

Long-EZ Split Canopy

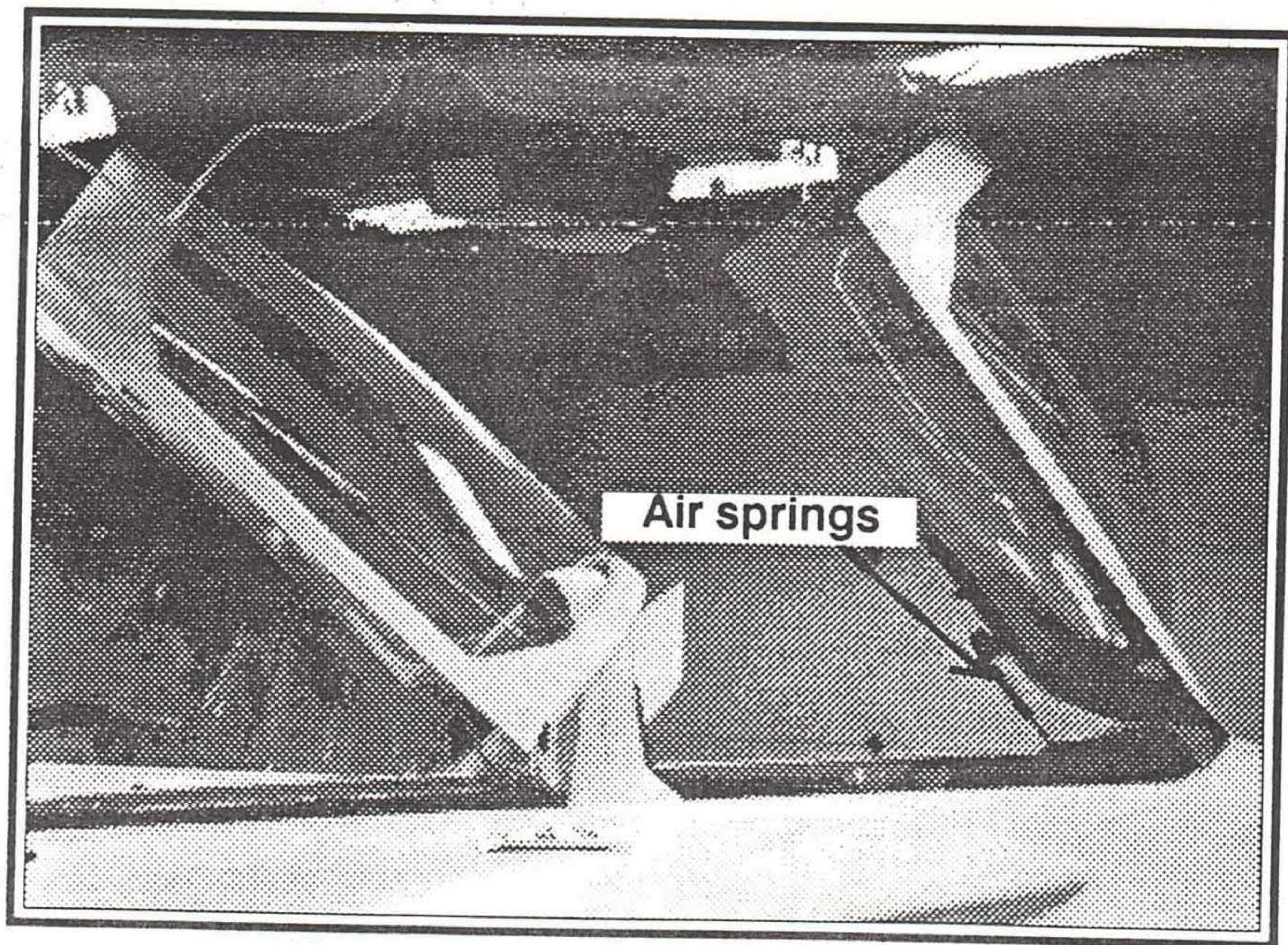
John Van Dusen - The foundation for the split canopy is the rollbar. This, and two structural members of the canopy, were laid up together to insure proper fit, inside the already completed single long canopy. The layup is located at a point over the previously shortened head rest.

