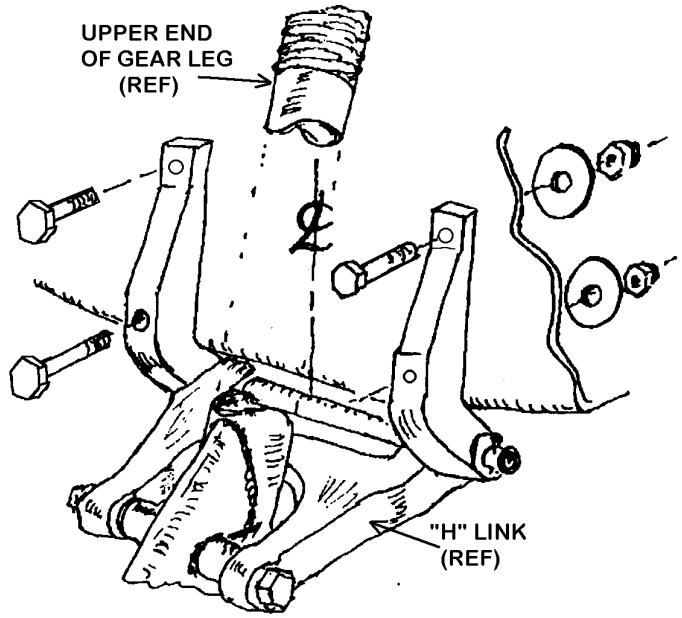
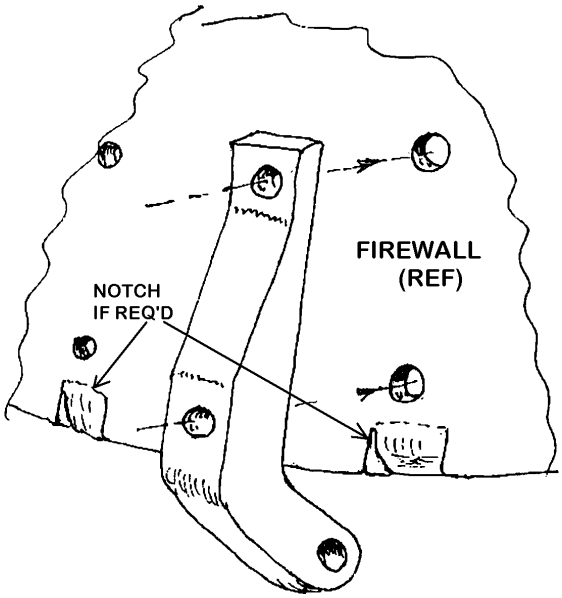
# 2 PLACE SUPPLEMENT - NEW NOSE GEAR

The nose gear for the two place KIS kits has been significantly modified in the later kits, and the revised design is also available as a retrofit for earlier kits. The new design utilizes a dedicated coil spring and hydraulic shock strut to absorb and dissipate the energy of a high drop velocity landing. The original gear, which only utilizes the spring of the welded assembly, has served the prototype aircraft well, with no problems, but some customers have experienced failures when operating in rough fields, or in rough landings. As in all upgrades there is a measurable penalty in system complexity and weight (about 7 pounds increase) but the use of a dedicated spring and shock absorber will significantly improve the durability of the system, and improve ground handling in rough terrain.




The gear assembly is shipped with the linkage assembled, and installation is pretty straightforward.

The first step is to locate and install the lower swing arm brackets on the lower face of the firewall. Keep the brackets assemble d to the swing arm (“H” link) to assure that they will line up and not put a bind on the movement. Center the gear assembly, and position the brackets up as far as the elbow of the arm will easily permit. Make sure that the gear leg is centered and extends straight downward.




Verify the location of the lower holes to determine if there will be sufficient room inside the firewall to install nuts and washers. A small pilot hole drilled in the firewall, centered in the lower holes in the support brackets, will aid in this determination. One side of the area

washer may be cut away to clear the bottom of the fuselage, but if there is still not enough room, the bottom corner of the firewall may be notched slightly to raise the assembly for required nut clearance.

If position is satisfactory, drill clearance holes for 5/16 inch. bolts install the 4 5/16 inch bolts to secure this assembly in place. Use large area washers to distribute the load on the back side of the firewall.

The linkage will work best, and should provide the proper running height if the top bracket is positioned such that the link is roughly level at static load. Setting the position such that the arm is about ½ inch down at no load should set this about right. It may well be a good idea to verify this setting to provide adequate prop clearance a desired static attitude during taxiing.

The linkage angle will work through a reasonably wide range, but setting it too high may result in the link binding before full stroke of the spring can be utilized.

When you are satisfied with this positioning, drill the firewall and install the top two 5/16 bolts with large area washers on the back side of the firewall.

It would be good to make a last minute check on the position of these holes to assure that they fall in an area that has been reinforced with added layers of glass, and that the bolts or washers do not interfere with the cross stiffener on the back side of the firewall. In this location it is also permissible to cut away one edge of the area washers to clear local stiffeners if required.

The adjustment of the castering nose wheel yoke is very similar to the procedure for the previous steel design. This item should come installed but if it is disassembled for any reason note the relationship of the spring and plain washers for proper reassembly.

Check the pivot friction regularly, particularly during early operation as it breaks in. It should take a fairly vigorous push (about 15 to 20 lbs) at the axle location to pivot the assembly. If shimmy is noted during operation, check the tension in this assembly to assure that friction is present for damping. Friction is increased by tightening the castellated nut (be sure and replace cotter key).

The aluminum yoke sides provide a wide choice of locations for drilled and tapped holes for fastening the front wheel pant. The drag of an unfaired nose wheel is very high so close attention to this area will help in cruise speed and fuel economy.

Since the aluminum yoke uses thicker material than the original steel yoke, it mat be necessary to trim about ¼ inch off the aluminum axle to properly tighten the axle bolt. Be sure that the ends of the aluminum axle are kept square (use a lath if possible).

