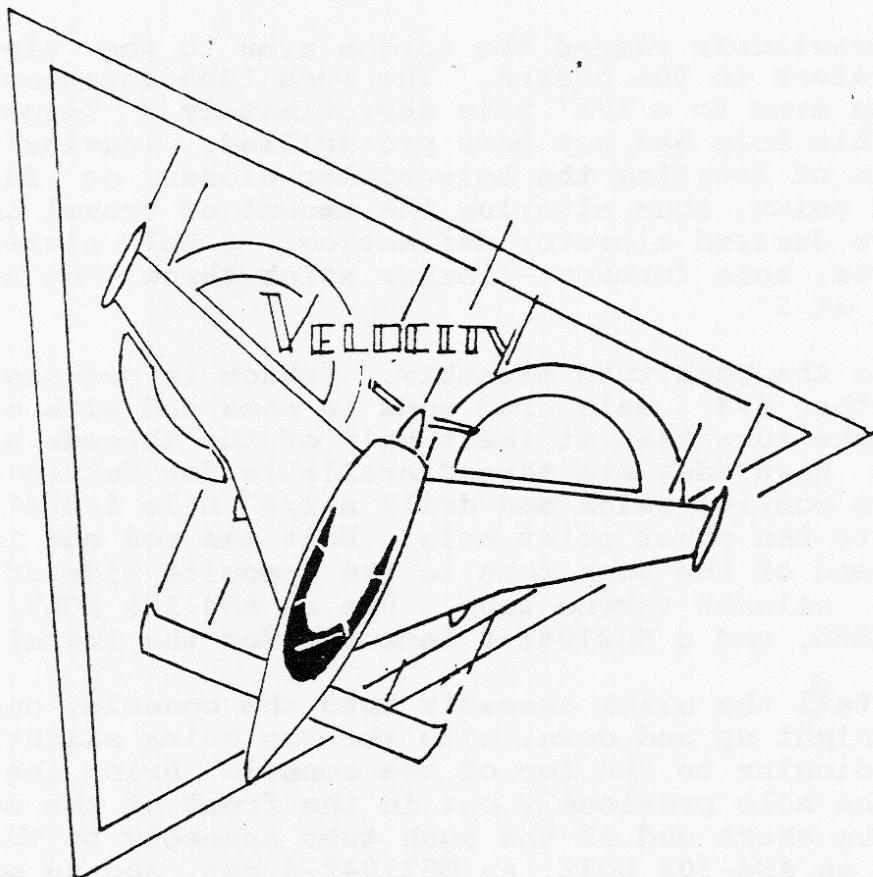


# VELOCITY



## Section VI

To install and rig the rest of the control systems in the VELOCITY, your aircraft must be assembled to the point that the wings, winglets, etc. are attached. First we will rig the canard. Back in the previous text, you installed the elevators to the canard, installed the torque arms to the elevators, and installed the canard to the airframe. All that remains to be done now is to link the torque arms to the stick, and install the pitch trim system.

#### CANARD AND ELEVATORS

You previously rigged the torque arms to the elevators and the elevators to the canard. The push tube attaches in between the torque arms to a 1/4" hole approximately 2" below the pivot holes. This hole has not been pre-drilled, leaving the builder the option of locating the hole either closer or further from the pivot point, thus altering the amount of travel in the stick to achieve desired elevator deflection. ( Hole closer - shorter stick throw; hole further - longer stick throw.) We suggest that you start at 2".

Locate the push tube assembly, (which is pre-assembled) and install the 1/4" male rod ends in each end with a jam nut in place. Make sure that at least half of the threads are used so that you have adequate thread available for future adjustment. Remove the control stick and drill a 1/4" hole 1-3/4" below and parallel to the pivot point hole. Bolt the rod end installed at the long end of the push tube to the opposite side of the stick from the aileron torque tube. Use an AN4-15A BOLT, (2)AN960-416L WASHERS, and a MS21042-4 lock nut for the installation.

Reinstall the stick assembly into the console, and jig the stick straight up and down, with the top being slightly forward of perpendicular to the top of the console. Bring the push tube through the hole previously cut in the front of the console. Now install the short end of the push tube assembly to the torque arms with an AN4-10A bolt, an MS21042-4 nut, and as many AN960-4 washers as needed to take up the slack between the torque arms.

Put the canard in place, get inside the fuselage, and mark the amount of material that needs to be cut off the front tube. Remove the canard and cut the tube to length, reinstall the canard and check the length again. If it is satisfactory, remove the entire push tube assembly and drill a 3/16" hole through the tube and pin to hold the assembly together. Try to drill this hole parallel to the other bolts in the push tube, and when the tube is installed, try to keep the bolts positioned vertically, with the heads on top. (This might insure that if a nut falls off, the bolt won't necessarily come out. This is a good practice to follow throughout construction of the airframe.)

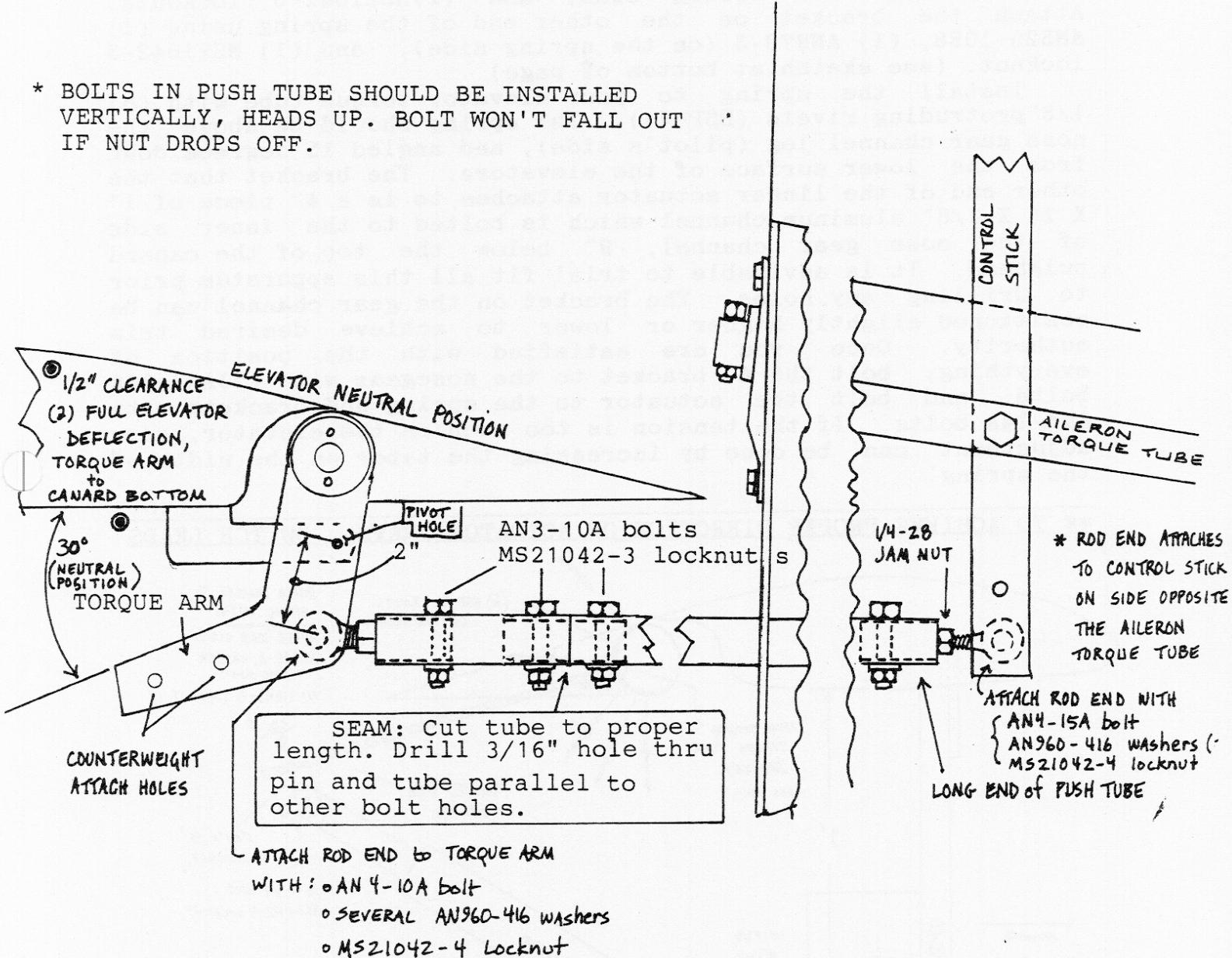
Reinstall the canard and stick assembly. Check for clearance,

