SECTION 6: EMPENNAGE

BUILDING THE HORIZONTAL STABILIZER

The assembly of the horizontal stab and following references are shown on DWG 3.

REAR SPAR ASSEMBLY

- ❑ Use a file or Scotchbrite wheel to "break" the edges of the HS-609PP (See Sec E-E). Lay the HS-609PP rear spar reinforcement bars inside the HS-603PP spar channels and check to see that the faces rest against one another when the holes are aligned. If the bend of the channel tends to lift the edge of the bar, use a coarse Vixen file to round the edge of HS-609PP to fit. Round the ends of the HS-609PP bars as shown in Rear View.
- ❑ Smooth the edges and surfaces of the HS-609PPs to a satin finish equivalent to that left by 400 grit wet/dry sandpaper, removing all the milling and file marks (See “Edge Finishing”, Section 5.2).
- ❑ The pre-punched holes used to attach HS-603PP to HS-609PP are slightly undersized, and must be "final drilled" to the correct size. Cleco and drill every second or third hole, drill #30, then move the clecos and drill #30 all the remaining holes.
- ❑ Carefully locate the holes that attach HS-708 to the rear spar assembly (it is the eighth hole from the end of HS-609PP) and enlarge it to #21 (See Rear View).
- ❑ Cleco the HS-412PP Hinge Brackets to the rear spar assembly and final drill #30 through the holes common to the hinge brackets and web of the rear spar.
- ❑ Cleco the HS-00716A Nested Spar Doublers and HS-00717A Hinge Brackets to the rear spar assembly and final drill #30 through the holes common to the hinge brackets, nested spar doubler, and web of the rear spar.
- ❑ There are two HS-411PP brackets, but only HS-411BPP is pre-punched for the VA-146 attach holes (See Exploded Iso View). Clamp HS-411APP and HS-411BPP around the VA-146 bearing and cleco the assembly to the spar.
- ❑ Using HS-411BPP as a drill guide match drill and cleco the aft four VA-146 attach holes.
- ❑ Remove the assembly from the spar and match drill the forward two VA-146 attach holes.
- ❑ Deburr the parts, prime VA-146 if desired, then rivet them together (the –5 rivet is the correct length, see Section 5.4). This sort of one at a time priming makes having a spray can self etching primer nice.
- ❑ Cleco the HS-411 assembly back to the spar. Drill/enlarge the bolt holes that will attach the HS-411 assembly to the spar to #12.
- ❑ Mark all the parts in the rear spar assembly so they can be returned to their previous positions. Use a "Sharpie" pen or equivalent for all marks on aluminum, but in this case the ink will be lost if you clean the parts for priming.

FRONT SPAR ASSEMBLY

- ❑ Separate the two HS-00001 spar doublers and draw the rivet lines as shown in the HS-00001 Detail View.
- ❑ Place the two HS-702 front spar channels on a work table, end to end, with the flanges facing down. Cleco HS-710 reinforcement angle, HS-714 splice angle to the two HS-702 spar channels.
- ❑ HS-702 has been designed for use on an RV-8 and will require extra trimming for use on an RV-7. In order for the spar to be bent to match the HS-710 and HS-714, the spar flanges inboard of the bend line must be removed.
- ❑ Lay the spar on the workbench with the flanges facing up and mark the bend line on the spar as shown in the HS-702 Front Spar Tab Detail.

- ❑ Drill a #30 relief hole 1/8” inboard of the bend line and centered on the bend radius of the flange (See HS-702 Front Spar Tab Detail and HS-702 Front Spar Tab Detail). Turn the spar over and enlarge this hole to 1/4" using a unibit.
- ❑ Trim the inboard ends of the HS-702 flanges as shown in the HS-702 Front Spar Tab Detail. Be sure to only trim the flanges down to about halfway along the bend. Flatten the remainder of the bend.
- ❑ Bend the tab as shown in HS-702 Front Spar Tab Detail using a hand seamer or blocks of wood.
- ❑ Clamp the HS-00001 spar doublers to the HS-702 spar channels. Position the top edge of the doublers flush with the top edge of the spar channels. Position the doublers left and right from the center line of the horizontal stab as shown in View B-B. Match-Drill #30 the inboard holes shown in Vew A-A. Cleco the doublers to the spar.
- ❑ Drill/match-drill all the holes inboard of the HS-00006/HS-00005 rib attach points (See View A-A). DO NOT drill the holes that will attach the HS-00006 and HS-00005 ribs or the holes outboard of the bend line. The holes outboard of the bends will be drilled later, after the bends are made. Also see Figure 6-6.
- ❑ Remove HS-710, HS-714 and HS-00001 from the two HS-702 spar channels. Taper the ends of HS-710 and HS-714 (See HS-710/HS-714 Taper Detail).
- ❑ Bend the outboard ends of HS-710, HS-714 (See View B-B). Clamp the aluminum angle between wood blocks in a vise and bend with a mallet. Use a simple cardboard template to check the angle.
- ❑ Refer to View A-A for the rivet pattern at the center of the front spar. Note that the center four rivets are AN426AD4 rivets with the flush heads aft. Dimple HS-702 and countersink HS-710 and HS-714 (See “Countersinking”, Section 5.5).

PREPARING THE RIBS

- ❑ Notch the aft end of the HS-00006 ribs to fit around HS-714 and HS-710 (See HS-00006 Trim Detail). Make sure to make one left and one right.
- ❑ Prepare the HS-00006, HS-00005, HS-706, HS-707 and HS-708 ribs (See “Fluting and Straightening Ribs and Bulkheads” and “Edge Finishing”, Section 5.13 & 5.2).

