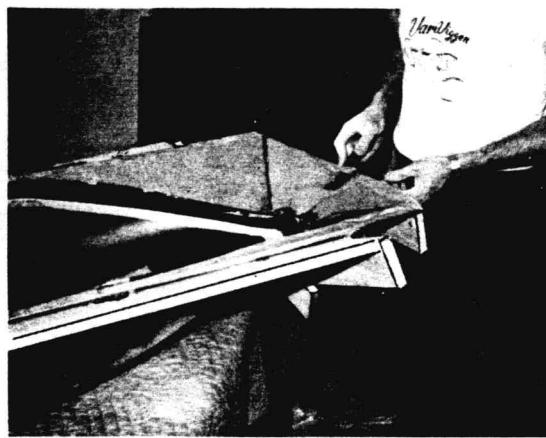


STEP 7

CARVING THE INSIDE FOAM

This step should take one to two hours. Carve the inside foam surfaces on the fuselage as shown. Carve the inside foam surfaces of the canopy as shown.

Remove all of the foam (down to top skin) in the areas shown for hinge and latch reinforcements.



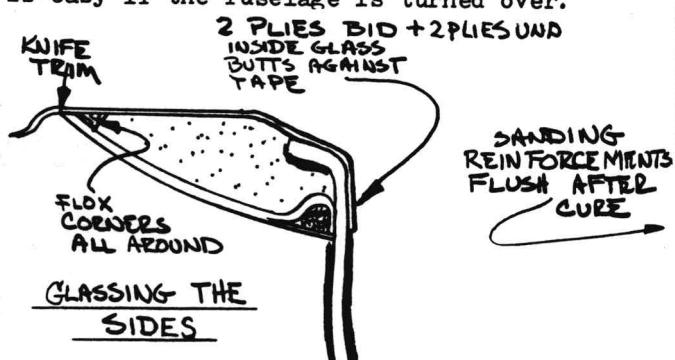
STEP 8

LAYING UP THE HINGE AND LATCH REINFORCEMENTS AND THE INSIDE GLASS SKINS

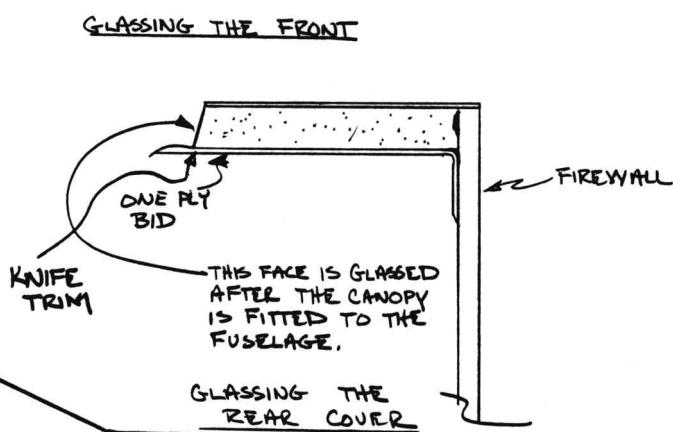
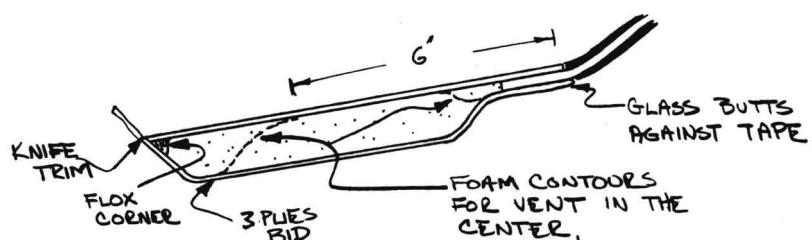
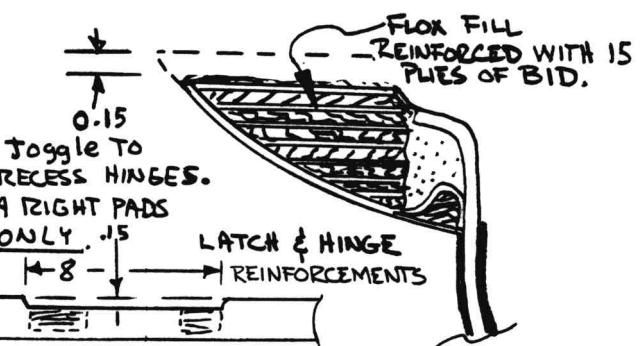
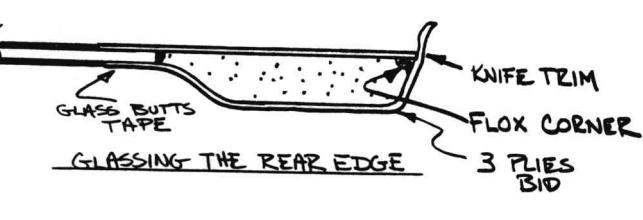
This step should take about three to four man-hours. Mix a batch of wet flox.