## SECTION 6

RIGGING OF CONTROL SYSTEMS

and for full elevator deflection with stick both to left and right. Slight enlargement of the hole in the front of the console might be in order. Use an AN3-10A bolt, AN960-3L washer, and an MS21042-3 nut.

\* BOLTS IN PUSH TUBE SHOULD BE INSTALLED VERTICALLY, HEADS UP. BOLT WON'T FALL OUT IF NUT DROPS OFF.

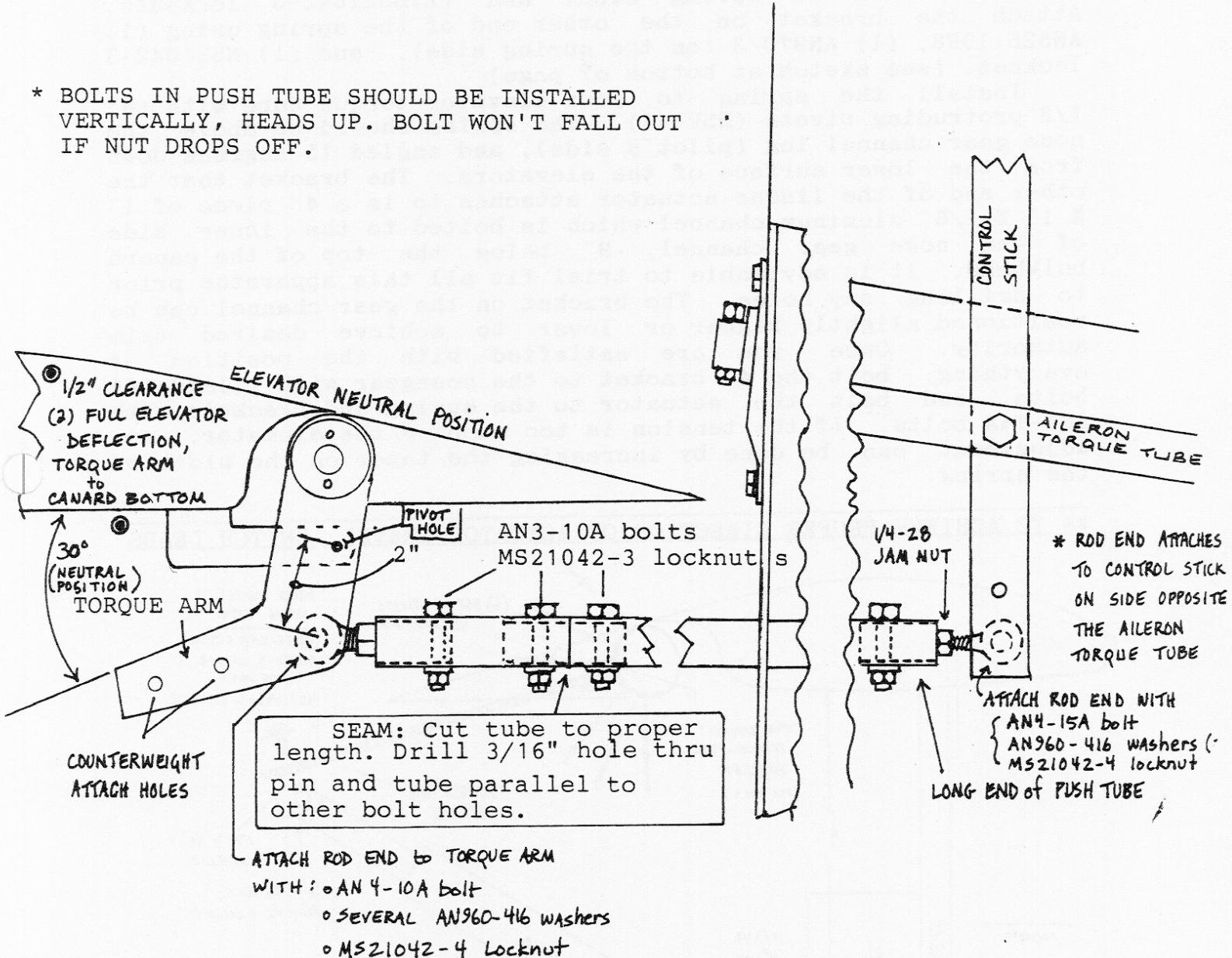


## SECTION 6

RIGGING OF CONTROL SYSTEMS

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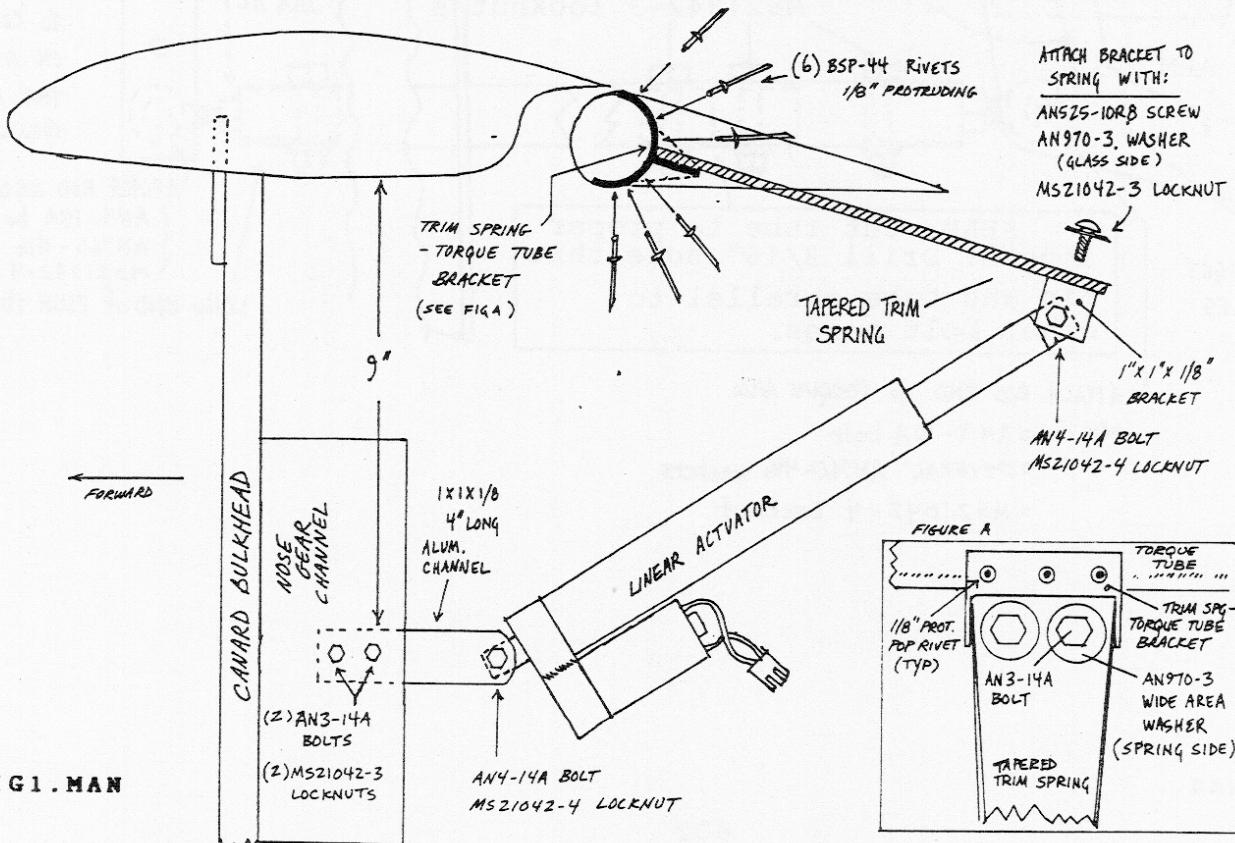
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ELEVATOR TRIM

There are two types of elevator trim on the VELOCITY. The first is electromechanical and the second is aerodynamic (optional). To begin installation of the electromechanical trim, you will first install the wide end of your trim leaf spring to the adaptor bracket with (2)AN525-10R8 screws, (2)AN970-3 wide area washers on the spring side, and (2)MS21042-3 locknuts. Attach the bracket on the other end of the spring using (1) AN525-10R8, (1) AN970-3 (on the spring side), and (1) MS21042-3 locknut. (see sketch at bottom of page)

Install the spring to your elevator torque tube with (6) 1/8" protruding rivets (BSP-44). The spring should be above the nose gear channel leg (pilot's side), and angled 15 degrees down from the lower surface of the elevators. The bracket that the other end of the linear actuator attaches to is a 4" piece of 1" X 1" X 1/8" aluminum channel which is bolted to the inner side of the nose gear channel, 9" below the top of the canard bulkhead. It is advisable to trial fit all this apparatus