These lay-ups consist of 13 pieces of 3" uni-directional (same as spar cap) glass tape 40" long. The first is a 3" wide 7 ply lay-up over visqueen inside the inverted canopy. The lay-up goes up and over the two visqueen covered canopy side rails. About 8" from the end, this lay-up fans out gradually to 6.5" width to give it a better footprint for later attachment to the fuselage longeron on both sides. After cure, the two narrower lay-ups, separated by visqueen, are laid up over the bare plexiglass next to the first one on either side. They run up and over and are joined structurally to the previously sanded canopy rails.

I then had one 3" lay-up, that was removable, and one 1.5" lay-up on either side of the removable one. The 1.5" lay-ups were now a structural part of the canopy. They follow the sides of the 3" lay-up and were separated by visqueen. The 1.5" lay-ups

consist of 3 - 3" tapes folded along the center line to get the 1.5" width. After cure, the lay-ups were trimmed along the rails and all bumps and excess were sanded off until the canopy fit smoothly on the fuselage. Wood wedges were made, trimmed, and floxed under the "feet" of the center 3" lay-up where it attaches to the fuselage.

After cure, a 5" wide strip, centered over the 3" lay-up, was cut through the plexiglass and side rails. After separation, the two halves of the canopy were then removed and the side rail corners were trimmed to fit the contour of the roll bar bottom (3" lay-up). 4 ply BID pads were laid up on the bottom of the roll bar, extending down inside the headrest shelf. Pads were also laid up on the outside of the longerons. When cured, the roll bar became structural. After trimming the raw foam and glass ends of the rails, 4 plies of BID reinforcement, with flox corners, were laid up over the foam corners of both front and rear canopy halves extending to the plexiglass. 3 plies of BID were laid up across the corners on the plexiglass to reinforce these areas. 3 BID tapes were laid up over cross members and down both sides to the corners. The lay-up went over the .5" of plexiglass that lapped over the cross member when the 5" strip was cut and



removed.

After filling and sanding the base of the roll bar, the canopies were reinstalled. The base of the roll bar was filled and sanded to fair into the canopy rails and then glassed. The canopies are raised and lowered with assistance from air springs acting as a counterbalance. Two springs are used on the front canopy and on the rear.

The front canopy hinges on 2 hooks buried in the front of the canopy frame and reinforced with BID plies. The rear part employs a square hollow shaft (4130 steel) that is slaved by the air spring. This square shaft lifts the rear half through 2 levers bolted to it and 2 flat aluminum struts to the dog leg hinge levers on either side of the canopy.

The hooks on the front edge of the front canopy pivot on 2 AN bolts which are floxed in place in two 4130 U shaped brackets. The brackets are buried in the fuselage foam just above the instrument panel. These U brackets were drilled first and located by using a long piece of 1/4" rod temporarily passing through the holes of the brackets. The holes are then located by installing the forward canopy on the fuselage with the hooks hooked on the rod.

Put everything in place, making sure the rod and brackets are pulled forward into the hooks. 5 minute epoxy was used to hold the brackets in place. After cure, the canopy was removed. Upon carefully removing the rod, AN bolts were installed in each bracket. Flox was added to lock them in. Voids were filled with foam, and micro, then sanded and glassed. The curved edge of the canopy, between the two hook hinges was removed and reattached to the fuselage cockpit edge. This is necessary to prevent binding when opening and closing the canopy. This forward part of the cockpit lip and canopy lip must be angled to avoid binding.

NOTE: The fore and aft fit of the

canopy is very important. Any slop in this direction in the hooks would be taken up by the pressure of the air springs. That would cause binding at the back of the canopy. While the flox on the brackets was curing, blocks were inserted between the canopy and the long 1/4" rod to locate the U brackets accurately. This removed all excess play while the canopy was in place.