Fill the holes carved for latch and hinge reinforcements by alternating layers of flox with BID plies. Overfill the holes slightly so the reinforcements can be sanded flush after they cure.

Trial fit the contoured canopy to your fuselage to check its fit. Then take it back to your work bench and lay up the inside glass as shown. Glass the inside surface of the rear cover on the fuselage with one ply BIDlapping onto the firewall as shown. This layup is easy if the fuselage is turned over.



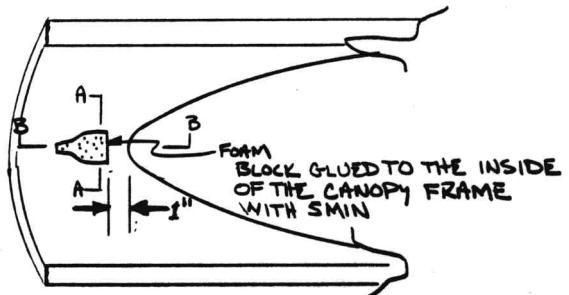
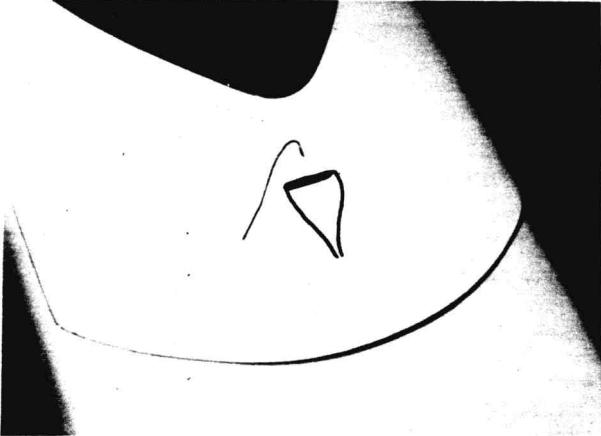
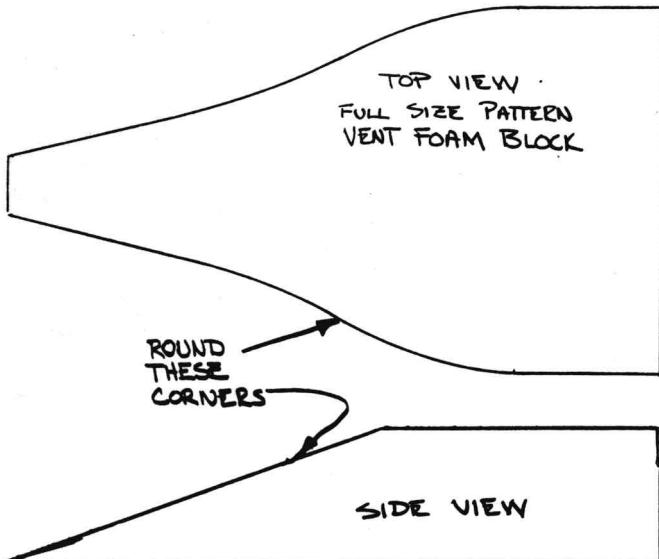
LAYUP SCHEDULE IS SAME AS STEP 5 Pg 18-3.



STEP 9

INSTALLING THE VENT AND CROSS BRACING TUBES

This step should take you two hours. Carve a green urethane block as shown. Glue it to the inside of the canopy frame as shown with a blob of 5MIN. Glass over the foam block with three plies BID. Lap onto the inside glass of the canopy an inch.