prior to drilling any holes. The bracket on the gear channel can be positioned slightly higher or lower to achieve desired trim authority. Once you are satisfied with the position of everything, bolt the 4" bracket to the nosegear with (2)AN3-14A bolts, and bolt the actuator to the spring and brackets with AN4-14A bolts. If the tension is too much on the elevator, some adjustment can be done by increasing the taper on the width of the spring.

\*\* TO ACHIEVE PROPER DIRECTION OF ACTUATOR TRAVEL, SWITCH LEADS

Good Luck Steve! Mel

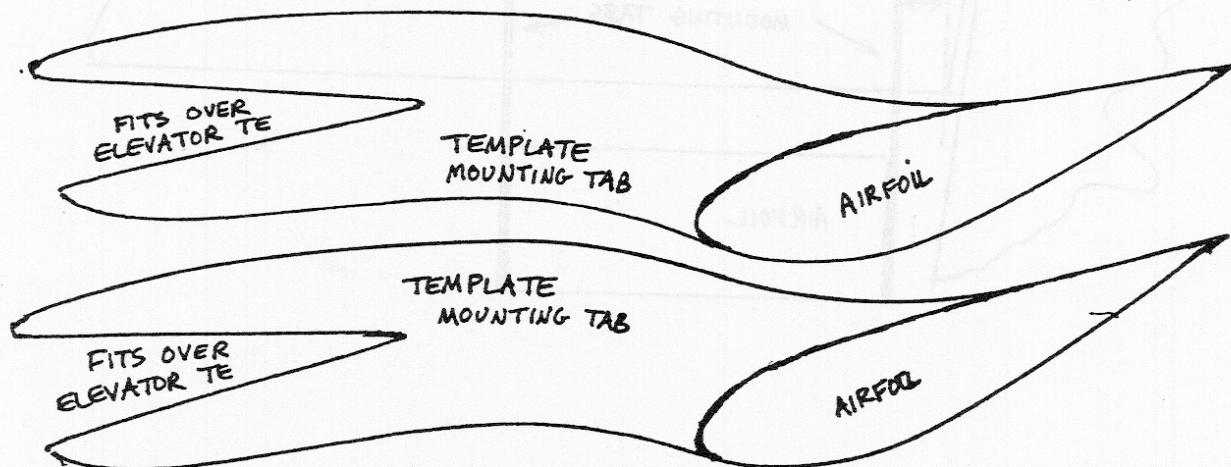
INSTALLATION OF AERODYNAMIC TRIM (SPARROW STRAINER)

The aerodynamic trim is simply a small inverted airfoil, that helps trim the aircraft, especially around cruise speed. It seems to minimize the number of electric trim inputs made by the pilot, and really helps us take advantage of the inherent stability of the Velocity.

The aerodynamic trim mechanism can be fabricated by the builder with the following materials:

- (2) 8" X 3" blocks of 3/8" Clark Foam (Blue Foam will work too)
- Fine Bid (Aprox 9" X 7", cut on bias) Covers Airfoil
- Coarse Bid (8 pieces 7" X 4") Mounting Tabs
- (3 pieces 5" x 1") Mounting Flanges

To fabricate the mounting tabs, take your (8) 7 X 4 pieces of coarse bid, and make an (8) ply layup. Let cure, and cut out (2) mounting tabs according to templates below:



Glue your two pieces of Clark Foam together (sandwiched), and let cure. Align the airfoil templates at each end of the foam, and sand/cut the piece to shape. Slurry surface with SAFETYPOXY/MICROBALLON, and cover with one ply Fine Bid. Let cure.