# AIRFRAME ASSEMBLY

## MOUNTING WING

The mounting and positioning of the wing is one of the most important steps of the airframe assembly, both from the standpoint of structural integrity, and flight performance.

The first step is to level the fuselage assembly very accurately and securely in all axes. Use the cockpit sills for this operation, since they are a convenient reference and should accurately reflect the aircraft center plane. The wing should be located beneath the plane and centered on the spar box opening. Foam or padded wood blocks should be prepared for blocking up the wing in the desired position. Carefully raise the wing up into the spar box opening in the fuselage. You will probably encounter interference between the wing upper skin and the sides of the fuselage. Mark these areas for trimming, such that about one quarter to a half-inch clearance will be provided when the wing is installed (this gap will be covered by wing root fairings so it is not greatly critical.)

**NOTE - BE VERY CAREFUL DURING THESE TRIMMING OPERATIONS TO NOT NICK OR CUT INTO THE SPAR CAP (WHICH IS DIRECTLY BELOW THESE SKINS) IN ANY FASHION, THIS IS A HIGHLY STRESSED FLIGHT SAFETY PART.**

After trimming, raise the wing into position once more, and adjust position for centering, leveling, and angle of attack. Centering is rather straightforward, just measure out from the fuselage on each side to an identifiable feature at each tip. For leveling side to side a water level is suggested as the easiest and most accurate way to establish this measurement. Use transparent tubing, and make sure that there are no air traps nor significant bubbles in the fluid. Extra help is almost a necessity for these operations. If the spar touches the top of the "box" on one side, but not the other, a shim on the side that does not touch is a good idea.

Verify the "square" with fuselage centerline by marking a dot on the center of the fin dorsal at a convenient point and measuring from that dot to a corresponding point on each wing tip (The forward edge of the spar intersection with the outer edge of/the skin is probably a good point). Rake one side or the other forth or back, to make these dimensions equal.

The angle of attack specified for this aircraft is 3 degrees positive (front edge of the chord line higher than the rear) . The easiest way to establish this is to use the upper surface contour template, and cut a straight edge 3 degrees down on the upper surface of the template. This edge can then be tested with a level to establish the 3 degrees on the airfoil. Check several places to assure that there is no twist in the wing assembly (If a measurable amount of twist is noted contact Tri R Technologies for sympathy and assistance).

When the wing is positioned satisfactorily (and located securely so it will not shift), locate and drill the ¾ inch holes for the main spar mounting bolts. Drill through first with about a 1/4 inch pilot hole, and enlarge at about 1/8 inch increments (If you get greedy the drill may grab and lock up in the hole, and possibly damage the surrounding material). Use ¾ inch diameter hardware store bolts for temporary attachment and to hold alignment while lining up the final hole.

Locate and drill the ½ inch diameter holes through the rear spar of the wing, and the fuselage stub spar, for the rear spar bushings. This also should be drilled in conservative steps to provide a clean accurate hole. Again use ½ inch hardware store bolts for temporary alignment.

Remove the temporary bolts and drop the wing carefully out of position, Bond the appropriate hat shaped bushings into position in the wing mounting holes in the main spar box, and the aft spar center section protruding from the side of the fuselage. The proper bushing is the hat shaped bushing with the ½ inch O.D.

reduced size section, and the longer ( ½ inch) reduced section (part number KS-20)(the shorter pair (KS20A) are for the rear spar section in the wing assembly). Bond in place with FLOX/Micro slurry, with the flange side away from the location of the wing rear spar section. Bond the other pair with the shorter ½ inch diameter section into the rear spar section in each wing half, with the flange side away from where the fuselage mounted section of the rear spar will occupy.

Use the larger hat shaped bushings (part no. KS19) in the ¾ inch holes in the main spar "box". Again use a FLOX/MICRO slurry to bond them in place. Slip the straight main spar bushings (part no. KS18) into the ¾ inch hole drilled through the central (neutral axis) section of the spar, and bond them solidly in place with FLOX/MICRO. These should be a little extra long, so carefully dress down the protruding ends until the assembly can be re-inserted into the spar "box"

Re assemble the wing using the specified bolts and associated hardware. The main spar shear bolts are AN8 46. The aft spar mounting bolts are AN514A. Line up these bolt holes as required with a tapered pin. Some reaming at nominal bolt diameter may be required, but only do this reaming if absolutely required and after all fit up procedures have been expended. If more than just a light ream appears to be required, disassemble and re-investigate all of the process steps.