The airsprings are located as far forward as possible (mine attach to the fuselage at station 40). The instrument panel on my Long-EZ is at station 36. The canopy hinge points are at station 36. These hinge points are located at and above the instrument panel. The airsprings attach to the canopy, through 3" brackets, at about station 46.6. (this was arrived at by trial and error)

The original Vari-Eze/Long-EZ latches will work on the split canopy but must be modified somewhat. The ones I am now using don't impress me and I would not recommend them to anyone.

There are 2 catches on each side of the front canopy and one on each side (back end) of the rear canopy. They should pull the canopy down and compress the seals all around the edges. My present ones don't. I must hold the canopy down while

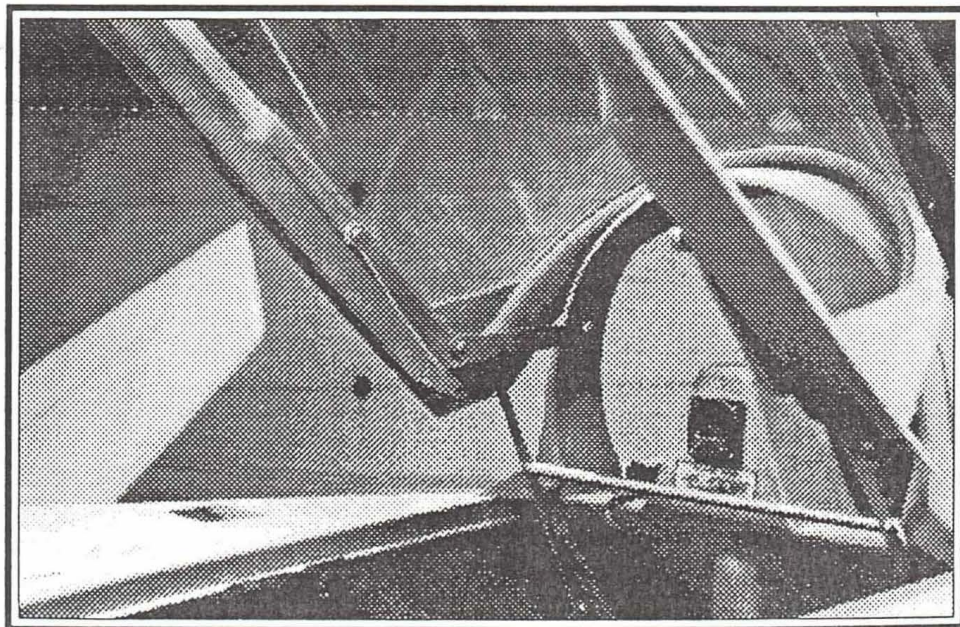
sliding the catches closed. Not too cool!

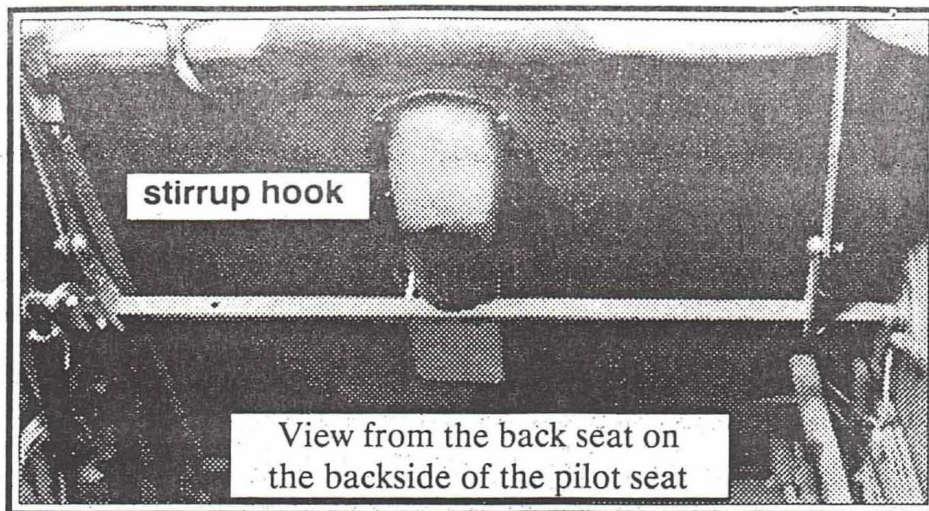
Though not perfect, I'm going to do the first flight with them. The 3" brackets that attach the airsprings to the canopy and the front latches are 4130 weldments. With a different latch system these brackets could be fabricated from 2024-T3. The redeeming feature of the present latches is they won't shake open.