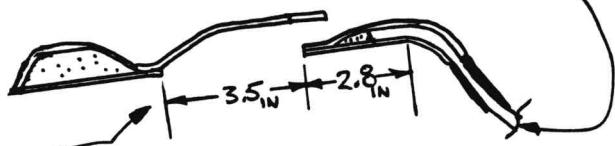




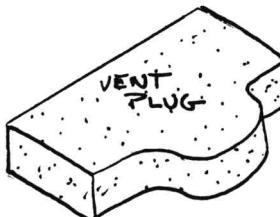
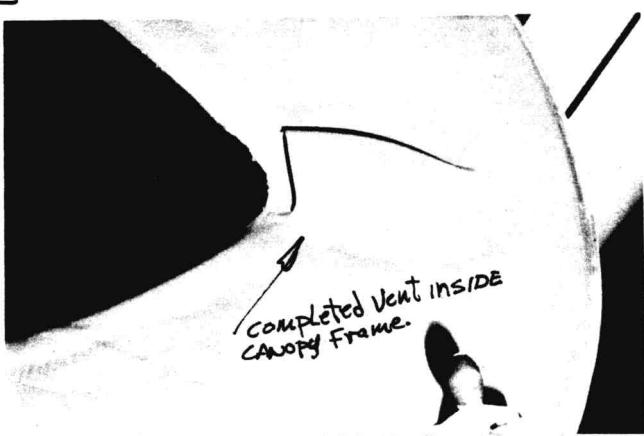
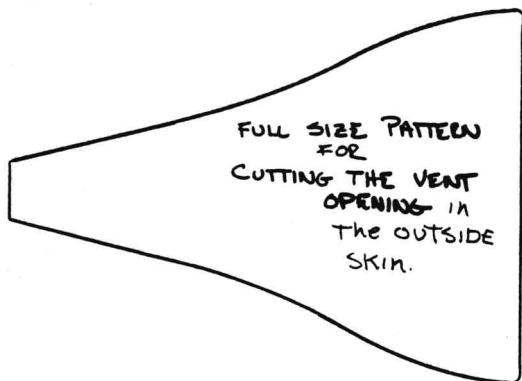
SECTION A-A



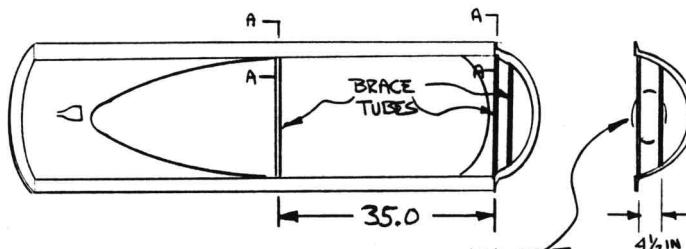
SECTION B-B



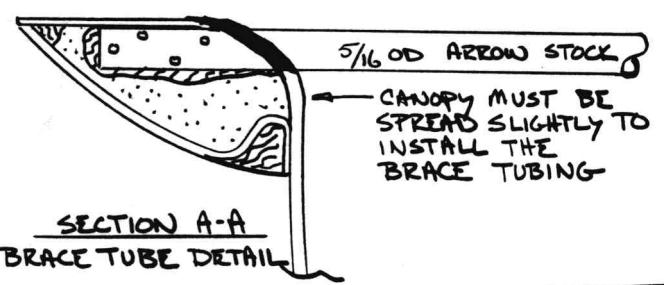
After cure, use the dremel to cut the skin along the pattern shown, and remove the foam. The result is a NACA flush scoop that provides excellent ventilation for both cockpits. The simplest valve for the vent is a plug, carved to fit tight (carve from dark blue P.V.). The plug stops all flow when fitted straight and allows partial flow when stuck in sideways.



Carve holes through the glass at the canopy frame side in six places, as shown, with your dremel. Cut three lengths of 5/16 OD fiberglass arrow shaft tubing to fit across the canopy. Sand the ends dull for bonding. Install the tubing with flox, filling the holes to flush. The two aft tubes support the aft head rest (see CHAP 26). When this is fully cured, you can knock the Bondo and boards off of the outside.



HEADREST ATTACHES TO REAR BRACE TUBES (CHAP 26).