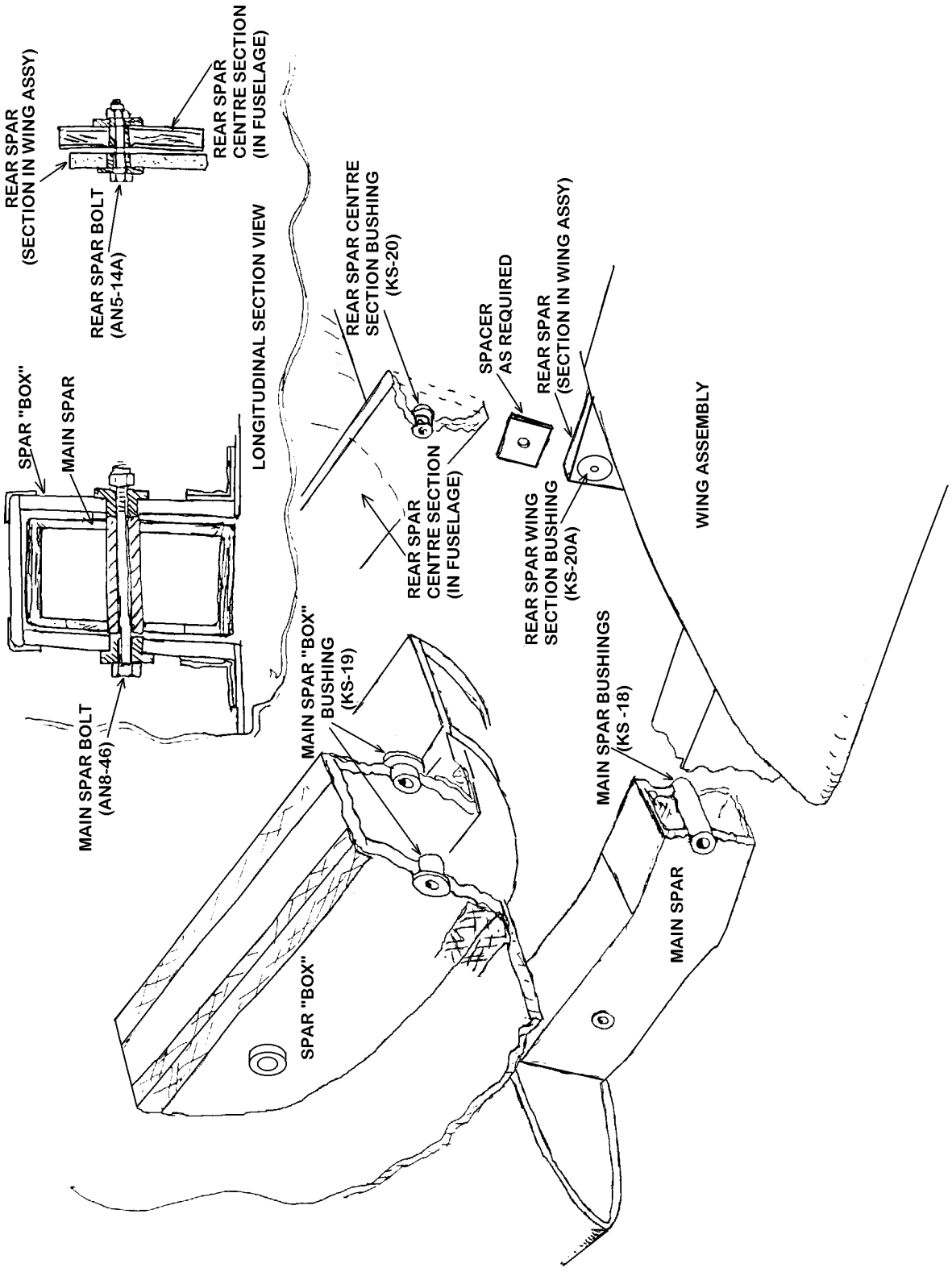



**FIGURE - Wing Installation - Bushing Placement**

## FABRICATION AND INSTALLATION OF CONTROL TUBES

The primary flight control system in the aircraft utilizes seven push-pull control tubes to move the elevators and ailerons. This section of the manual describes making and installing these push-pull tubes.

The control tubes are as follows:

FORWARD ELEVATOR TUBE (1 required) connects the elevator control crossover (KS30) to the elevator idler arm (KS31). This tube is fabricated and installed during construction of the fuselage.

AFT ELEVATOR CONTROL TUBE (1 required) connects the elevator idler arm (KS31) to the elevator horn assembly (KS1). This tube is installed during construction of the fuselage.

BETWEEN-STICKS TUBE (1 required) connects the left and right control sticks (KS34). This tube is fabricated and installed during construction of the fuselage.

LONG AILERON CONTROL TUBES (2 required) connect the right and left control sticks (KS34) to the right and left aileron bellcranks (KS2). These are fabricated and installed during final assembly.

SHORT AILERON CONTROL TUBES (2 required) connect the right and left aileron bellcranks (KS2) to the right and left aileron control brackets (KS4). These are fabricated and installed during final assembly.

First study the drawings on the following page to understand exactly how the tubes are to be prepared with end fittings. Each diameter aluminum tube is terminated slightly differently. Note that in some cases an adapter is required to sleeve the parts.

No length specifications are given for the tube lengths because all tubes should be cut to length and assembly-fitted while in place on the airframe. This method will minimize cutting tubes too short.

Before assembling any of the parts fill the cavities in all the AN490 type end fittings with micro-fox and allow it to cure. The reason for doing this is that rivets will be used to fasten the assembled fittings; peening heads on these rivets without the micro-fox prevents column buckling of the rivet shank inside the cavity while driving the rivet.

When fabricating a tube (or pair of tubes) select the proper diameter 6061T6 aluminum tube and the end fittings that are required. Mark the tube very accurately regarding rivet spacing from the end.

**NOTE: IF THE RIVETS ARE NOT ACCURATELY SPACED FROM THE TUBE END THEY WILL EITHER INTERFERE WITH EACH OTHER OR BE POORLY LOCATED TO SAFELY CARRY THE CONTROL LOADS. IF YOU DEEM THAT YOU HAVE NOT PROPERLY PLACED THE RIVETS START AGAIN.**

If you are unfamiliar with riveting it would be wise to have an experienced person give you some tips and loan you some tools. Also refer to FAA Advisory Circular 43.13 “Aircraft Inspection and Repair” for proper riveting technique.

Assemble the parts into one tube end at a time. Do the drilling with a drill press. Place the tube in a drill press vise and tighten it enough that the fittings will not move inside the tube while drilling. Drill the first hole with a 1/8 or #31 drill. Place an AN470AD-4-22 rivet through the hole. (Use an AN470AD-4-12 for ½ inch diameter tubes.) Cut the excess rivet shank off so that about 3/16 inch remains. Form the rivet head using aviation techniques. A hammer may be used. The finished head should be about 3/16 inch in diameter and about 3/32 (.090) high.

When you are satisfied with the first rivet repeat the process for the second rivet. The hole should be oriented approximately 90 degrees from the first. This virtually completes one end except for threading the proper nut and ball end fitting which should be added at this time.