The unit will be mounted on the right elevator in the position shown in the diagram on the previous page. The IB mounting tab is located 1.75 inches outboard from the IB TE corner of the right elevator. The OB mounting tab will be 8 inches outboard of the first tab.

To construct mounting flanges for the tabs, place release tape on the elevator to cover an area 1" all the way around the mounting flange positions. Tape both the upper and lower surfaces of the elevator. The tape is to provide a release surface for the following layup, and to protect your elevator surface from any stray epoxy. You can cover a larger area with the tape if you like. See lower diagram - previous page.

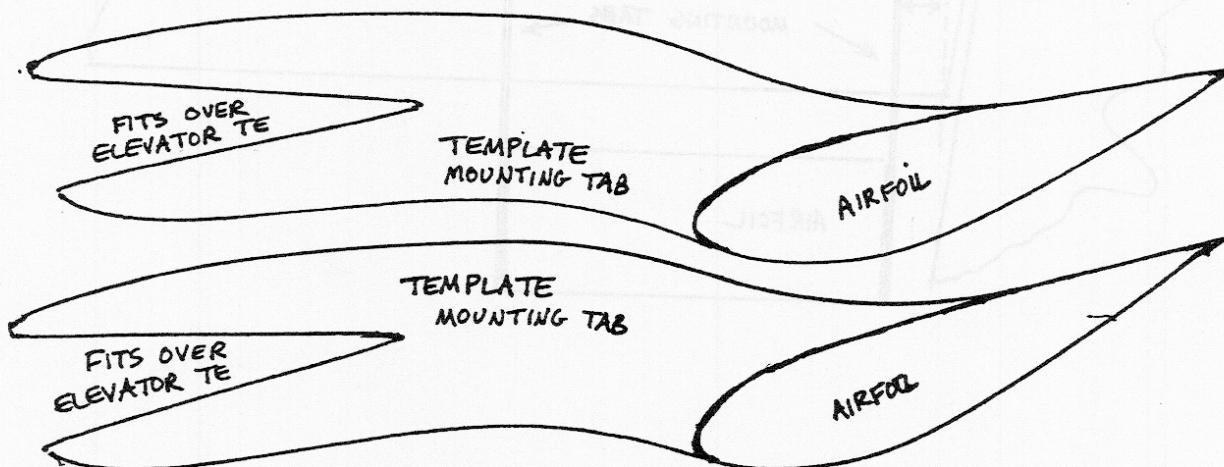
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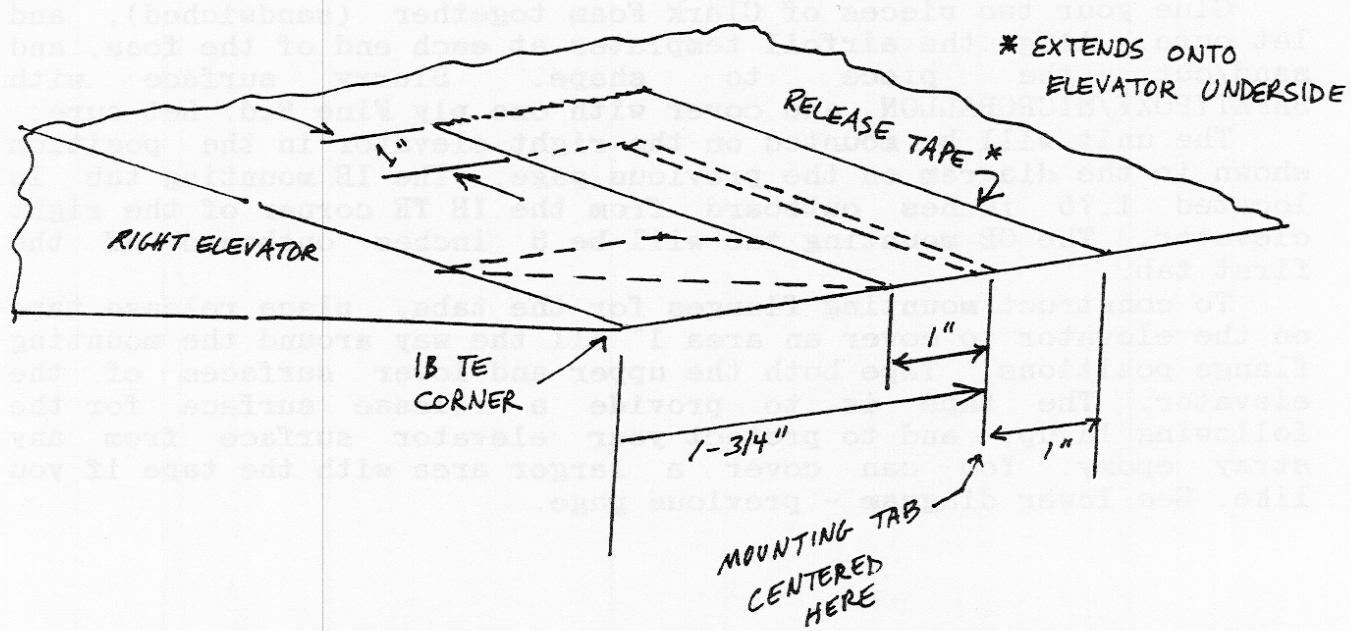
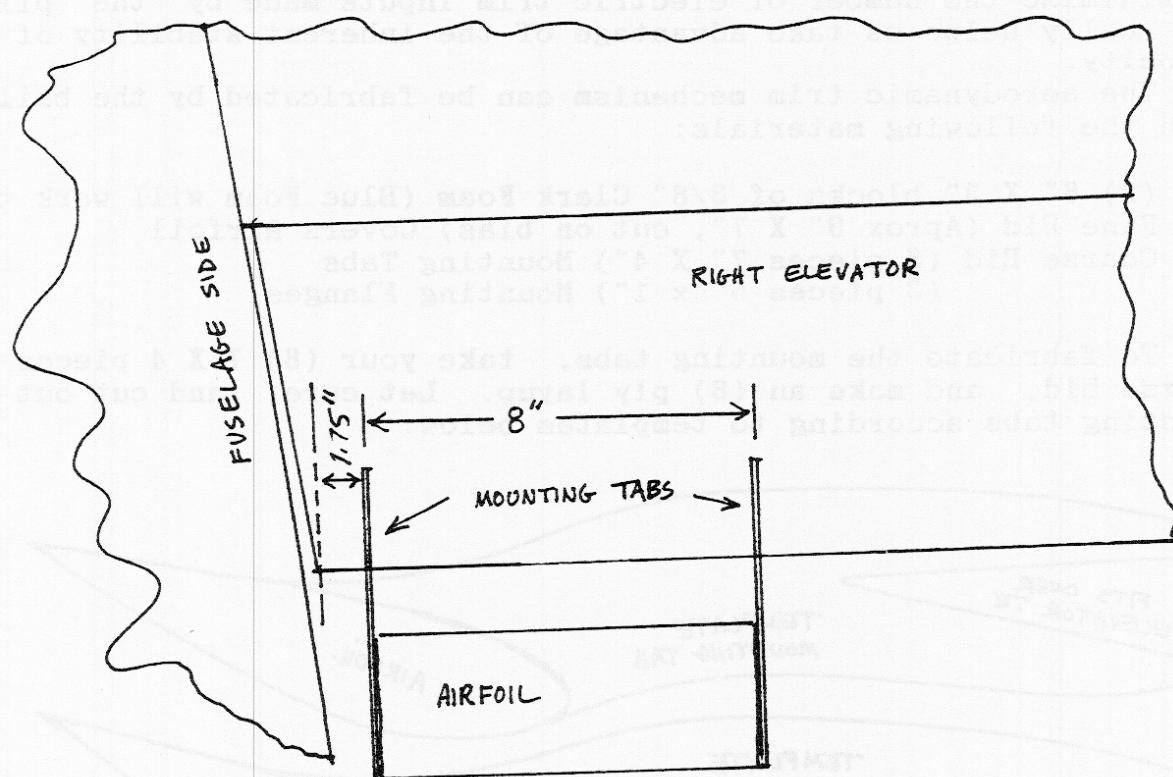
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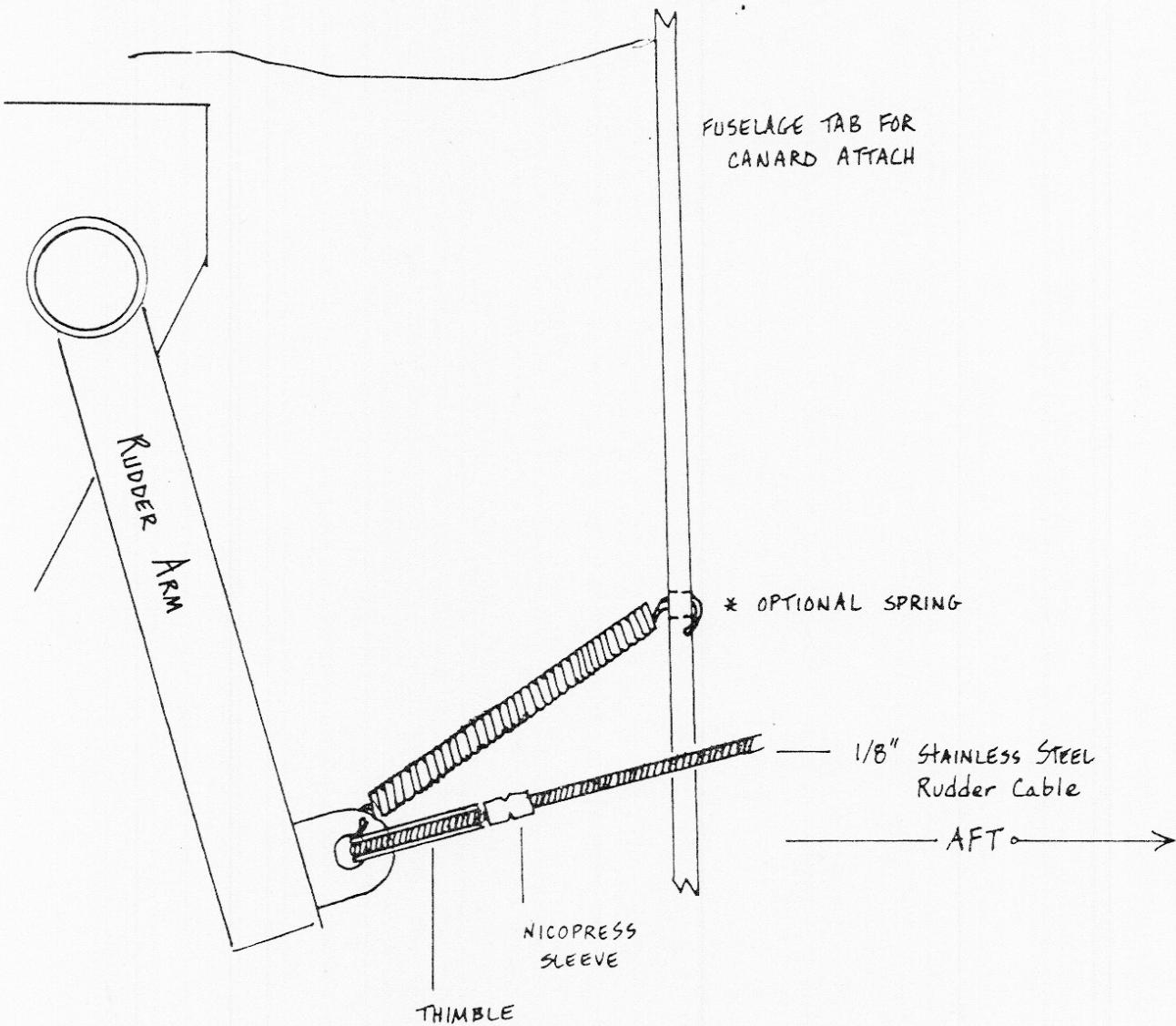