Once canopies, hinges, and lift systems were installed, with all bugs worked out, a fiberglass lip was layed up all around both canopies. When cured, a second longer lip was installed on the rear edge of the front canopy. This lip overlaps the front of the rear canopy. Both canopies have to be down before the front canopy can be latched. This second long lip prevents accidental opening of the rear canopy should the rear canopy latches fail to engage properly. Since both halves are hinged at the front, air pressure should prevent them from snapping open. With the proper foam seals under these lips, I feel I have the cold air problem under control.

The rear canopy lift mechanism looks more complicated than it is. I tried several different methods and finally decided the following method got the job done simply and securely.

Rear canopy lift mechanism





The square tube used to activate the canopy is .5 X .5 by X .050 wall, 4130 steel, 21" long and located behind the pilot's seat back, 2" behind and 9" below the longeron, parallel to the seat back.

Pivots were made by welding the heads of two 1/4" X 20 bolts to the ends of the square tube. The wall mounted pivot so

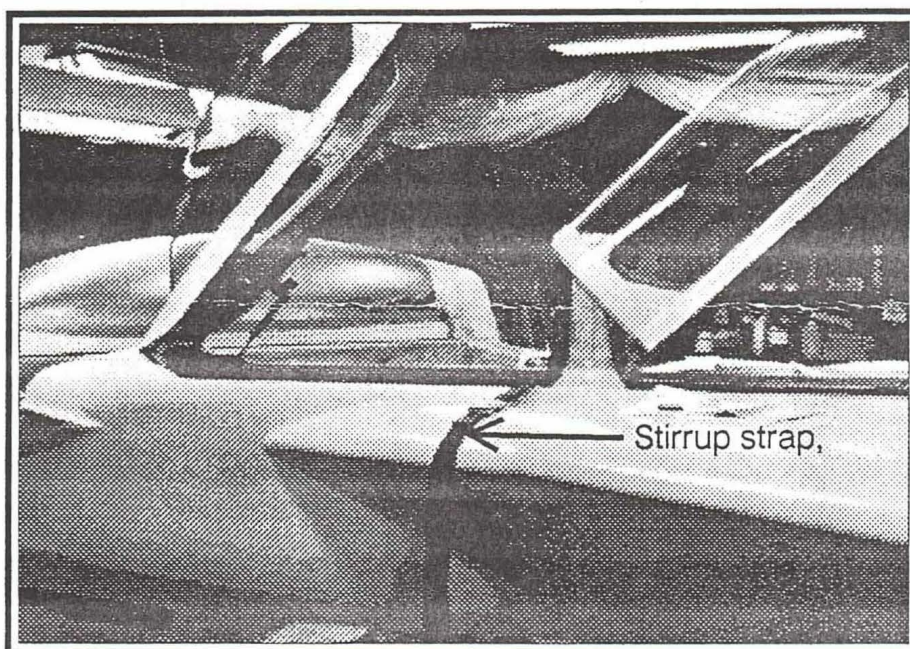
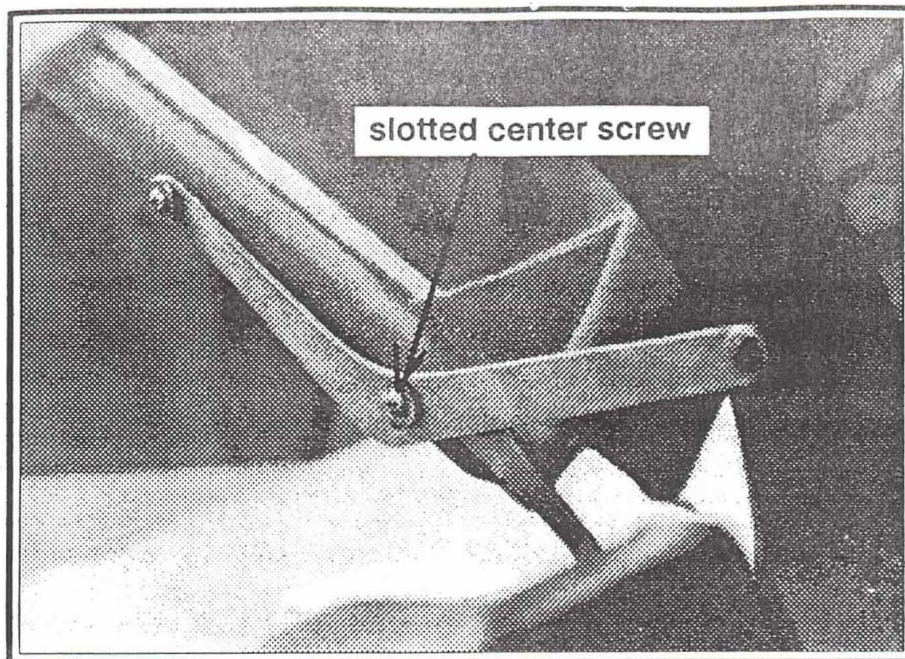
up with each other.