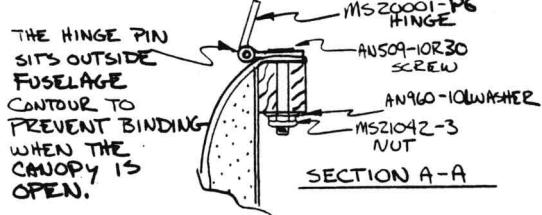


SECTION A-A
BRACE TUBE DETAIL

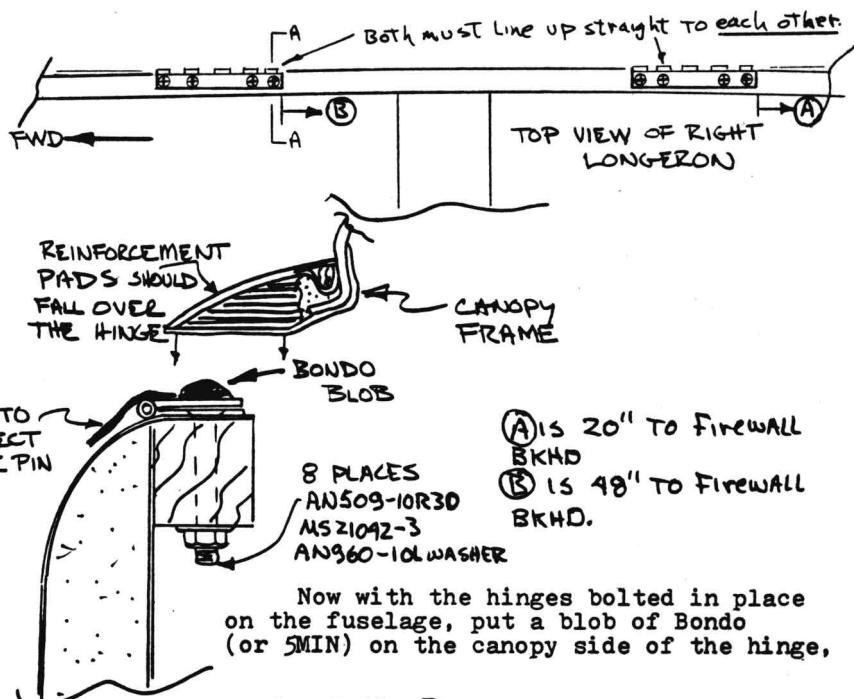
STEP 10

INSTALLING THE CANOPY HINGES

This step should take an hour. Locate the canopy hinges (MS20001-P6) as shown, opposite the recesses, carved during STEP eight. Drill four #10 holes vertically through the longerons in each hinge. Countersink (100°) the hinges for AN509-10R-3D screws and install as shown.



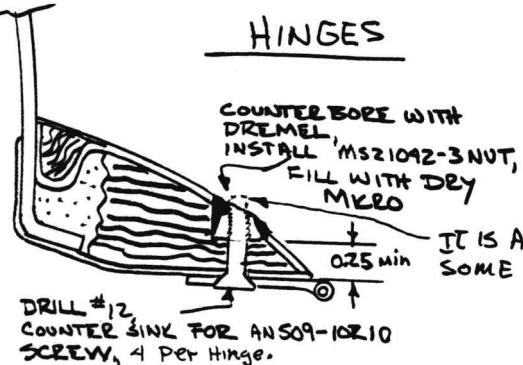
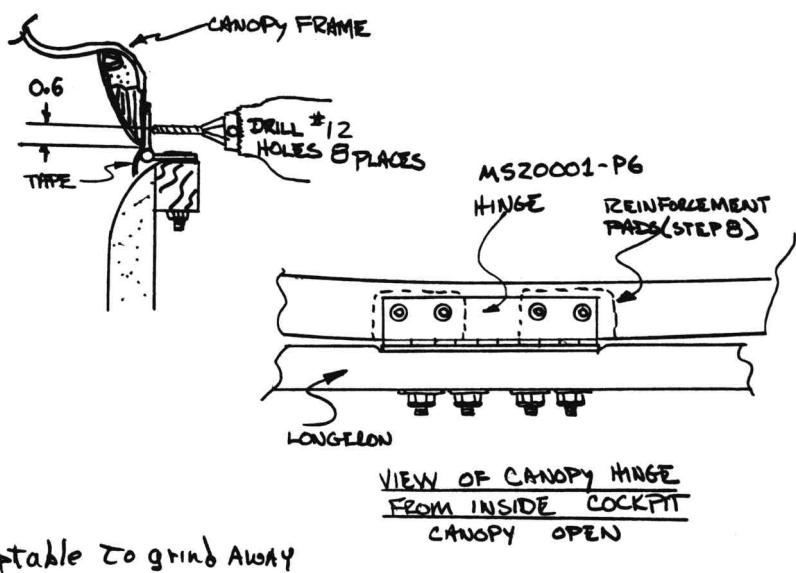
THE HINGE PIN SITS OUTSIDE FUSELAGE CONTOUR TO PREVENT BINDING WHEN THE CANOPY IS OPEN.