**WARNING: DURING ADJUSTMENT OF END FITTINGS BE SURE THAT EACH BALL FITTING IS THREADED FAR ENOUGH ONTO ITS AN490 FITTING THAT A PIECE OF SAFETY WIRE CANNOT GO THROUGH THE WITNESS HOLE IN THE SHANK OF THE BALL END FITTING. LOCK THE ADJUSTMENT WITH THE AN315 NUTS.**

After installing the fittings on one end of the tube it is time to determine the exact length and cut the tube to proper length. Mark the cutting length while the tube is in position on the airframe. The length should be such that connected controls are in their neutral position. Bellcranks and idler arms should be in the middle of their throw and fittings should interface with them at right angles.

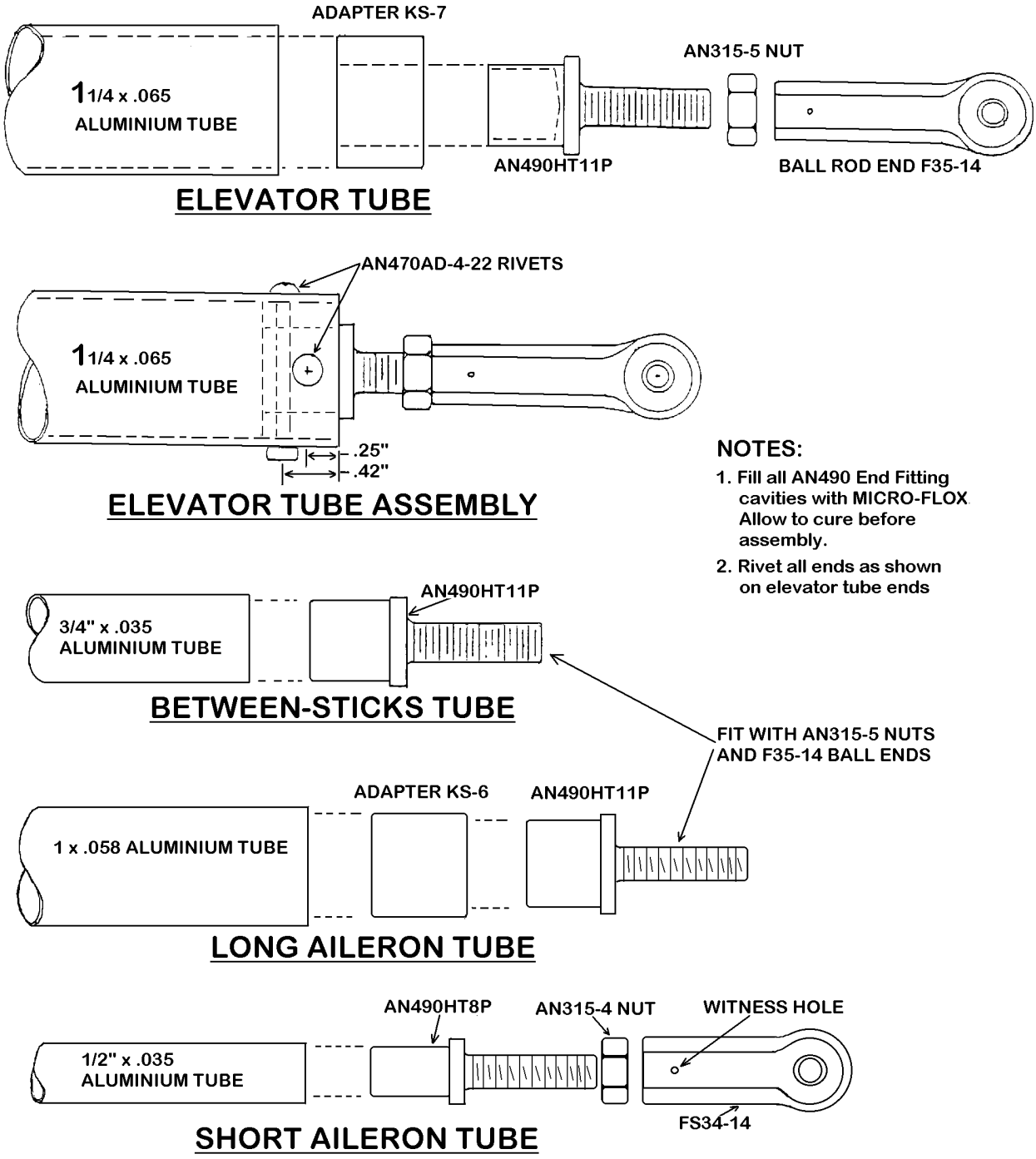
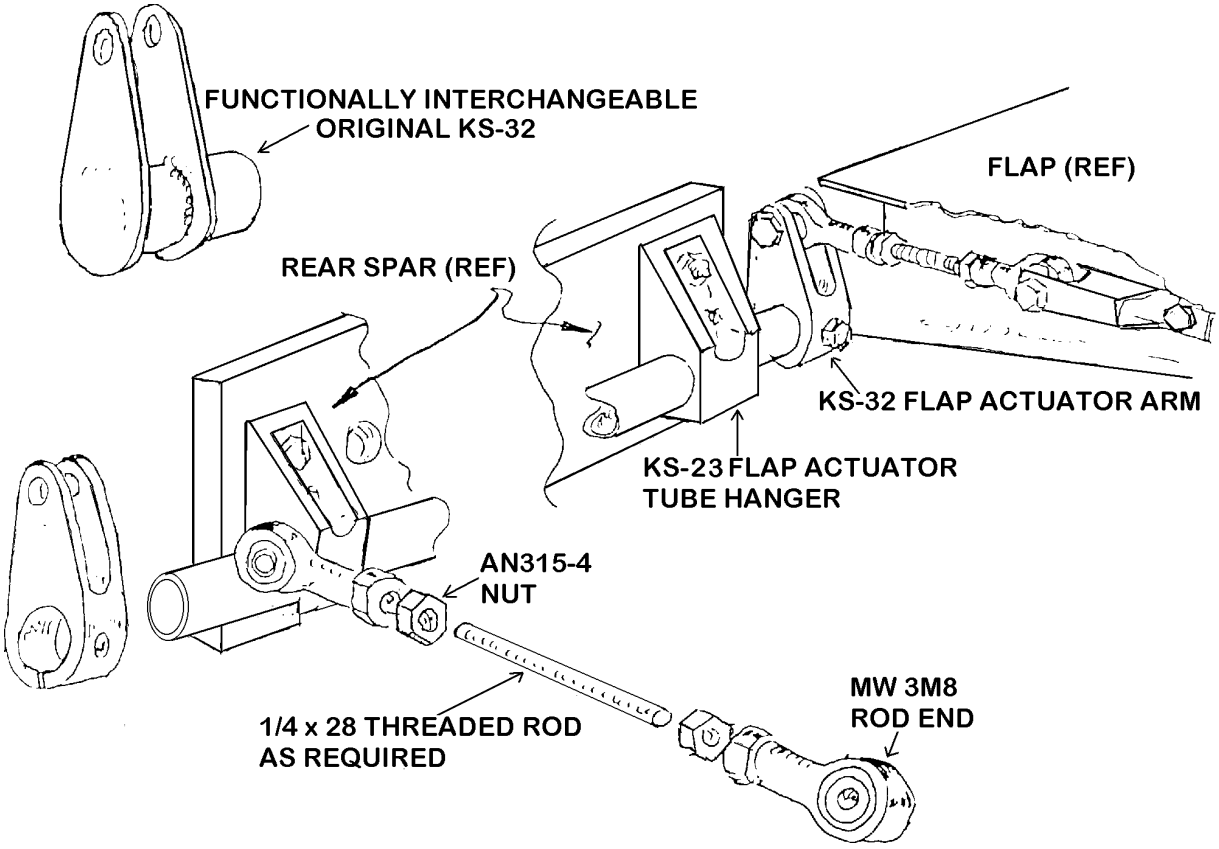