Alignment of the airspring arm is not critical. The placement of the airspring anchor point on the fuselage determines the correct action. I achieved this by fabricating a curved slot in a piece of 1/8" aluminum. Secure it to the side of the fuselage in a position determined by eyeball. Just put it where it looks about right

5/16" round steel stock, drilled and tapped to 1/4-28 and floxed into place. The hinge levers are secured to the canopy rails by four 1/4"-28 pan head bolts. The one at the corner of the canopy rail (middle of lever) is a slot.

The lift struts attach to this bolt. All these attach and hinge points include steel bushings 1/4 X 1/4 X 5/16 OD plus a washer under each head. The canopy rails, where the lever is attached, should be reinforced with a strip of 5 ply plywood and glassed over. Next the 1/4-28 anchor stock is installed.

A piece of .5" dia aluminum round stock, 16 - 5/8" long was drilled and tapped 10-32 on both ends and installed between the two lift struts at a location 7" down from the top hole. A 3/16" hole was drilled through each lift strut for this. The .5" round rod acts to brace the lift struts together and serves as a handle for manually



can be used for both seats. The airsprings are quite expensive from Aircraft Spruce. I see similar ones are available from Sears at half the cost. They aren't exactly the same but could be easily adapted.

This setup is a first time effort and I think it could be built to weigh less. A simpler latching system could also be devised. Even when expert design engineers are involved in a project, trial and error is often the bottom line and becomes the deciding factor in the end product. In my case, trial and error was the only course avail-

able and it was with a great deal of anxiety that I began this alteration. As I proceeded it became clear that it was a good choice. Once the two canopies were made, it came down to a simple choice of how they would be hinged and locked.