(A) IS 20" TO FIREWALL BKHD
(B) IS 48" TO FIREWALL BKHD.

Now with the hinges bolted in place on the fuselage, put a blob of Bondo (or 5MIN) on the canopy side of the hinge.

locate the canopy on the fuselage and let the Bondo harden. Flip the canopy open and drill through the hinge, as shown, with a #12 drill bit in eight places. Be sure these holes go through the reinforcement pads of the canopy (two holes per pad). Counter bore the top of the frame for an MS21042-3 nut to sit below contour. Install as shown. Don't be upset if you can't get the canopy to fit perfectly. The frame or fuselage can be filled with dry micro and sanded to fair in.



STEP 11

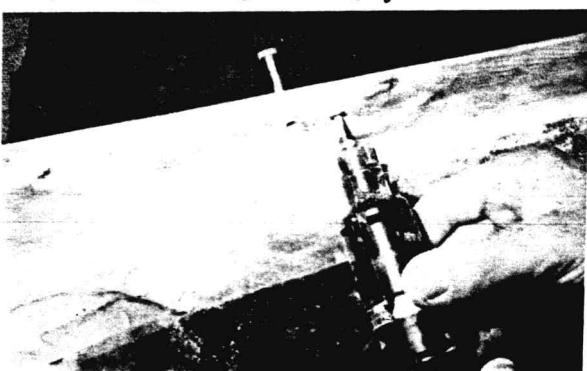
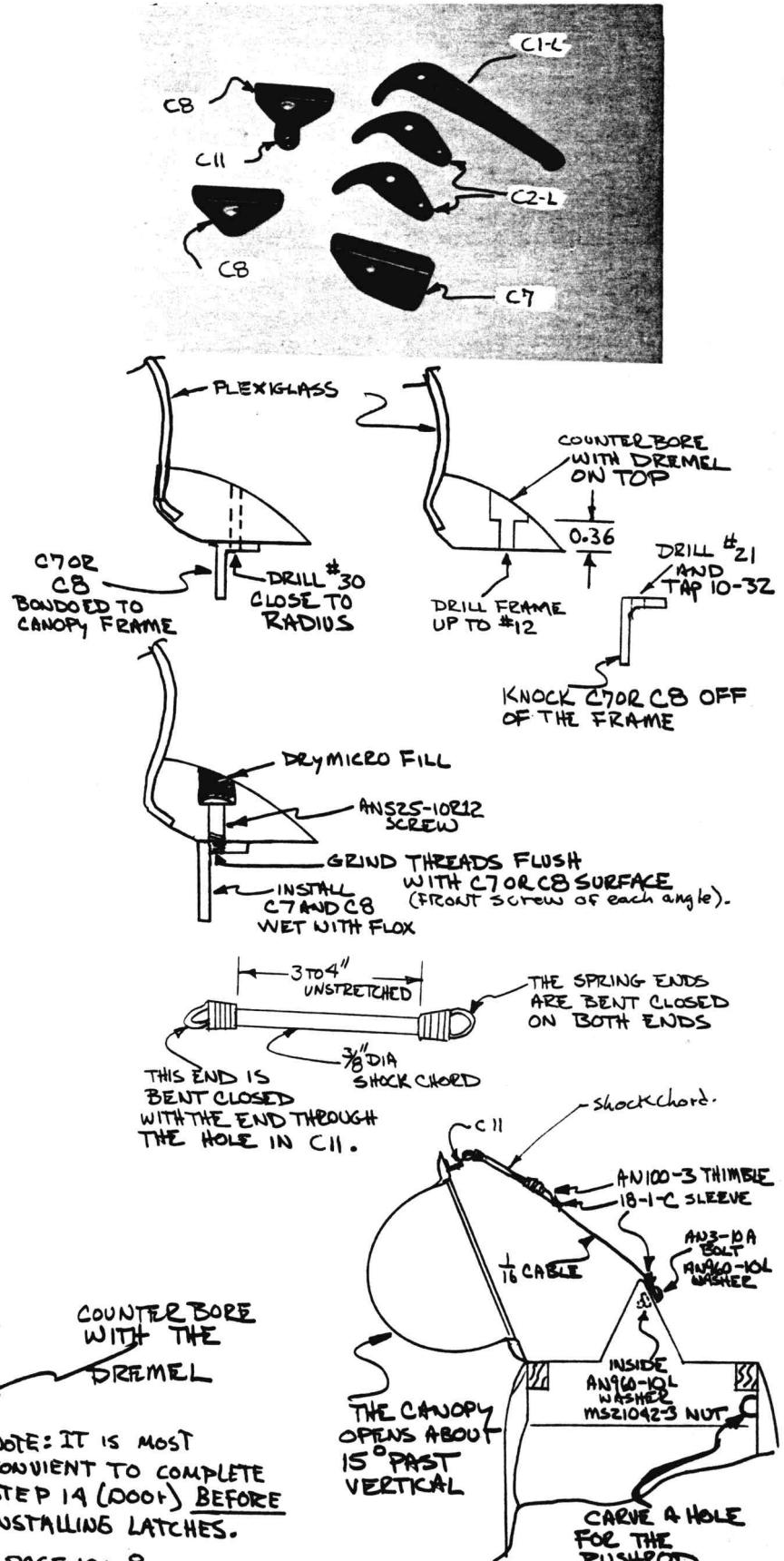
INSTALLING THE CANOPY LATCHES