**FIGURE -** Rod end assemblies for push pull tubes.

## FABRICATION AND INSTALLATION OF THE FLAP PUSH LINKS

Set the cockpit flap control lever in the "flap up" position. Slide the flap actuator arms (KS32) into position on the ends of the flap torque tubes. Adjust the endplay and drill and bolt these in the vertical position using AN3 bolts and elastic stop nuts.

Tape the flaps in the "up" position in order to determine the length of the flap push links. Make two push links the correct length. Each of these is made from a length of ¼-28 threaded rod about 2½ inches long, two female rod ends (MW3M8), and two nuts (AN 3 15-4). Install the links and adjust to exact length. Be sure to use the nuts to lock the ends in place once adjusted.



## FUEL SYSTEM

Configuration of that part of the fuel system which lies aft of the firewall will be essentially the same for any KIS regardless of engine selection. Components to plumb the fuel to the firewall have been provided with the kit.

Configuration forward of the firewall will be dependent upon the engine to be used plus other factors. Therefore components to build that portion of the system must be defined and provided by the builder.

Before proceeding with work on the fuel system read “Firewall Forward”. It has countless techniques and ideas that can prevent disaster at a later time.

Refer to the drawing of a typical fuel system shown on the next page for ideas and help in planning and building your system. It shows that fuel from each wing tank is carried by a short length of 3/8 I.D. neoprene hose to a bulkhead fitting at the side of the fuselage. A length of 3/8 O.D. aluminum tubing carries the fuel athwartships to the selector valve and another tube then takes it forward to the bulkhead fitting on the firewall.

The drawing shows that after passing through the firewall the fuel goes via 3/8 aluminum tube to an electric boost pump and then to the gascolator. A flexible fire-resistant hose carries the gas to the engine-driven fuel pump.

**WARNING: This is a low wing aircraft with tanks in the wings and no header tank. The fuel must be pumped to the carburetor or injectors at all times. Never trust a single pump system. Also be particularly careful that the fuel system has adequate filtration. Fiberglass fuel tanks usually contain small bits of stray glass fiber and debris left from the fabrication process; this contamination can work its way through screens and stop flow further down stream. Don’t hesitate to use a superior auto fuel filter of adequate size somewhere in the line.**

Think your system requirements through. For example, what pressure range and delivery rate must the boost fuel pump satisfy? Too much pressure can be as bad as too little. Select the pump and other components with thought. Remember, your engine reliability depends on your fuel system; it must provide enough good clean fuel at the correct pressure.