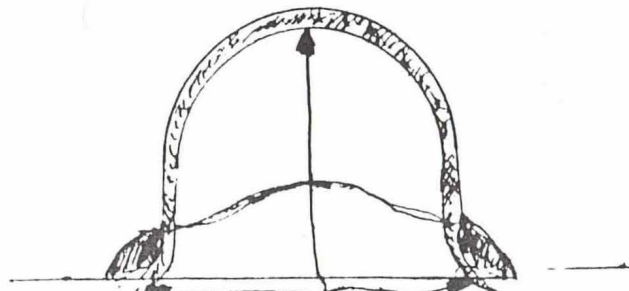
This brings me to the reason for the forward tipping canopy versus the rearward tipping action. In addition to the previously mentioned drawback of hardware proximity to the pilot and passenger, the rear tipping canopy shares the same negative possibility of a failed catch and

opening unexpectedly in flight as the side opening canopy. Hence, no real reason to change the canopy design except for aesthetics. So I settled on the forward action and anchored the forward edge with two hinging hooks. The idea was to incorporate a small lever under the inside front of the canopy which, when pulled, would unhook the front of the canopy and raise it into the airstream. The canopy would then be pulled off for bailout. The rear half can likewise be ejected.

After considering the very low need factor I dropped the idea. After the article on 164JV (*Central States Newsletter, Spring, 1988*) I was contacted by 2 builders. Both expressed identical fears of bailout from a split canopy and ground roll over. Neither could recall a bailout incident from an EZ, but both focused then on not being able to open the canopy after a roll over. I mentioned the fact that no canopy will open with an airplane sitting on it. The conversation ended.

Considering unlatched canopies opening on take off, against bailouts, the balance falls heavily in favor of a canopy that cannot open in flight. To my knowledge, there have been no inflight structural failures. This is remarkable considering the wide range of skill involved in constructing these airplanes. The opening canopies, folding nose gears, and fuel mismanagement have been the primary causes of most incidents. In all cases, cause has been traced to pilot error, poor construction, poor maintenance, or all of the above. The EZs have proven to be a basically safe aircraft. This is why I took the trouble to remove one more possible mistake. **NUFF SAID!**

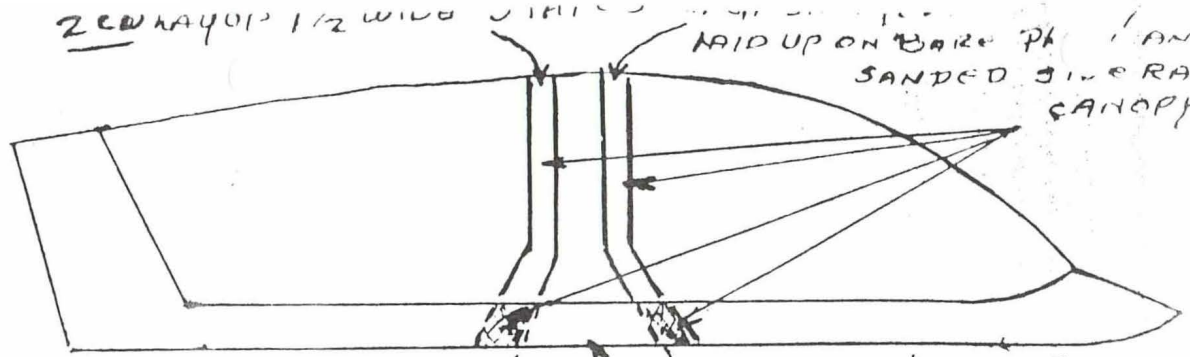
**See The Following
Pages For Drawings
Illustrating Canopy
Parts.**