DRILLING THE HORIZONTAL STABILIZER

- ❑ Choose which ribs will be used on the right and which will be used on the left then mark them.
- ❑ Using the dimensions given in SEC D-D, mark the hole locations on the centerline of the aft side of the aft flange of HS-00006. These holes attach HS-00006 to the forward spar assembly and HS-00005. Make a light mark with a center punch to keep the drill bit from wandering then pilot drill the holes to #40.
- ❑ Draw a centerline on the forward side of the forward flange of HS-00005.
- ❑ Select the left side HS-702, HS-603PP, HS-706, HS-707 and HS-708 and cleco them together.
- ❑ Drill all HS-706, HS-707, HS-708 rib to spar attach holes to #30 (except the HS-708 and HS-603PP holes)
- ❑ Un-cleco, deburr holes, clean out chips and re-cleco.
- ❑ Cleco on the HS-601PP skin.
- ❑ Enlarge the HS-708 to HS-603PP holes to #21.
- ❑ Cleco HS-00001, HS-710 and HS-714 to HS-702.
- ❑ Slip the HS-00006 and HS-00005 ribs into place and mark the approximate hole locations on the top and bottom rib flanges with a pen using the holes in the skin as a guide.

- ❑ Remove the HS-00006 and HS-00005 ribs and flute as necessary between the rivet hole marks.
- ❑ Reinstall the HS-00006 and HS-00005 ribs. Clamp HS-00006 to the HS-601PP skin and spar assembly.
- ❑ Match Drill #30 and cleco the aft flange of HS-00005 rib to HS-603PP spar, using the holes in the spar as a drill guide. Remove HS-00005, clean out any chips.
- ❑ Match Drill #40 the holes in the aft flange of the HS-00006 rib to HS-702 and HS-00001.
- ❑ Mark and drill #40 the two holes common to the HS-00001, HS-702, HS-710 or HS-714 on the forward side of the spar bars, keeping the holes in line with the holes in the aft flange of the HS-00006. See SEC D-D.
- ❑ Reinstall HS-00005. Align the centerline line drawn on the forward flange to the previously drilled holes in the spar assembly and HS-00006 rib. Clamp the rib in place, making sure it fits tightly against HS-00001. Next, cleco the aft flange of the HS-00005 rib to the aft spar. Finally clamp the top and bottom flanges to the HS-601PP skin. Finally, Match-drill the holes in the forward flange of the HS-00005 rib.
- ❑ Cleco the HS-00716A doublers to the rear spar.
- ❑ Cleco the ribs and spar assembly together.
- ❑ Beginning at the rear spar and working forward, match drill the holes in the HS-601PP skins to the HS-00005 rib.
- ❑ Be sure that the front flange of HS-00005, HS-702, HS-710 and HS-714, HS-00001 and the aft flange of HS-00006 are pulled up tight. Re-clamp the upper and lower flanges of HS-00006 to HS-601PP.
- ❑ Drill to final size or match drill all the remaining holes attaching the HS-601PP skin. The suggested drilling sequence begins at the intersection of the HS-708 center rib and the rear spar and proceeds both up along the rib and outward toward the tip. Put clecos in every second or third hole as you drill them.
- ❑ Remove the skin and drill the remaining holes in HS-714, HS-710 and HS-00001. Remove HS-710, HS-714 and HS-00001.
- ❑ Repeat the above steps for the right side.

PREPARING THE HORIZONTAL STABILIZER PARTS FOR ASSEMBLY

- ❑ Mark and disassemble all parts.
- ❑ Deburr all the holes in both the skin and the skeleton (See “Hole Deburring”, Section 5.2).
- ❑ Dimple the understructure using a pneumatic or hand squeezer. Dimple the rivet holes in the skins using a C-frame dimpling tool (See Section 3).
- ❑ Smooth the edges of the parts (See “Edge Finishing”, Section 5.2).
- ❑ Prime all parts as required (See “Priming”, Section 5.1). The HS-609PP rear spar reinforcement bars, HS-710 reinforcement angle and HS-714 splice angle are not made of Alclad material, so before riveting, they must be primed.

RIVETING THE HORIZONTAL STABILIZER

- ❑ Locate the rivet holes in the rear spar that will attach the HS-706, HS-708 and HS-00005 ribs and the HS-412PP hinge brackets. Put tape over them to prevent accidentally riveting these holes before the ribs are attached.
- ❑ Rivet the HS-609PP bars to the HS-603PP spar channels. The rivet callout is correct on the plans. See Section 5.4. This can be accomplished with either a gun, pneumatic or hand squeezer. You may find it takes a bit of "grunt" to set -4 rivets with a hand squeezer.
- ❑ Rivet the HS-412PP hinge brackets to the rear spar.

- ❑ Rivet the HS-00717A hinge brackets and HS-00716A doubler to the rear spar.
- ❑ Bolt the HS-411PP center bearing to the spar (See Torque Value Chart, Section 5.20).
- ❑ Rivet HS-710 and HS-714 and HS-00001 to the HS-702 front spars. Remember the flush rivets in the center of the assembly (See View A-A and Section D-D.)
- ❑ Rivet HS-00006 and HS-00005 to the front spar assembly. The ribs may be gently flexed out of the way to allow better access during riveting.
- ❑ Lay the HS-601PP skin marked for the left side down on a clean surface. Use foam padding if desired.
- ❑ Cleco then rivet HS-707 to the top side of the skin.
- ❑ Cleco HS-706 to the skin. Temporarily cleco HS-708 to HS-601PP and the aft flange of HS-707 to help hold the skin tight against HS-707, then rivet the bottom side of HS-707 to HS-601PP. Remove HS-708.
- ❑ Cleco the forward spar assembly to HS-706, HS-707 and HS-601PP, then cleco on HS-708.
- ❑ Blind rivet HS-702 to HS-707 and HS-708.
- ❑ Rivet HS-702 to HS-706.
- ❑ Rivet HS-702 and HS-708 to HS-601PP.
- ❑ Repeat the above steps for the right side then cleco on the rear spar assembly
- ❑ Rivet the rear spar assembly, HS-00006, HS-00005, and HS-706 to HS-601PP. These holes can all be reached by a hand squeezer.
- ❑ Blind rivet the rear spar assembly to HS-708.

Congratulations! You've finished the first major sub-assembly on your new airplane.

BUILDING THE VERTICAL STABILIZER

The assembly of the vertical stab and following references can be found on DWG 6. Construction of the vertical stabilizer is very similar to the horizontal stabilizer.