This step should take from one to four hours, depending on how well everything fits! Refer to the full-size drawing on 18-9 & 18-10 for the details of the canopy latch locations and hardware. Make all of the metal parts shown, and install the three pivot bolts, C1 and C2 arms, and pushrods (C3, C4, C5, and C6) on the longerons. With these items installed, take your C7 and C8 extrusions and a batch of Bondo, climb into the cockpit, close the canopy, and (one at a time) position the C7 and C8's on the canopy frame to match the pivots and arms. Hold the C7 and C8's in position while the Bondo hardens, then open the canopy gently and drill in as shown. Install all latches with AN525-10R12 screws (install wet with flox, wipe excess). File away the exposed threads on the front screw of each latch to avoid interference with the C2/C1 arms.

Adjust C4 so that all three latches seat evenly. For a good seal, contact cement a thin, soft, foam rubber strip to the canopy frame where it mates the fuselage. Adjust the lock plates (C9) slotted holes, so the canopy closes snugly when the handle is pulled firmly forward and into the C9 holes.

CAUTION: Good workmanship and fit up of the canopy latches, is important for flight safety. Poor canopy retention on your airplane can ruin your whole day.

The C9 plate and bolt head on C1 engage in such a fashion that you have to move C1 forward and pull it inboard to unlock the canopy. This prevents it from being bumped open inadvertently. To keep your canopy from banging on the fuel tank when open and to provide some shock absorption if a strong wind gust blows the canopy open, a cable retainer with a shock cord is mounted as shown. This can be made from a motorcycle or bicycle-type bungee strap.



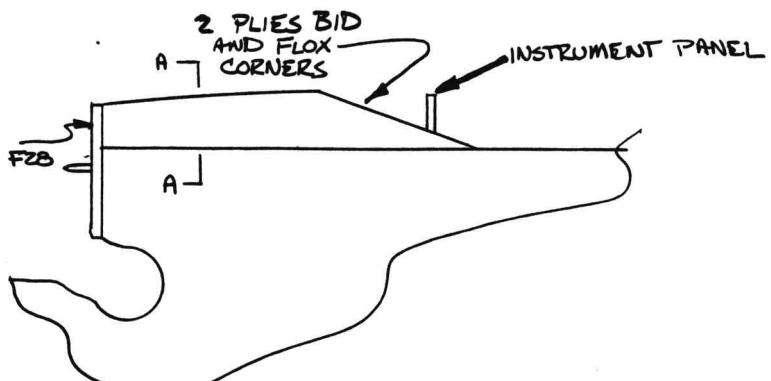
NOTE: IT IS MOST CONVENIENT TO COMPLETE STEP 14 (0001) BEFORE INSTALLING LATCHES.

STEP 12

GLASSING AND INSTALLING THE FRONT TOP FUSELAGE COVER

This step should take about two hours. The front cover is the hunk of glass and foam, forward of the canopy that was left in place on the fuselage, way back in step 6. Pop the forward cover free of the front bulkhead and longerons. Remove the tape and take the cover to your work bench. Contour the inside foam surface so that the foam is about 1/2" thick.