## SECTION 6

RUDDER CABLE INSTALLATION

In the fuselage section, you installed the rudder cable conduits down each side of the fuselage, and in the wing section, you installed the conduits in the wings. Now it is time to install the actual cable in the conduit.

Run a length of your 1/8" SS cable down each side of the fuselage. Affix a nicopress sleeve and thimble to the rudder pedal end of each cable and attach them to the pedal ends. Leave yourself approximately 12" of cable extending through the firewall, then cut off the conduit so that it extends only about 1/4" aft of the firewall. Assemble the pulleys and the two angle brackets with AN3-6A bolts and MS21042-3 nuts.



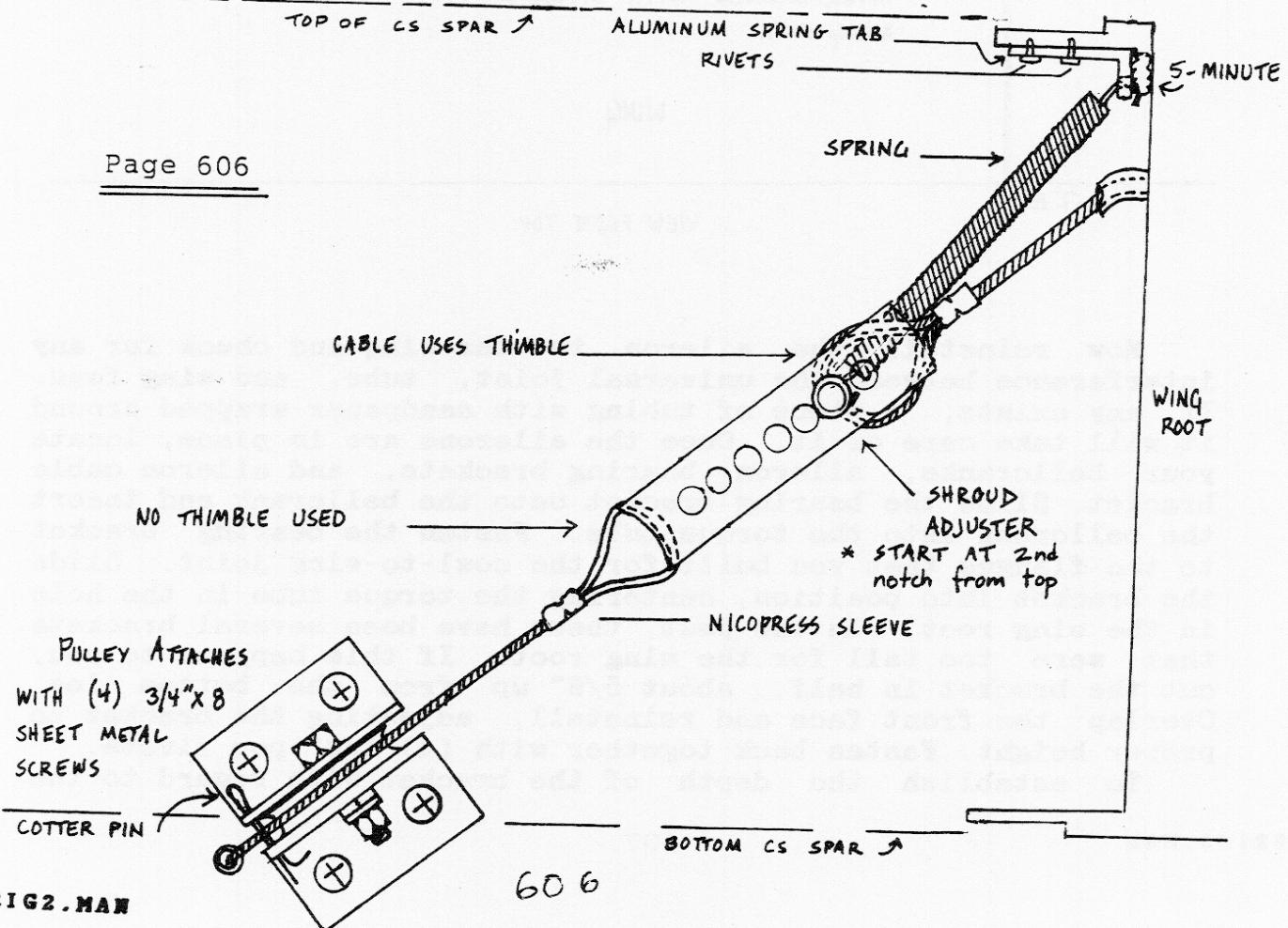


RUDDER CABLE INSTALLATION

Take a section of cable and run it the length of the wing. Put this length into the wing conduit and run it through. Trim the cable so that 12" extends out the winglet end, and 8" extends at the wing root. Cut the conduit flush with the winglet skin. Tape the fuselage cable and wing cable together, and pull out the slack at the winglet end. Now position your pulley so that the cable comes through the firewall, around the pulley, and straight towards the wing conduit. Move the pulley around to achieve best alignment. When you are satisfied with the pulley position, attach the fixture to the firewall with (4) 3/4 X 8 sheetmetal screws. Install the small cotter pin as shown below to keep the cable from jumping track. Now install the rudder cable to the rudder bellcrank with a thimble and nicopress sleeve.

The shroud adjuster is installed on the end of the fuselage cable with a nicopress sleeve, no thimble is needed. At the firewall end of the wing root rudder cable, install a thimble and nicopress sleeve. This should fit tightly when attached to the second position on the shroud adjuster. This gives you one hole to loosen the system, and several to take up excess slack. After some use, the system may need adjustment to achieve full rudder deployment. We have found that it is helpful to attach a small tension spring between the shroud adjuster and the wing root to assist the rudder return spring with the rudder pedals themselves. Rudders on the VELOCITY are not critical, and the aircraft can be operated without them, but they sure come in handy during taxi and final approach.

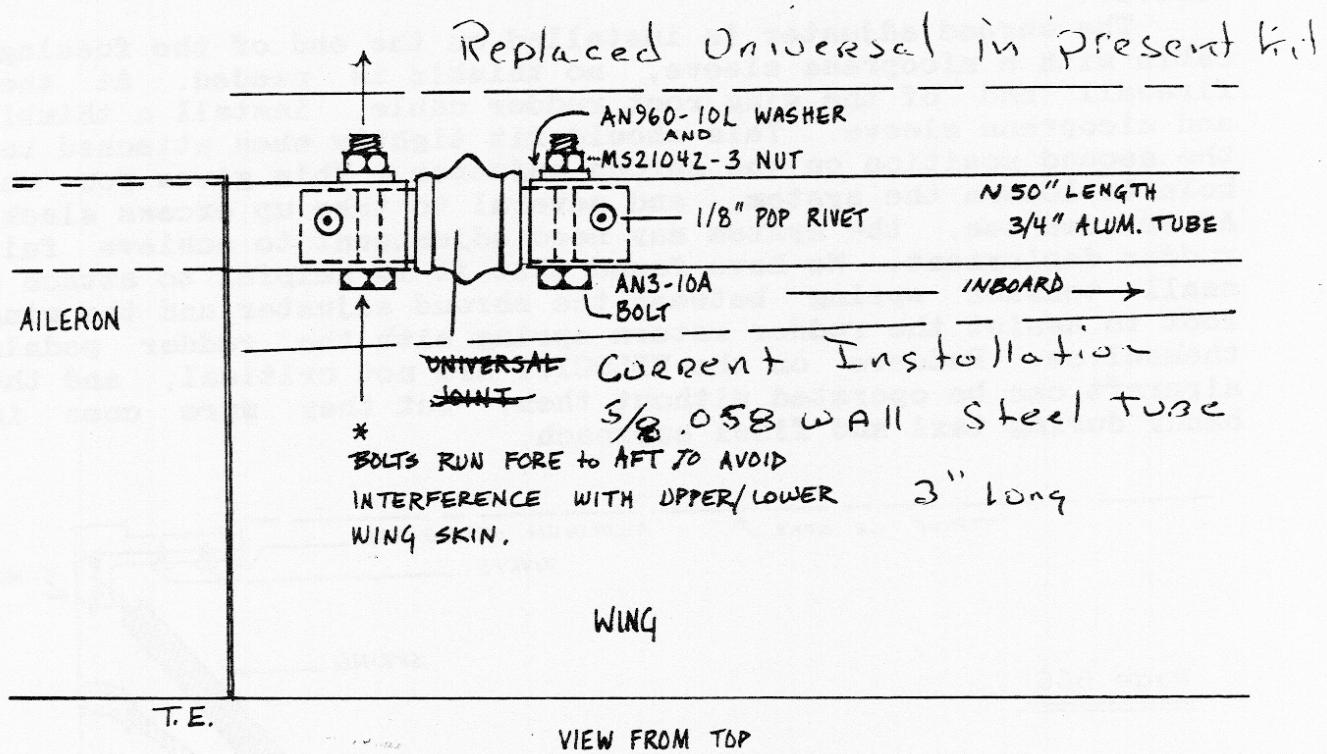
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## SECTION 6