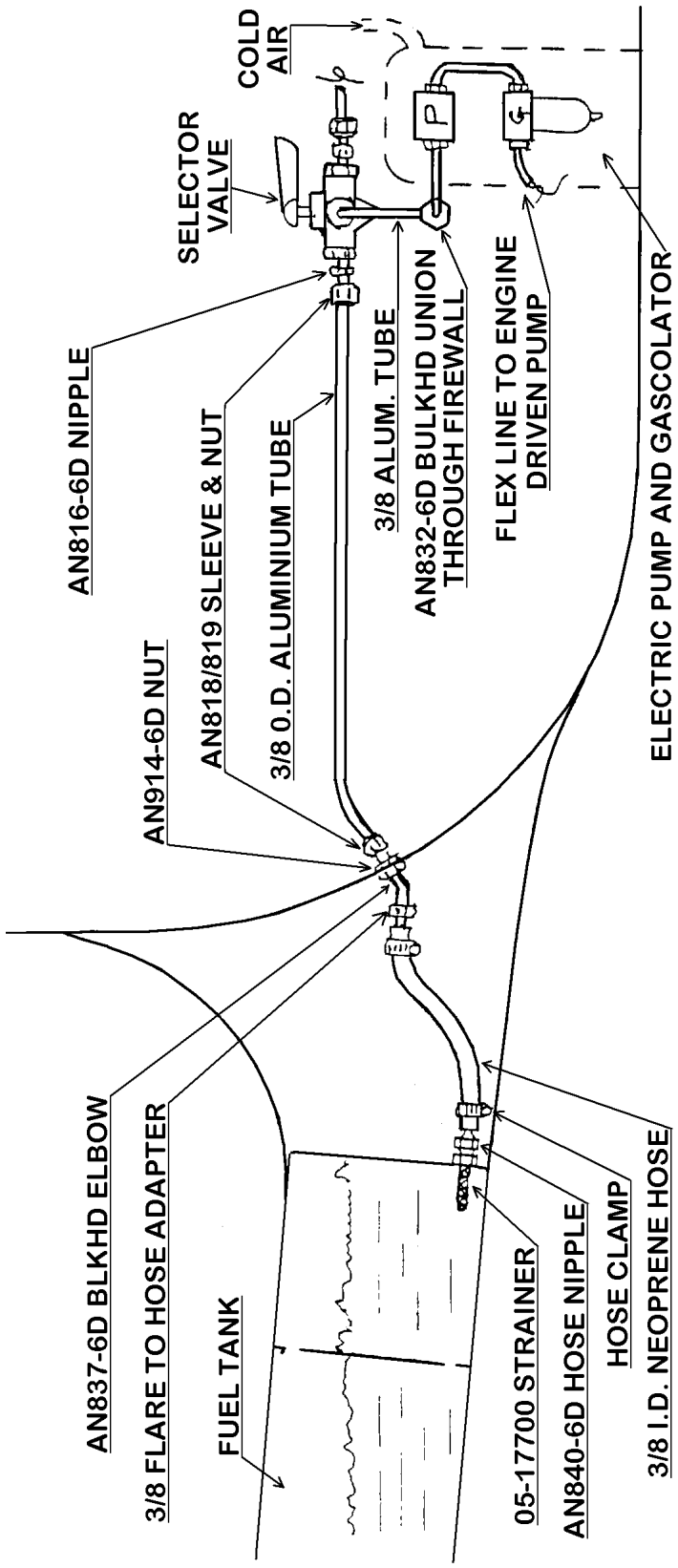



**FIGURE - Typical Fuel Section**

## WING TO FUSELAGE FAIRINGS

Select the molded fairing components, and trim them carefully. With the wing installed in it's proper position, fit the upper forward sections into place to smoothly cover the wing/fuselage intersection. Make a trial installation using cleco's to hold the fairings to the fuselage sides. When you are satisfied with the fit and position, bond the fuselage side joint with a FLOX/Micro slurry. Prepare both surfaces prior to bonding with coarse sandpaper, and clean with solvent.

The rear, double surface fairing is a bit more complex, but it is bonded in place in a very similar fashion. Remember that the wing must still be able to be removed and re-installed, and verify clearance to permit this operation. Also verify flap movement to make sure that the fairing seals relatively well, but provides no hiderence to flap operation. Use the same procedure as before, temporarily fitting the fairing into place with cleco's , and bonding after cleaning, once the proper position is assured

## WING TIP INSTALLATION

Prepare the pre-molded polyester and fiberglass wing tips for installation. Cut two trailing edge ribs of ¼ foam using the template supplied. Install each rib about 7/8 inch into its tip so as to allow the tip to slide over the joggle end of the skin. The rib should butt up against the aft spar face. Apply one layer of BID to each rib to keep them in place and help them hold shape. Check fit the tips onto the wing panels. The joggles on the skins help make them fit flush. If everything is okay use a thin mixture of resin and fox to bond the wing tips permanently in place. Be sure to tape or screw the tips in position so they don't shift while the fox is curing. Stand back and make sure they are properly aligned before cure; a "bent" wing tip would really be an eyesore.

An alternate method of attaching the tips is to leave them removable. If this is desired attach each tip with equally spaced AN507-832-8 c.s. machine screws (six top and six bottom) and K 1000-832 anchor nuts. The alternate installation hardware is not provided.