DRILLING THE VERTICAL STABILIZER

- ❑ Cleco the VS-808PP spar doubler to the VS-803PP rear spar. Then cleco on the hinge brackets VS-410PP, VS-411PP and VS-412PP (See Exploded Iso View).
- ❑ The VS-410PP hinge brackets have two holes missing from the pattern. Use the holes in the spar channel and spar doubler as drill guides and back-drill the entire six-hole pattern through the upper VS-410PP only. The corner holes in the lower VS-410PP will be drilled for bolts later, in assembly with the fuselage (See DWG 27/27A).
- ❑ Prepare the ribs VS-704, VS-705, VS-706 and VS-707 (See “Edge Finishing”, “Fluting and Straightening Ribs and Bulkheads”, Section 5.2 & 5.13).
- ❑ Cleco the ribs to the front and rear spars.
- ❑ Final drill #30 VS-808PP, VS-410PP, VS-411PP and VS 412PP to VS-803PP.
- ❑ Drill all rib to spar attach holes to #30.

- ❑ Cleco on the VS-801PP / VS-901 skin.
- ❑ Drill / match drill to final size all the holes attaching the VS-801PP / VS-901 skin.
- ❑ Mark the location and orientation of VS-803PP, VS-411PP and VS-412PP. Disassemble, de-burr, dimple, machine countersink and prime parts as desired (See “Countersinking”, “Dimpling”, “Hole Deburring” and “Priming”, Section 5.1, 5.2, & 5.5).
- ❑ Note as shown on DWG 27/27A the lower portion of the rear spar must lay flush against the F-712/812 bulkhead assembly. Therefore the rivets in this region must be flush on the forward side of the rear spar that mates to the F-712/812 bulkhead (See Rear View, SEC A-A and “Countersinking and Dimpling”, Section 5.5).

FINISHING THE VERTICAL STABILIZER

- ❑ Cleco VS-803PP to VS-808PP, VS-410PP, VS-411PP and VS-412PP together. Then tape over the holes that will attach VS-704, VS-706 and VS-707.
- ❑ Rivet the rear spar together remembering the flush rivets on the lower rear spar.
- ❑ Rivet VS-704, VS-705, VS-706 and VS-707 ribs to the front spar.
- ❑ Cleco on the VS-801PP / VS-901 skin.
- ❑ Rivet on the skin. Begin at the intersection of VS-707 and VS-702 and work towards the tip, then restart at the same place and rivet along the front spar toward the root and along the VS-707 rib starting at the front and riveting toward the rear spar.
- ❑ Cleco on the rear spar assembly and install the remaining rivets along the rear spar and end ribs with a squeezer.
- ❑ Blind rivet the rear spar assembly to VS-707.

BUILDING THE RUDDER

FITTING THE STIFFENERS TO THE RUDDER SKIN

- ❑ Pre-punched holes in the R-915 rudder stiffeners match corresponding pre-punched holes in the R-901-L and R -901-R rudder skins.
- ❑ Trim individual stiffeners from strips consisting of two stiffeners. See diagram on DWG 7. Shorten all the stiffeners (except the lowest) by trimming the excess from the forward end. Use the pre-punched hole pattern in the rudder skins to determine the correct amount of trim. See note on DWG 7.
- ❑ Before you begin actually drilling stiffeners and skins, be sure that you are placing the stiffeners on the inside surfaces of the right and left rudder skins. Study the exploded isometric view on DWG 7.
- ❑ Match drill the stiffeners to the rudder skins. Having a tabletop you don’t mind drilling into will make the job easier. You can drill through the part right into the table. A cleco run into the hole in the table will not hold the part up off the surface.
- ❑ Disassemble and debur the holes. BE VERY CAREFUL deburring the thin R-901 rudder skins -- it doesn't take much pressure or over-enthusiasm (one turn is usually plenty) to ruin a hole in 0.016 aluminum. You do not want to be left with a knife-edged hole when you are done.
- ❑ Because 0.016 is too thin to machine countersink, it must be dimple countersunk. Use a C-frame deep-throat dimpler/riveter as shown in Section 3. Remember that the pressure needed to dimple 0.016 is quite low.
- ❑ Dimple the stiffeners and skin, and prime the parts if you choose. Now you are ready to rivet the skin and stiffeners together. BACK-RIVETING is the best technique here. See Section 5.6. Be sure you fully set the aft rivet in each stiffener…if you leave these standing too tall, they will interfere with the opposite skin when the rudder is assembled.
- ❑ When back-riveting, the flush head rivets are taped in place with Van’s Special Riveting tape (See VAN'S ACCESSORIES CATALOG), Mylar, or Scotch 811 tape (masking or regular Scotch tape does not work well.) The flush heads are placed on a flat, smooth plate of steel or hard aluminum. A small flat, cupped, or special sliding-sleeve set is used to make the shop head. If you are careful to keep the bucking surface clean, this

method almost ensures clean, well-set rivets.