1ST. + 2CD. LAYUPS
INVERT CANOPY
FOR THIS

2CD LAYUP 1/2 WIDE

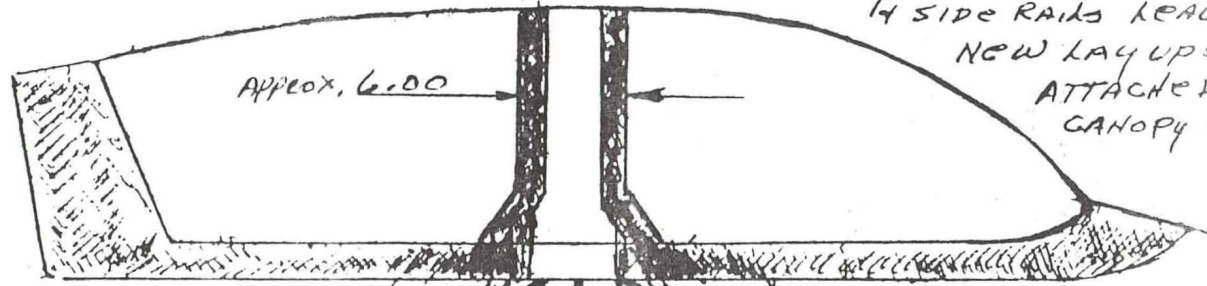
LAID UP ON BARE PL 1 AND ON
SANDED SIDE RAILS OF
CANOPY



VISQUEEN UNDER 1ST
LAYUP AND BETWEEN
1ST AND 2ND LAYUP

1ST LAYUP 3" WIDE 7 TAPES

5' CUT CANOPY HERE THRU plexiglas
4 SIDE RAILS LEADING
NEW LAYUPS
ATTACHED TO BOTH
CANOPY HALVES

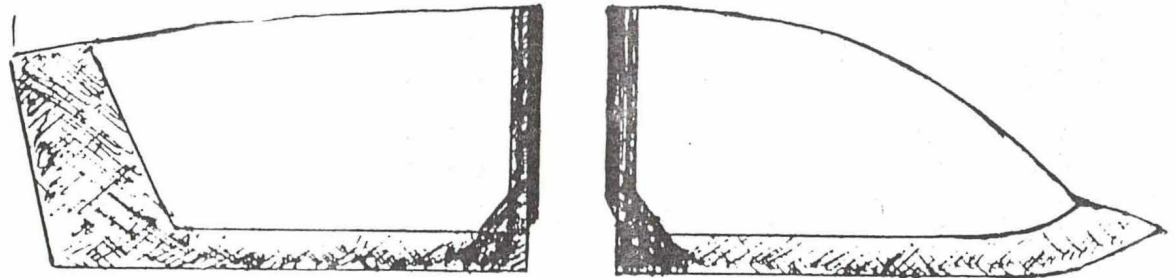


APPROX. 6.00

FLOX CENTER LAY UP TO FUSELAGE
USING SMALL WOOD WEDGES

VISQUEEN

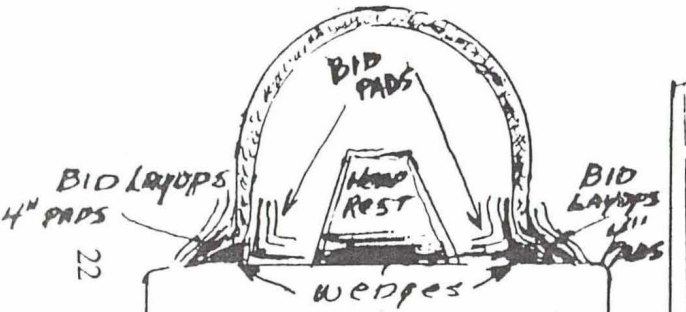
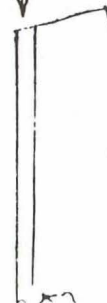
VISQUEEN