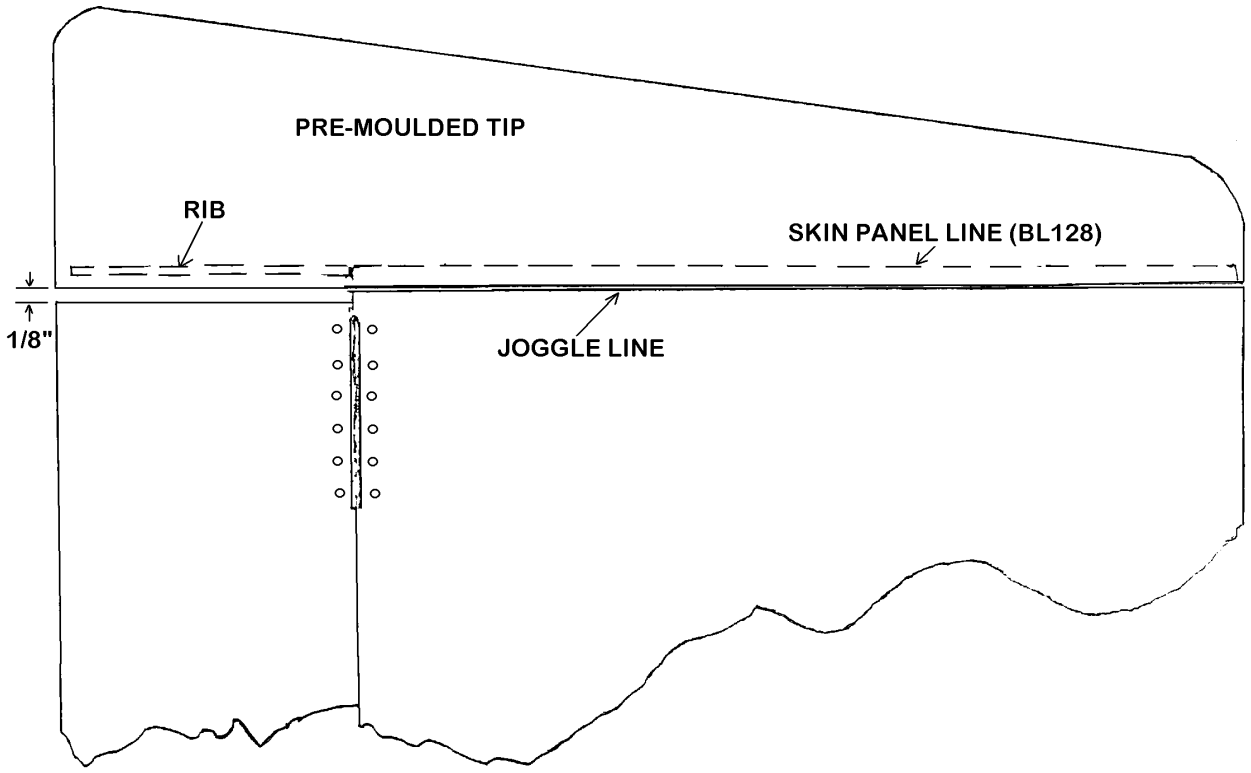



FIGURE - Wing tip assembly

## OPTIONAL WHEEL FAIRING ASSEMBLY

Note: Wheel fairings are not provided in the standard KIS kit. These instructions are provided for those builders who purchase the fairing kit at extra charge.

## MAIN GEAR

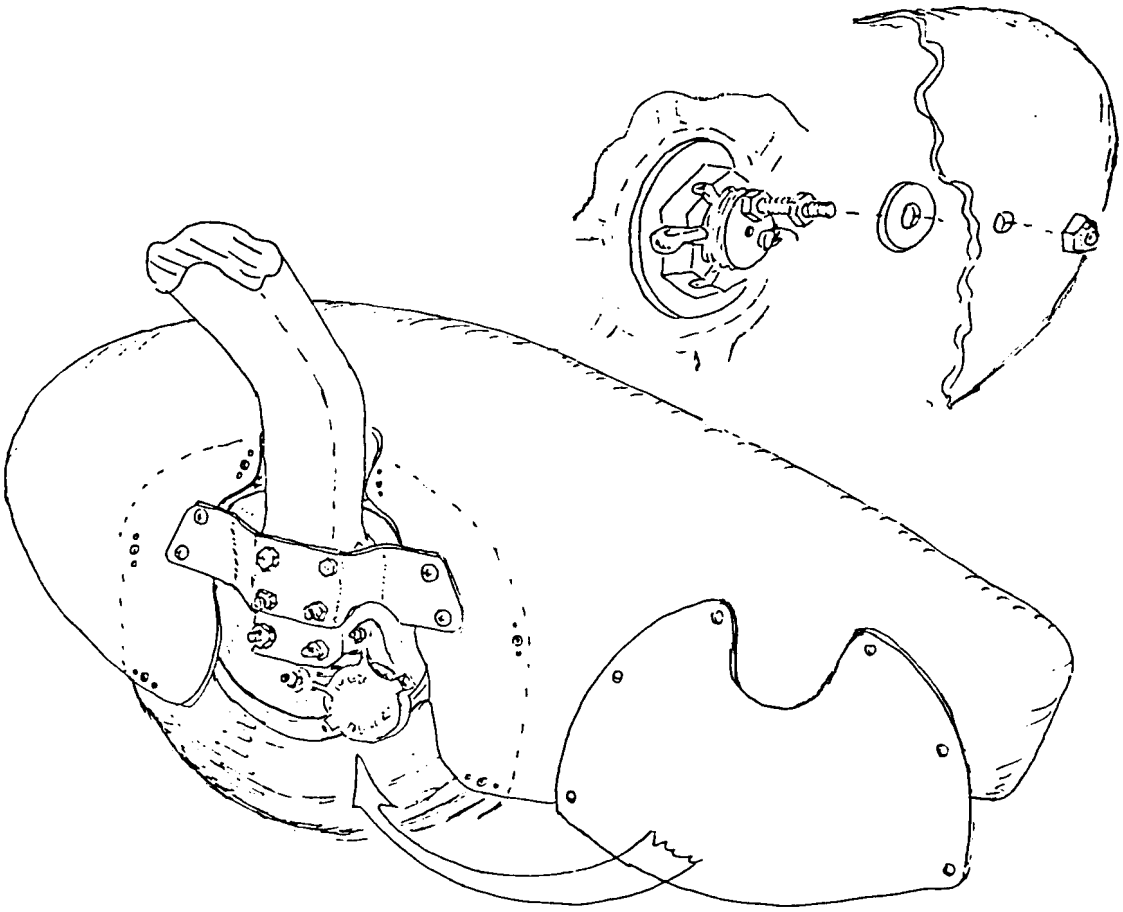
With an aircraft of the speed potential of the KIS, the wheel fairings become a very valuable option, adding 5 to 10 mph to the cruise speed at the same fuel burn. However, a poorly installed set of fairings can quickly become a greater bother than a benefit.