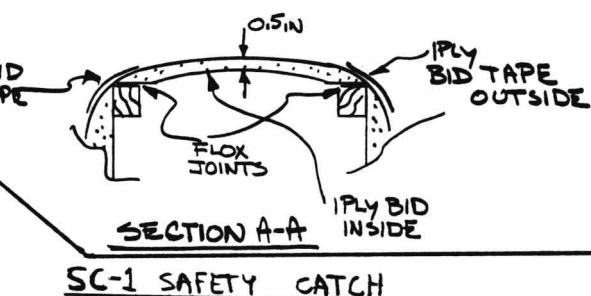
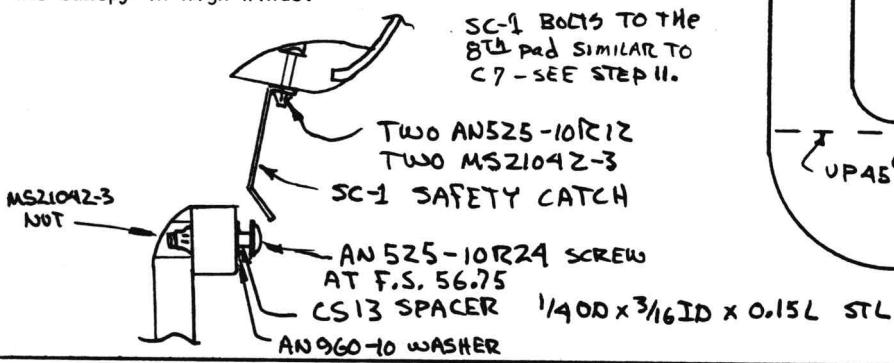
Glass the inside foam surfaces with one ply BID, allow to cure an hour or two, then flip the cover over and install on the fuselage with flox. Layup a BID tape over the outside as shown, to join the outside skin to the fuselage skin, and to F28.



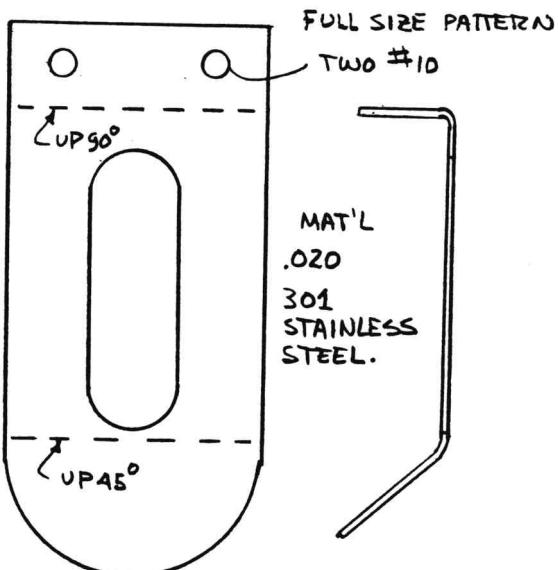
STEP 13 - Safety Catch.

Refer to the drawing for the SC-1 canopy safety catch. This catch keeps the canopy from opening more than 1" if the pilot forgets to lock it for takeoff. Do not skip this installation thinking you will never forget. Experience has shown that the most proficient pilots forget, if the conditions are unusual. All of us at RAF have forgotten on at least one occasion. Canopy up 1" is easily handled in any flight situation, however, canopy fully open is an extremely dangerous flight condition requiring good pilot ability to maintain aircraft control. Several pilots of VariEzes have handled this successfully, but in at least two cases it has resulted in an accident. The SC-1 automatically engages the AN525/Cs13 bolt when the canopy is closed (locked or not). To open normally, you lift the canopy up about 1", then push inward on SC-1 to disengage (similar to safety catch on a car hood).

Do not omit the knob on C7 - it is required to close the canopy in high winds.



SC-1 SAFETY CATCH



NOTE: SC-1 AND CS13 ARE AVAILABLE PREFAB.

STEP 14 - Door

The door shown provides a hole to reach through allowing you to fully lock the C-1L handle when you are outside your aircraft. The door also allows emergency canopy opening from the outside. Print the letters "EMERGENCY CANOPY OPENING" on the outside of the door. Apply the label shown on the inside of the door.

If you desire to install a key lock to secure your aircraft from radio theft, install a small drawer-type key lock (available from hardware stores).