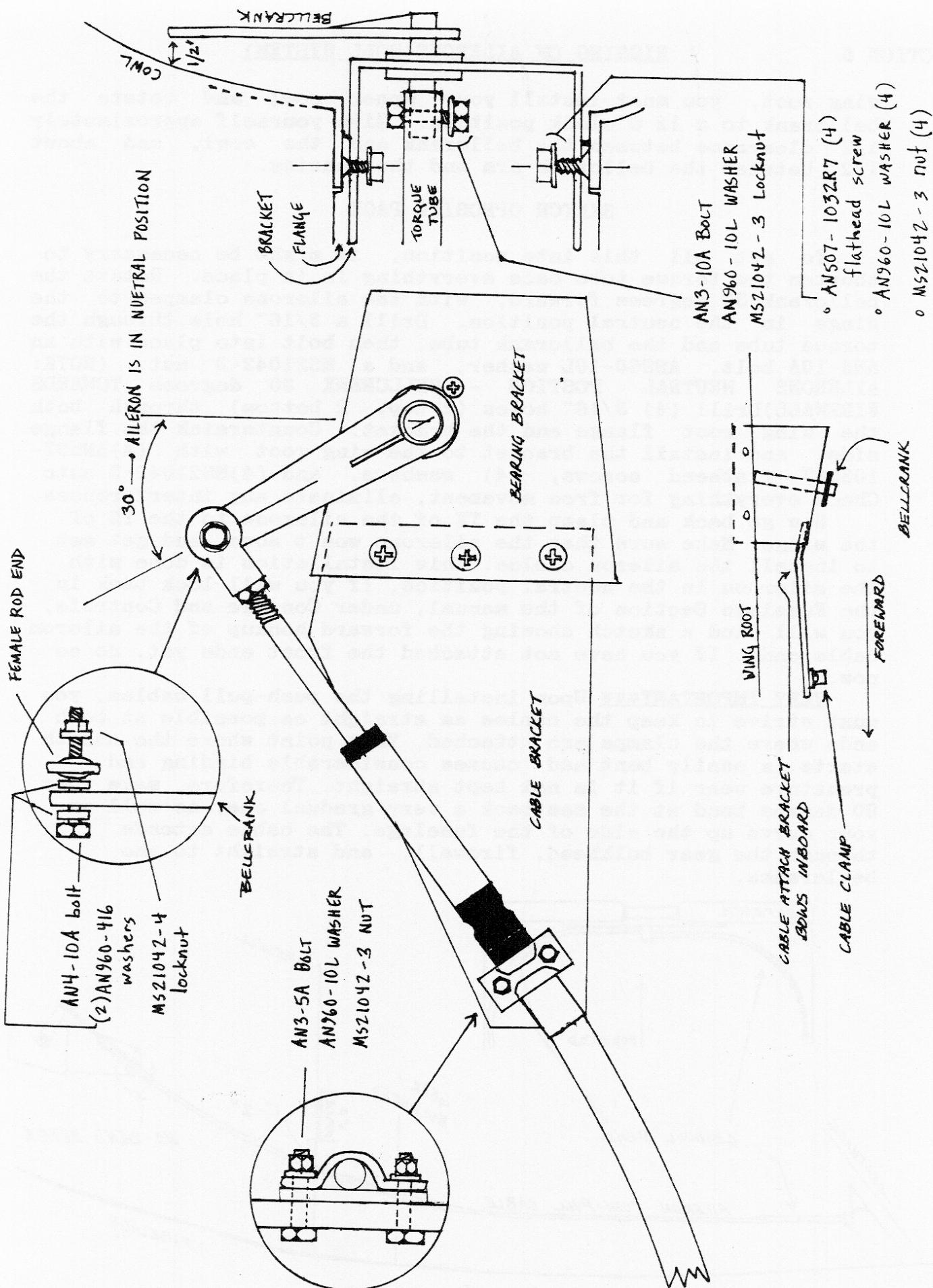
RIGGING OF AILERONS(ROLL SYSTEM)

To complete this portion of the project, the wings must be on the airframe. The first step is to install the aileron torque tubes to the ailerons. Remove the aileron from the wing and install approximately 50" of 3/4" aluminum tubing to the aileron universal joint and to the short piece of 3/4" aluminum tubing sticking out of the inboard end of the aileron. Attach with (2)AN3-10A bolts, (2)AN960-10L washers, and (2)MS21042-3 nuts. Make sure that the bolts are oriented fore and aft with respect to the airframe. If they are not, they will interfere with the upper and lower skins of the wings. Once the bolts are in place, put in a couple of pop rivets for insurance.



Now reinstall the aileron to the wing and check for any interference between the universal joint, tube, and wing foam. If any exists, a piece of tubing with sandpaper wrapped around it will take care of it. Once the ailerons are in place, locate your bellcranks, aileron bearing brackets, and aileron cable bracket. Slide the bearing bracket onto the bellcrank and insert the bellcrank into the torque tube. Fasten the bearing bracket to the flanges that you built for the cowl-to-wing joint. Slide the bracket into position, centering the torque tube in the hole in the wing root. In the past, there have been several brackets that were too tall for the wing root. If this happens to you, cut the bracket in half, about 5/8" up from the bottom leg. Overlap the front face and reinstall, adjusting the bracket to proper height. Fasten back together with (4) 1/8" pop rivets.