BUILDING THE RUDDER SKELETON

- ❑ Cleco R-904 Bottom Rib to the R-902 Spar. Enlarge the 0.125 hole in the center of the forward flange of R-904 to 3/8 using the hole in R-902 as a drill guide.
- ❑ Fabricate R-917 Shim per DWG 7.
- ❑ Use a 3/8 bolt to fasten the R-405PD rudder horn squarely on the rudder spar and final drill the four holes through the upper edge of the rudder horn to #30 using the pre-punched holes in the spar as a drill guide.
- ❑ Cleco the rudder horn to the R-904 bottom rib to check the fit. If necessary radius the top of the rudder horn so it nests nicely in the radius of the rib flange.
- ❑ Cleco the R-904 bottom rib and R-405PD rudder horn to the R-902 rudder spar. Slide the R-917 shim into place between the rudder spar and rudder horn and drill to #30. Use the pre-punched holes in the spar as a guide.
- ❑ Cleco the R-606PP, R-607PP, and R-608PP reinforcement plates to the R-902 rudder spar. NOTE that the R-606PP lower reinforcement plate goes on the forward (flange side) of the spar web, while the R-607PP and R-608PP plates go on the rear.
- ❑ Flute the R-903 tip rib and R-912 counterbalance rib. Use a ruler along the holes to make sure they are straight. Use a hand seamer to adjust the flanges square to the web.
- ❑ Cleco the tip rib and the counterbalance rib to the top of the spar and drill to #30.
- ❑ Cleco the R-913 counterbalance skin to the R-903 tip rib and R-912 counterbalance rib. Match drill #40 the counterbalance skin to the ribs using the pre-punched holes in the R-913 counterbalance skin as a drill guide.
- ❑ Cleco the R-901R&L rudder skins to the ribs and spar. Fit the R-916 rudder trailing edge and cleco it in place. Drill all remaining holes in the rudder to final size.
- ❑ Trim the excess material from R-710 rudder brace. Fit the R-710 between R-405PD and R-904. Cleco the aft edge of R-710 to the bottom of R-904 and drill #30. Match drill through the forward edge of R-710 using the holes in R-405PD as a drill guide.
- ❑ Make the R-918 rudder bottom attachment strips shown on DWG 7 and clamp them in place. Drill them to the skeleton, using the existing holes as drill guides.
- ❑ Disassemble the rudder and deburr all the holes. Dimple the skin, spar and ribs.
- ❑ The aft three 3/32 holes in the upper edge of R-901-L and R-901-R should be drilled to #30 and dimpled. These holes will later be used to attach the R-909 rudder tip. While the holes could be opened up to #30 when drilling the tip to the rudder, it would be nearly impossible to dimple the skins because the rudder is so narrow at that location.
- ❑ Drill the E-614-020 counterweight to the R-912 counterbalance rib. The forward tooling hole on the R-912 rib matches with the forward hole on the counterweight. Use the aft hole in the counterweight to match drill into R-912. Remove the counterweight and machine countersink the holes for a #10 countersunk screw. De burr the holes in the counterbalance rib and dimple for a #10 countersunk screw.
- ❑ Although the rudder and elevator spars are 0.032 and could technically be machine countersunk, we strongly recommend that these parts be dimpled. Be careful that the dimple dies do not drag along the web of the spar and gouge it. It may be necessary to grind a flat side on the dies to obtain the necessary clearance.
- ❑ The trailing edges of both the left and right R-901 skins are dimple countersunk and both sides of the R-916 rudder trailing edge are machine countersunk. These rivets will be double flush. The shop head actually turns out looking pretty nice when it is driven into a dimple. Prime all the components desired.

RIVETING THE RUDDER

- ❑ Install the reinforcement plates and platenuts on the spar.
- ❑ Rivet the R-904 rib and associated parts.
- ❑ Rivet the R-912 counterbalance rib to the R-902 spar. Then rivet the R-913 counterbalance skin to the counterbalance rib, but not the spar. Install the E-614-020 counterweight (see exploded view on DWG 7).
- ❑ Cleco both skins to the spar.
- ❑ There are six rivets on each side that join the R-901 skins and the R-913 counterbalance skin and three that join the rib, counterbalance skin and spar. The aft end of the R-913 counterbalance skin will lay *under* the R-901 rudder skin. Set these, then rivet on the R-903 tip rib. Blind rivets are used for the first time here. They are simple to set with a hand pop-riveting tool, but they are difficult to drill out. Make sure that the heads of the

rivets are firmly against the rib before setting.

- Rivet the skin to the skeleton. A rivet squeezer will reach almost all the rivets, depending on the throat depth. In the narrow spaces at the end of the ribs a narrow bucking bar will be necessary. If one isn't available, these holes may be enlarged to 7/64" and MK-319-BS blind rivets may be substituted for the last one or two AN rivets. Both rivets have heads that fit the same dimple.
- The trailing edge is the last in the sequence. Building a truly straight trailing edge is one of the more difficult things to do in the empennage kit. Take your time and work as precisely as possible. A wavy or bowed trailing edge doesn't look good, and in more extreme cases will affect the flying qualities of the airplane. Strive to build a trailing edge that does not vary more than 0.100" from a straight line.
- One way to help keep the trailing edge straight is to bond the components together before setting the rivets. The bonding agent can be fuel tank sealant or any good epoxy with a 30 minute working time.
- Trailing edges are riveted with "double-flush" rivets. These are standard rivets, but instead of setting the shop head on a flat surface, it is set in a dimple and ends up flush with the skin surface. However, a double flush rivet will not look the same on both sides. The factory flush head will set almost perfectly flat. The finished shop head will be flush with the skin, but it will not fill the dimple completely...it's been described as "an acorn sitting in a dimple." Do not fall in the trap of trying to use a longer rivet and "fill the hole." The rivet will bend over instead of setting properly.
- Begin by using one of the skins as a guide and drill the trailing edge pattern of holes into a rigid, straight piece of aluminum angle. Cleco the trailing edge together, with both skins and the AEX wedge clecoed to the angle and check the alignment. The angle should hold the trailing edge straight. Because the rudder tapers in thickness, the trailing edge cannot simply be clamped to the table. Lay the rudder with the trailing edge and clecoed angle off the edge of the table so it can remain straight.
- Disassemble the trailing edge and clean the surface completely, using the directions for cleaning the fuel tank components in Section 7. Mix (follow the mixing directions on the can) and apply tank sealant thinly and evenly to both surfaces of the AEX wedge and cleco the trailing edge together, including the alignment angle. Wipe away any sealant that squeezes out and make sure that the parts fit tightly. There should be no globs of sealant holding the skin and wedge apart, for instance.
- Check the alignment once more, and set the assembly aside. Let the sealant cure for a couple of days. After curing, remove the angle and the clecos.
- Insert rivets into the trailing edge holes with the manufactured head on the top side. Tape all the rivets in place and flip the rudder over. Put blocks on either side of the back-riveting plate, so the rudder can stay flat as it slides over the plate. Weight the rudder down to the worksurface so it remains straight while riveting.
- Back-rivet about every tenth rivet just enough to to lock everything in place…don't set the rivets all the way just yet.
- Back-rivet the rest of the trailing edge rivets, but for now, set the rivets only about halfway. Set every fifth or sixth rivet and check constantly to see that the trailing edge is not bending one way or the other. If the rivets are set fully in only one direction it can leave a "hook" in the trailing edge. Start with the rivet set parallel to the rivet and tilt it to set the rivet flush to the skin as the rivet sets.
- Flip the rudder over and set the trailing edge rivets to the final size with a mushroom set, again checking constantly.
- A little finesse will produce a nice double flush joint, but you must constantly guard against bowing the trailing edge.