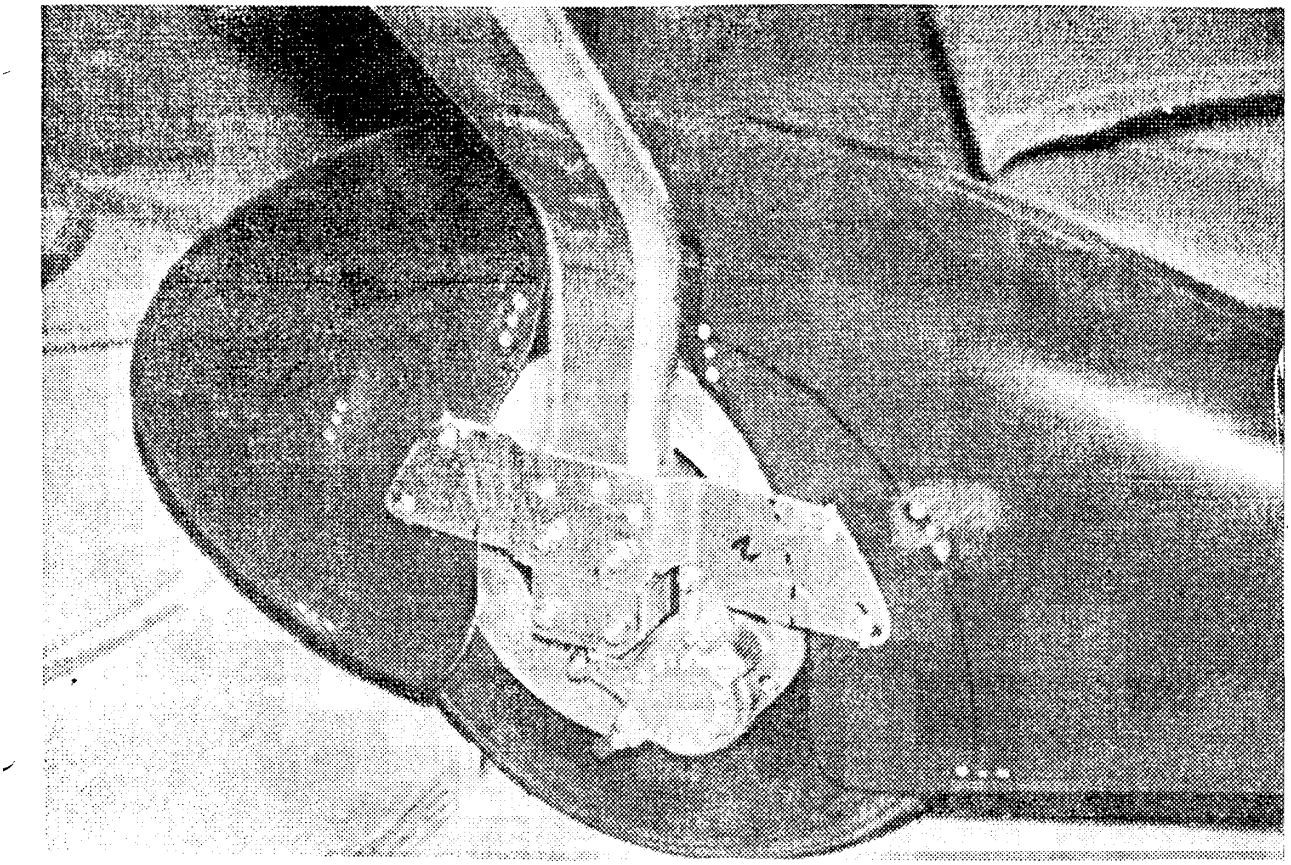
Carefully trim and fit the wheel fairing to the wheel, centering it to avoid rubbing on any surface, and provide enough wheel protrusion below the faking to suit the type of landing surface where you will be operating. There should be enough wheel showing such that even with a flat tire and in landing attitude, the faking will not strike the surface. Refer to the pictures on the next page and fabricate a bracket of aluminum sheet at least .080 thick as shown to retain the inner side of the wheel fairing. (It may be advantageous to make the bracket flat rather than as shown; in this case the bracket will clamp between the axle and the gear leg.) Use the upper two axle bolts for attachment, and drill and tap the gear leg #10-32 for two additional bolts if desired for added rigidity, secure to the fiberglass wheel fairing with two #10-32 bolts at each end. Verify location and length of bolts for clearance to the wheel and tire. Nut plates can be added to the fiberglass part for ease in assembly and disassembly

For support to the outer side of the wheel faking, drill and tap the end of the axle above the centerline to avoid the cotter pin hole. A ¼ inch threaded rod is suggested for this support. Use a jam nut to secure it tightly to the axle, and another nut to space out the fairing shell. Use an area washer inside the surface of the shell, and a self locking nut on the outside of the faking. An area washer here would ad d structural support, but is probably not required. Trim excess rod for a neat looking job with minimum air drag. Supported on both sides in this manner, the fairing should almost be secure enough to stand on.

Trim and fit the back cover of the fairing assembly. Position and drill 6 holes for securing it to the main fairing body. Verify the length and position of the securing bolts such that they will not rub on the wheel or tire. Install #8-32 nut plates at these locations and bolt into place with #8-32 screws. Again verify that the screws are not excessive length and will not drag on the wheel.

Make note of the complexity of assembly and disassembly and decide if you are going to provide a hole for tire inflation. If so cut it before painting. Electrical supply houses frequently sell plated metal cover plugs with spring fingers for closing access holes in electrical equipment., and you might consider these as an option.





## NOSE GEAR

The nose gear fairing is equally important, and presents a slightly different challenge. This gear must be free to swivel to permit steering on the ground, and the interface with the gear leg fairing is an extra place of concern during the installation.

The nose gear fairing comes as a two piece assembly split roughly in the middle lengthwise of the section. Position the half with the positive overlap (right side), locating the desired placement of the wheel axle and the orientation of the fairing to the ground level. Also note the location of the gear leg pivoting action to assure proper steering of the wheel without interference with the gear leg fairing (it might be prudent to test fit this fairing at the same time). locate one attach bolt as far forward as practical on the flat surface on the side of the "shoe" (pivoting wheel fork). A shaped "shim" of Bondo or dry micro can be used to match and space the inner surface of the wheel fairing to the side of this "shoe". Center the fairing longitudinal seam with the centerline of the tire during this fitting. The material of the side of the "shoe **"** can be tapped for the attaching thread - we suggest a #10-32. Another attach bolt and "shim" should be provided back near the axle (be sure that the bolts extending through this surface will not rub on the tire or wheel -watch both positioning and trimmed length for this). If the attachment holes are tapped as suggested rather than using self locking nut plates, remember to use Loktite or similar thread securing compound in final assembly.

Temporarily attach the other half, and locate a similar pair of bolts and "shims" in symmetrical locations. Double check at each step to assure that the proper alignment is being maintained, and trim away or add shimming material as required.

As before, decide if you are going to provide a hole for tire inflation, and if so locate in the desired position and cut hole before painting.