To establish the depth of the bracket with regard to the



## SECTION 6

RIGGING OF AILERONS(ROLL SYSTEM)

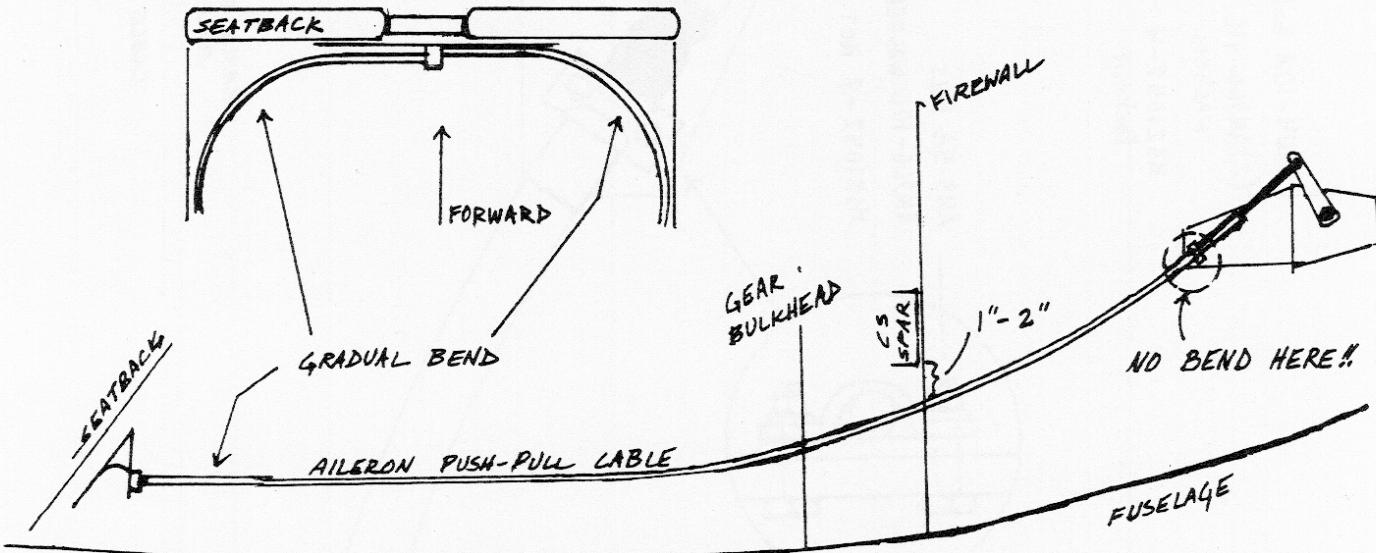
wing root, you must install your upper cowl and rotate the bellcrank to a 12 O'clock position. Give yourself approximately 1/2" clearance between the bellcrank and the cowl, and about 1/2" between the bellcrank arm and the bearing.

## SKETCH OPPOSITE PAGE

To get all this into position, it might be necessary to shorten the torque tube once everything is in place. Rotate the bellcrank 30 degrees forward, with the ailerons clamped to the wings in the neutral position. Drill a 3/16" hole through the torque tube and the bellcrank tube, then bolt into place with an AN3-10A bolt, AN960-10L washer, and a MS21042-3 nut. (NOTE: AILERONS NEUTRAL POSITION - BELLCRANK 30 degrees TOWARDS FIREWALL) Drill (4) 3/16" holes (2 top, 2 bottom) through both the wing root flange and the bracket. Countersink the flange side, and install the bracket to the wing root with (4)AN507-1032R7 flathead screws, (4) washers, and (4)MS21042-3 nuts. Check everything for free movement, eliminate any interferences.

Now go back and clamp the TE of the ailerons to the TE of the wings. Make sure that the ailerons won't move, and get set to install the aileron cables. This installation is done with the ailerons in the neutral position. If you will look back in the Fuselage Section of the manual, under Console and Controls, you will find a sketch showing the forward hookup of the aileron cable ends. If you have not attached the front ends yet, do so now.

**VERY IMPORTANT\*\*\*** Upon installing the push-pull cables, you must strive to keep the cables as straight as possible at both ends where the clamps are attached. This point where the sheath starts is easily bent and causes considerable binding and premature wear if it is not kept straight. Therefore, make your 90 degree bend at the seatback a very gradual one, as well as your curve up the side of the fuselage. The cable extends through the gear bulkhead, firewall, and straight to the bellcranks.



If installed properly, these cables will give you many years of smooth, trouble-free performance.

Returning to the cable installation, project your cable forward from the end of the bellcrank, down through the firewall approximately 1" - 2" below the spar and right up against the fuselage skin. Drill a 5/8" hole in the firewall at this point, then go inside and drill another hole in the gear bulkhead just a bit lower than the one in the firewall. This allows you to install the cable with a slight, continuous curve towards the nose of the airplane. ( Cables do not go inside the duct.) Curve the cables gradually inboard at the seat bulkhead to intersect with the control tube bellcrank. Connect the cables to the control bearing bracket as in the sketch that you referred back to in the above text. Once the stick is hooked up, check entire assembly for any binding. Use white lithium grease to lubricate the cable ends under the little rubber cups.

Now install the cable brackets to the aileron bearing brackets. The cable clamp holes are pre-drilled and the brackets are slightly bent where they attach to the bearing bracket. This bend may have to be altered to insure that the cable remains straight at this point. Clamp the cable to the bracket with (2)AN3-5A bolts, (2)AN960-10L washers, and (2)MS21042-3 nuts. Use the clamps and shims provided.

Once the cable is clamped to the bracket, attach to the wing root bellcrank (angled at 30 degrees forward) with a 1/4" female rod end, an AN4-10A bolt, (2)AN960-416 washers, and an MS21042-4 locknut. Position the cable at the middle of its travel, control stick in vertical position. Hold the cable bracket up against the bearing bracket and position it so that the cables are as straight as possible. Clamp in place, drill (3) holes through both brackets, and bolt into place with (3)AN525-10R8 truss head screws, (3)AN960-10L washers, and (3)MS21042-3 nuts. When everything is in place, check for binding.

\*\*\* WHEN EVERYTHING IS HOOKED UP PROPERLY, STICK SHOULD POINT AT UP AILERON.\*\*\*

If any binding occurs, check for misalignment in the cables, over-tightened bolts, lack of lubrication, or misalignment of bearing to torque tube. When the stick is fully deflected, you should get at least 2" of deflection at the inboard TE of the ailerons, both up and down. A properly rigged system will get approximately 2-1/2" both up and down. Any adjustments to achieve symmetry in aileron deflection should be done with threaded rod ends. Be careful to always use locknuts and that there is at least 1/4" of thread in the rod end following any adjustments. The system will become smoother with use.

After approximately 400 hours on 401DM, the system is as good as ever and smoother than ever. We have found that there is very little slack in the cables and that tiny bit goes away once the craft is in flight due to aerodynamic loading on the

## SECTION 6

### RIGGING OF AILERONS(ROLL SYSTEM)

ailers. If excess slop occurs, it is usually the result of sloppily drilled holes in mated components in the linkage between the ailerons and stick. If you find a poor joint, either redrill or ream the hole, and install an oversize tolerance bolt. In the case that the hole is on a permanent assembly not used for dismantling the aircraft, put a couple of 1/8" pop rivets in to help out.

BE AWARE THAT SLOPPY CONTROLS DIRECTLY AFFECT AN AIRCRAFT'S V.N.E.. FLUTTER USUALLY STARTS IN A CONTROL SURFACE, THEREFORE KEEP A CLOSE EYE ON THE SYSTEM IF SOMETHING SHOWS UP THAT SHOULDN'T BE THERE. INVESTIGATE AND REPAIR PRIOR TO YOUR NEXT FLIGHT !!!