COMPLETING THE LEADING EDGE OF THE RUDDER

- Before the rudder can be installed on the vertical stabilizer, its leading edge must be formed. The object here is to achieve a smoothly curved surface that fits neatly between the skin overhang of the stabilizer. Simply pulling the overhanging skins together results in an angle or crease where they cross the edge of the spar (See Rolled Leading Edges", Section 5.9)
- Rivet the leading edge together. Blind rivets are used here. They are simple to set with a hand pop-riveting tool, but they are difficult to drill out. Make sure that the heads of the rivets are firmly against the rudder skin before squeezing. See the Rudder Leading Edge Detail on DWG 7.

BUILDING THE ELEVATORS

The assembly of the left elevator is shown on DWG 4. The assembly of the right elevator is shown on DWG 5. The elevators are built much like the rudder. The elevators are balanced surfaces, having lead weights forward of the hinge lines to counteract the weight of the structure behind it. This improves the control "feel" and helps prevent flutter. The major difference between elevators and the rudder is the installation of a trim tab in the left elevator. This need not be an especially difficult task, but it does require careful attention to detail. The majority of builder mistakes on the empennage are made on the left elevator and trim tab. Fair warning! Because of the complication of the trim tab, we'll leave it to last and start with the right elevator.

PREPARING THE ELEVATOR SKINS

TRIMMING THE STIFFENERS

- The E-701-L/R elevator skins and E-720 (A-L) elevator skin stiffeners are provided with pre-punched holes. The various E-720 stiffeners are snipped from the pre-punched lengths of aluminum angle. The double notch in the edge denotes the overall length of the stiffener. Use aviation snips to cut from center to center of the guide holes (See E-720 Trim Detail, DWG 5).
- Trim the flange of the stiffener (surface perpendicular to the skin) to fit inside the tapered elevator. Single notches on the edge of the stiffener note the beginning points of these trim cuts. Trim the stiffeners and clean up the edges with a file and the Scotchbrite wheel (See E-720 Trim Detail, DWG 5).
- Make stiffeners E-720J, E-720K and E-720L from the existing E-720D, E-720E and E-720F (See E-720 Trim Detail and Note 1, DWG 5). Set aside stiffeners for use in the left elevator assembly.
- Drill the stiffeners to the E-701-L/R skins. Drill E-615PP to E-701-L. Disassemble parts then, deburr, dimple and prime as desired (See "Edge Finishing", "Hole Deburring", "Dimpling" and "Priming", Section 5.2, 5.5 & 5.1). Dimple the #6 screw holes and rivet the K-1100-06 platenuts to the E-615PP.
- Back rivet the stiffeners to the E-701-L/R skins (See "Back Riveting", Section 5.6).
- Back rivet E-615PP to E-701-L.
- Bend the trailing edge of the elevator (See "Folded Trailing Edges", Section 5.7). Remember do not add the sealant to the trailing edge until just prior to assembly.

PREPARING THE RIGHT ELEVATOR

- Separate the E-00001A & B hinge doublers.
- Use a file to radius the top and bottom edges of the E-00001A outboard hinge doubler to nest against the spar radii.
- Cleco and drill the E-610PP and E-611PP reinforcement plates, E-00001A & B hinge doublers and corresponding platenuts to the E-702 spar.
- Prepare the E-703 end ribs and E-704 counterbalance ribs (See "Edge Finishing" and "Fluting", Section 5.2 & 5.13).
- Cleco and drill the E-703 end rib to the E-704 counterbalance rib then cleco and drill them to E-702. Remove the ribs from the spar.
- Place the E-714 counterweight on the forward end of E-703 and E-704 as shown (See View F-F, DWG 5).
- Cleco the E-713 counterbalance skin to E-703 and E-704, overtop of E-714. The step in the front face of E-714 should butt against the outboard edge of E-713.
- Use the two holes in the forward face of E-713 as a guide and drill #12 the holes for the screws that will hold E-714 in place. Use a drilling lubricant when drilling the lead E-714's.
- Un-cleco E-713, remove and set aside E-714, re-cleco on E-713 to E-703 and E-704. Then cleco the E-703, E-

704, E-713 subassembly to E-702.

- ❑ Cleco the E-709 root rib right to E-702.
- ❑ Final drill #40, E-709 to E-702.
- ❑ Cleco E-701-R to the understructure. Note that E-701-R lays on top of E-713.
- ❑ Remove the clecos connecting E-709 to the E-702 then cleco and drill the WD-605-1-R elevator horn to E-702 and E-709.
- ❑ Drill the E-701-R skin to the understructure.
- ❑ Disassemble the elevator.
- ❑ Dimple E-713 for the screw heads that will attach E-714 (See “Dimpling”, Section 5.5).
- ❑ Machine countersink E-714 for the dimples in E-713 (See “Countersinking”, Section 5.5).
- ❑ Machine countersink the E-709 attach holes on the forward face of E-702 (See “Countersinking”, Section 5.5). E-709 and E-702 will be riveted together with flush head rivets, so that the WD-605-1-R elevator horn can be mounted flush with the forward face of the E-702 spar.
- ❑ Bevel the inboard and aft edges of E-713 locally where E-713 overlaps the spar and rib flanges to provide a smooth transition between the counterbalance skin and the E-701-R elevator skin.
- ❑ Deburr, dimple and prime the parts as desired (See “Deburring”, “Dimpling” and “Priming”, Section 5.2, 5.5 & 5.1).

RIVETING THE RIGHT ELEVATOR (See “Riveting”, Section 5.4)

- ❑ Rivet E-703 to E-704.
- ❑ Rivet E-610PP, E-611PP, E-00001A & B and platenuts to E-702.
- ❑ Rivet E-709 to E-702 (flush heads forward).
- ❑ Rivet E-703/E-704 to E-702.
- ❑ Rivet WD-605-1-R to E-702 and E-709.
- ❑ Rivet E-713 to E-701, two rivets on the top and two rivets on the bottom (assembling this way eliminates the need for blind rivets).
- ❑ Loosely place E-714 in place nested inside E-713 with screws partially inserted.
- ❑ Insert the elevator skeleton into E-701-R/E-713 beginning at the front end of E-703/E-704 and then rotating the root end aft into proper position.
- ❑ Cleco and rivet E-701-R and E-713 to the understructure.
- ❑ Finish attaching E-714.