Roll over
BAR

JOINED TO FUSELAGE WITH FLOX,
WEDGES + BID INSIDE
OUT

FIREWALL



INSTALLING Roll BAR TO FUSELAGE

BID LAYUPS

4" PADS

22

BID PADS

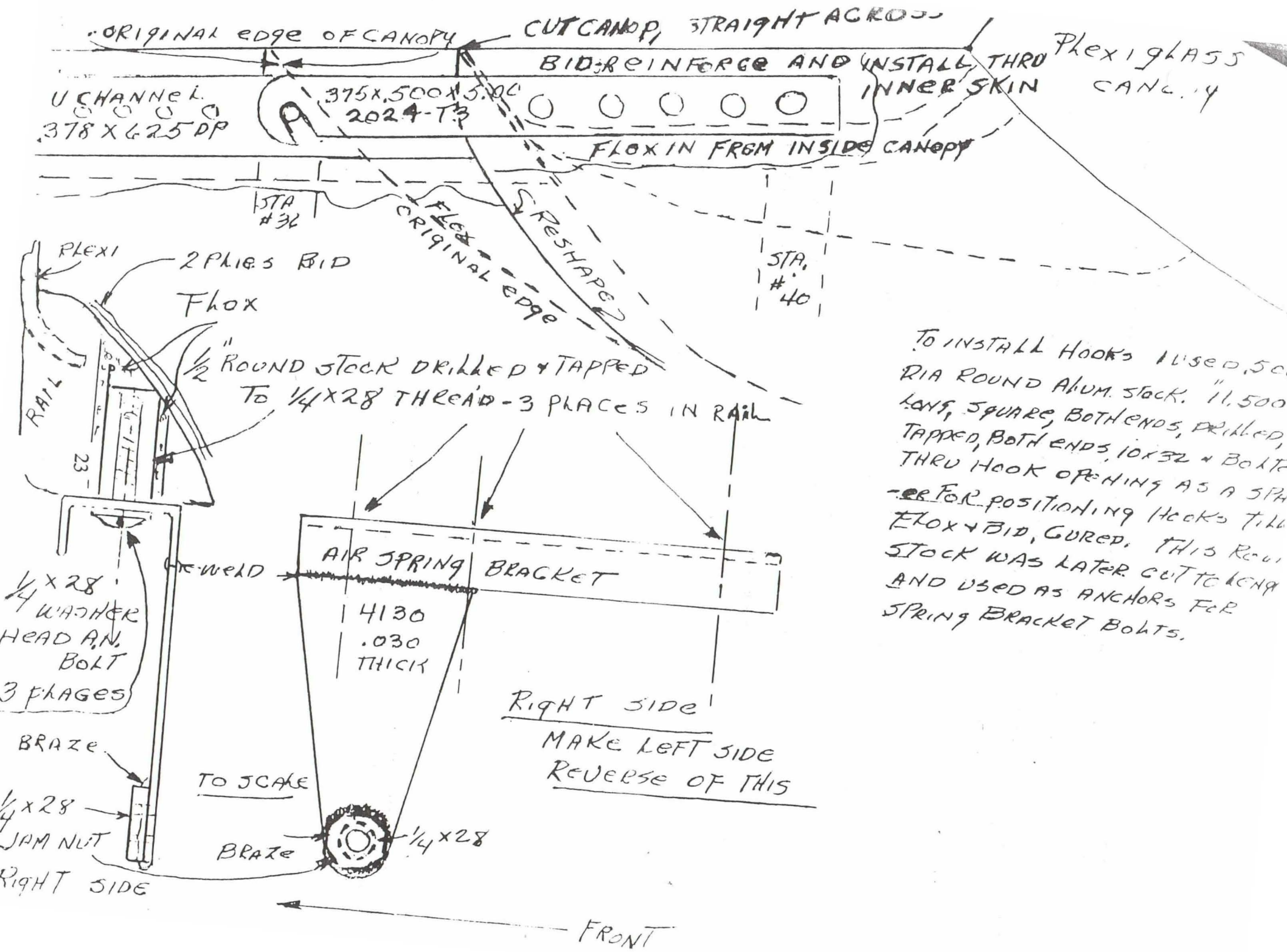
WOOD
REST

BID LAYUPS

4" PADS

WEDGES

ON REINFORCE + FLOX



TO INSTALL HOOKS I USED .50 DIA ROUND ALUM. STOCK. 11.500 LONG, SQUARE, BOTH ENDS, DRILLED, TAPPED, BOTH ENDS, 10x32 + BOLT THRU HOOK OPENING AS A SPACER FOR POSITIONING HOOKS TIL FLOX + BID CURED. THIS ROUND STOCK WAS LATER CUT TO LENGTH AND USED AS ANCHORS FOR SPRING BRACKET BOLTS.