PREPARING THE LEFT ELEVATOR

The left elevator is similar to the right elevator, the only difference is the use of the E-615PP trim access reinforcing plate, supporting the trim cable or servo, and the E-606PP trim spar.

- ❑ Use a file to radius the top and bottom edges of the E-00001A outboard hinge doubler to nest against the spar radius.

- ❑ Cleco and drill the E-610PP and E-611PP reinforcement plates, E-00001A & B hinge doublers and corresponding platenuts to the E-702 spar.
- ❑ E-704 counterbalance rib then cleco and drill them to E-702. Remove the ribs from the spar.
- ❑ Place the E-714 counterweight on the forward end of E-703 and E-704 as shown (See View F-F, DWG 5). Cleco the E-713 counterbalance skin to E-703 and E-704, overtop of E-714. The step in the front face of E-714 should butt against the outboard edge of E-713.
- ❑ Use the two holes in the forward face of E-713 as a guide and drill #12 the holes for the screws that will hold E-714 in place. Use a drilling lubricant when drilling the lead E-714’s.
- ❑ Un-cleco E-713, remove and set aside E-714, re-cleco on E-713 to E-703 and E-704. Then cleco the E-703, E-704, E-713 subassembly to E-702.
- ❑ Cleco the E-705 root rib left to E-702.
- ❑ Final drill #40, E-705 to E-702.
- ❑ Cleco E-701-L to the understructure. Note that E-701-L lays on top of E-713.
- ❑ Remove the clecos connecting E-705 to the E-702 then cleco and drill the WD-605-1-L elevator horn to E-702 and E-705.
- ❑ Cleco and final drill E-606PP to E-705 (at the root end of the E-606PP spar).
- ❑ Drill the E-701-L skin to the understructure.
- ❑ Disassemble the elevator. Deburr, dimple and prime the parts as desired (See “Deburring”, “Dimpling” and “Priming”, Section 5.2, 5.5 & 5.1).
- ❑ Dimple E-713 for the screw heads that will attach E-714 (See “Dimpling”, Section 5.5).
- ❑ Machine countersink E-714 for the dimples in E-713 (See “Countersinking”, Section 5.5).
- ❑ Machine countersink the top flange of E-606PP to accept the dimples in the E-701-L skin (See “Countersinking”, Section 5.5). Dimple the bottom flange of E-606PP.
- ❑ Machine countersink for the rivets that attach E-705 to E-606PP, the flush head can go on either the forward face of E-705 or aft face of E-606PP.
- ❑ Machine countersink the E-705 attach holes on the forward face of E-702 (See “Countersinking”, Section 5.5). E-705 and E-702 will be riveted together with flush head rivets, so that the WD-605-1-L elevator horn can be mounted flush with the forward face of the E-702 spar.
- ❑ Bevel the inboard and aft edges of E-713 locally where E-713 overlaps the spar and rib flanges to provide a smooth transition between the counterbalance skin and the E-701-L elevator skin.
- ❑ See DWG 4 for details of the trim system you have chosen. It is easier to install the necessary parts while access is still available to the inside of the skin. Note that the WD-415 trim cable anchor, related snap bushings and the manual trim cable will be sent in the finish kit.

BENDING THE LEFT ELEVATOR TABS

- ❑ Before the elevator is riveted together, the tabs that close the elevator at the trim tab cutout must be bent. Begin by removing any vinyl from the tabs and outboard of the tabs where the bending blocks will touch the skin surface (the vinyl allows the blocks to shift while bending the tabs).

- ❑ Lay a square reference along the trailing edge of E-701-L in the trim tab cutout (where E-606PP attaches). Mark the bend line perpendicular to the aft edge of the E-701-L trim tab cutout. While bending the tabs the bending blocks will move away from the bend line (outboard). Compensate for this by offsetting the bend line approx. 1/32 inboard from the desired bend location.
- ❑ Fabricate a set of bending blocks from particleboard or wood. The taper of the inside block should approximate the completed bend angle of the E-701-L elevator skin. Clamp the skin and blocks to the edge of a table (See Figure 6-1). Use double-sided tape between the mating surfaces of the bending blocks and the E-701-L skin, to prevent the wedge shaped blocks from slipping.
- ❑ Note that the upper tab overlaps the lower one so the joint sheds water. Bend the bottom tab down using the face of a block of wood, working progressively back and forth across the tab (See Figure 6-2). Finish the bend by using a flush set and a rivet gun turned down low (See Figure 6-3). Work the rivet gun across the entire tab without stopping.
- ❑ With the block still clamped in place repeat the above steps to bend the upper tab up and over the bottom tab.

RIVETING THE LEFT ELEVATOR (See "Riveting", Section 5.4)

- ❑ Rivet E-703 to E-704.
- ❑ Rivet E-610PP, E-611PP, E-00001A & B and platenuts to E-702.
- ❑ Rivet E-705 to E-702 (flush heads forward).
- ❑ Rivet E-703/E-704 to E-702.
- ❑ Rivet WD-605-1-L to E-702 and E-705.
- ❑ Rivet E-713 to E-701, two rivets on the top and two rivets on the bottom (assembling this way eliminates the need for blind rivets).
- ❑ Loosely place E-714 in place nested inside E-713 with screws partially inserted.
- ❑ Insert the elevator skeleton into E-701-L/E-713 beginning at the front end of E-703/E-704 and then rotating the root end aft into proper position.
- ❑ Cleco and rivet E-701-L and E-713 to the understructure.
- ❑ Rivet E-606PP to E-701-L along the bottom flange only. Leave the top flange unriveted at this point for installation of the trim tab hinge. Rivet E-606PP to E-705.
- ❑ Finish attaching E-714.

BUILDING THE TRIM TAB

- ❑ Complete the trailing edge bend of the E-619-1-020 trim tab skin (See "Folded Trailing Edges", Section 5.7).
- ❑ Fabricate a set of bending blocks from wood or particleboard (See Figure 6-1,6-2,6-3 and 6-4). Note that the upper block hooks over the lower block to prevent the wedge shaped blocks from slipping. The taper of the inside block should approximate the completed bend angle of the trim tab skin.
- ❑ Remove the vinyl from the ends of the trim tab and mark bend lines on the tab (See Trim Tab Bend Detail, DWG 4). While bending the tabs the bending blocks will move away from the bend line (toward the center of the trim tab). Compensate for this by offsetting the bend line approx. 1/32 from the desired bend location.
- ❑ Clamp the inboard end of the tab with the bending blocks to the edge of a table (See Figure 6-1) Use double-sided tape between the mating surfaces of the bending blocks and the trim tab skin to help prevent the wedge shaped blocks from slipping.

- ❑ Bend the bottom tab down using the face of a block of wood, working progressively back and forth across the tab (See Figure 6-2). Finish the bend by using a flush set and a rivet gun turned down low (See Figure 6-3). Work the rivet gun across the entire tab without stopping.
- ❑ With the block still clamped in place repeat the above steps to bend the upper tab up and over the bottom tab (See Figure 6-4).
- ❑ Repeat the above steps for the outboard tabs.
- ❑ Cleco E-607PP to the inside bottom surface of E-619PP-1-020.
- ❑ Clamp E-718 to E-717 and run a clevis pin through the clevis pin attach hole for alignment. Cleco the E-717 outboard horn to the trim tab skin. Using the holes in E-718 as a drill guide, match drill E-718 to E-619-1-020 and E-607PP.
- ❑ Use the dimensions given on DWG 4 to position and clamp E-721 to the top flange of E-607PP. Mark the inboard edge of E-619PP-1-020 and E-607PP on E-721.
- ❑ Drill the remaining holes attaching E-619PP-1-020 to the bottom flange of E-607PP. Drill the holes attaching E-619PP-1-020 to the top flange of E-607PP and E-721.
- ❑ Disassemble the trim tab.
- ❑ Machine countersink the top of the E-607PP trim tab spar to accept the dimples in the trim tab skin (See "Countersinking", Section 5.5). Dimple the bottom flange of E-607PP.
- ❑ Trim off the excess material from the E-717 outboard trim tab horn and the E-718 inboard trim tab horn depending on the type of trim system used (See Manual Trim Assembly or Electric Trim Assembly, DWG 4).
- ❑ Trim the inboard edge of the aft portion of the E-721 trim tab hinge.
- ❑ Prepare the parts (See "Edge Finishing", "Deburring", "Dimpling" and "Priming", Section 5.2, 5.5 & 5.1).
- ❑ Cleco the trim tab back together.
- ❑ Rivet the bottom of E-619-1-020 to the bottom flange of E-607PP, E-717 and E-718.
- ❑ Remove the clecos along the top flange of E-606PP and clamp E-721 to the upper flange of E-606PP and the aft edge of E-701-L.
- ❑ Adjust the position of the hinge on the elevator so that the inboard and trailing edges of the trim tab are aligned with the corresponding edges on the elevator (The trailing edge being more critical than the inboard edge). Use a long straight edge to aid in aligning the trailing edge.
- ❑ Match drill and cleco the forward portion of E-721 #40 using the holes in E-701-L and E-606PP as a drill guide.
- ❑ Mark the inboard edge of the E-701-L skin on E-721.
- ❑ Remove E-721 and trim the inboard end to match the inboard edge of the E-701-L skin.
- ❑ Re-cleco the tab hinge and trim tab assembly onto the elevator.
- ❑ Sight down the trailing edge of the elevator, with the trim tab in trail. If the tab has any twist and does not continue the straight line of the elevator trailing edge, now is the time to correct it. Even with the clecos installed, there is enough play in the holes to gently twist the tab as necessary to align it perfectly. When the tab fits, use tape or a second pair of hands to hold it, and drill the folded ends of the inboard tabs.
- ❑ With a pair of clecos in the inboard tabs, and a couple of reference marks for alignment, remove the trim tab from the elevator.

- ❑ Carefully maintaining the alignment, set the rivets on the top of the trim tab.
- ❑ Set the blind rivets in the ends of the trim tab, making sure they don't interfere with the rivets in the inboard tabs of the elevator.
- ❑ Rivet the forward (elevator) half of E-721 to the elevator.
- ❑ Install and bend the trim tab hinge-pin and secure as shown on DWG 4, View A-A. The hinge pin supplied is too short to do this now. You will receive longer pins with the fuselage kit.

FINISHING THE ELEVATORS

- ❑ Roll and rivet the leading edges (See “Rolled Leading Edges”, Section 5.9).
- ❑ Install the rod end bearings as shown (See Detail D, DWG 5).
- ❑ Make a preliminary check to see that the elevator will swing through its full up and down travel without any interference’s (See “Flight Controls”, Section 15). Travel is best measured with a protractor or an electronic "smart level". It will probably be necessary to remove the bottom flange of HS-603PP to allow the elevator horns enough swing. DO NOT remove any of the HS-609PP bar!
- ❑ Align the trailing edge on the extended chord line of the stabilizer: "in trail." The counterbalance arm should align evenly with the stabilizer. Secure the elevator in this position.
- ❑ Fabricate a “drill bushing” with an outside diameter of 1/4" and an 3/32" inside diameter. Any small metal tube can be used. The bushing will protect the VA-146 hinge bearing from the drill bit and act as a drill guide to locate and drill the hole in WD-605-1-R for the bolt that attaches the horn to the center bracket.
- ❑ Insert the drill bushing into the HS-411PP hinge bracket/bearing assembly. Using the drill bushing as a drill guide, pilot drill WD-605-1-R to #40.
- ❑ Remove the elevator from the horizontal stabilizer and carefully drill the hole in the WD-605-1-R horn to final size.
- ❑ Repeat the above steps for the left elevator assembly.
- ❑ At this point the E-714 counterweights will overbalance the elevators. Final adjustments are made after the elevators are complete and painted. It is impossible to make the elevator balance exactly until is finished. The best approach is probably to leave the counterweights a little heavy, then drill the inboard side of the counterweight with a series of small holes until the elevator balances. A correctly balanced elevator will remain "in trail".
- ❑ Install the elevators on the horizontal stabilizer and make a check for alignment. There should be no binding in the hinge line.

INSTALLING FIBERGLASS TIPS

You can add the fiberglass tips to the completed empennage now or you may chose to wait and do all the fiberglass work at a later stage. Fiberglass is abrasive and will dull your countersink.

After dimpling the skins and machine countersinking the fiberglass, the tips are attached with CS4-4 “pop” rivets. Installing the rudder and elevator tips first will make it easier to fit and trim the tips of the horizontal and vertical.

Figure 6-5 details ideas on closing the open ended tips.

Note: On the RV-7 only, wait to install the fiberglass rudder bottom until the rudder is fit to the fuselage. It may need to be modified to clear the tail spring.

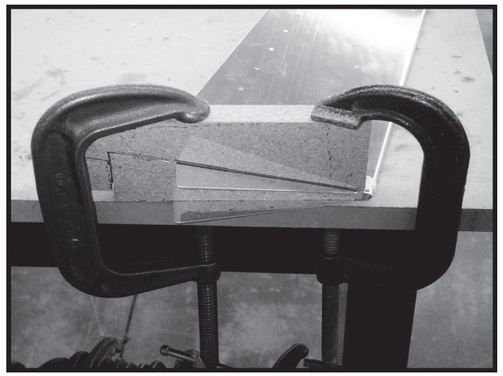


Figure 6-1

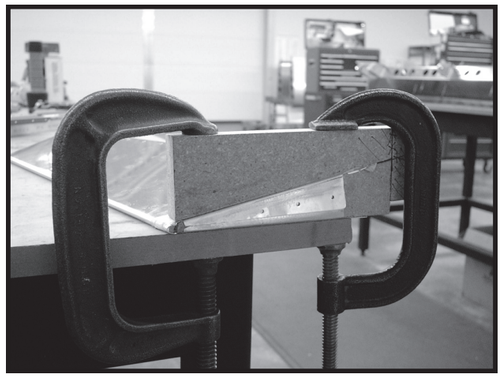


Figure 6-4

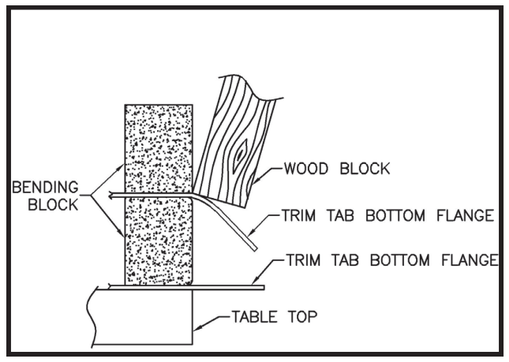


Figure 6-2

Figure 6-3

FIGURE 6-5

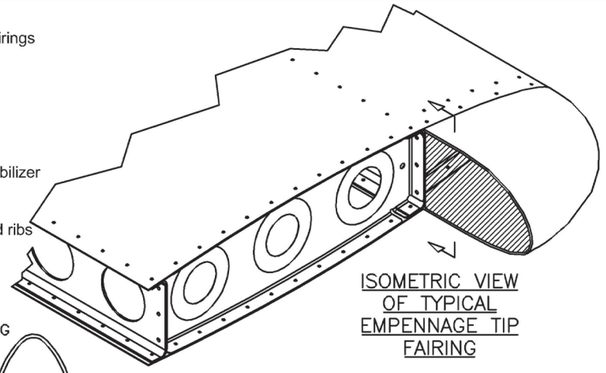
The open ends of the following empennage tip fairings must be closed:

RV-7 & RV-8: Elevator and rudder

RV-9: Horizontal and Vertical stabilizers

The open ends of the RV-7 & RV-8 horizontal stabilizer tip fairings may be closed if desired.

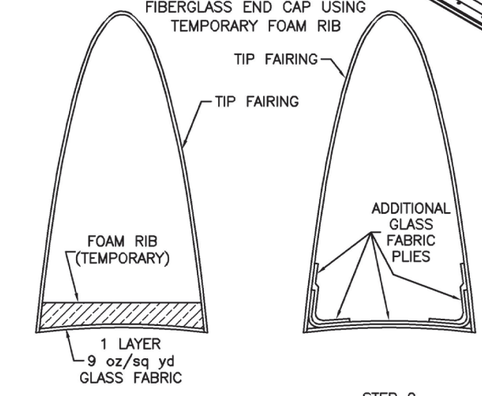
A couple of possibilities for creating tip fairing end ribs are presented here.



ISOMETRIC VIEW OF TYPICAL EMPENNAGE TIP FAIRING

OPTION 1:

FIBERGLASS END CAP USING TEMPORARY FOAM RIB

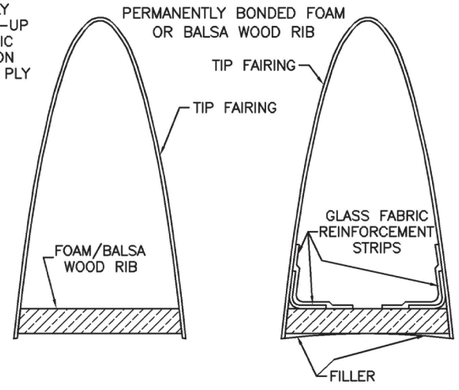


STEP 1
FIT FOAM RIB, TEMPORARILY BOND IN PLACE, TRIM 1 LAYER GLASS FABRIC, BOND IN PLACE OVER FOAM RIB

STEP 2
AFTER CURE, CAREFULLY CHIP-OUT FOAM RIB, LAY-UP ADDITIONAL GLASS FABRIC REINFORCEMENT PLIES ON INNER SURFACE OF FIRST PLY

OPTION 2:

PERMANENTLY BONDED FOAM OR BALSA WOOD RIB



STEP 1
FIT FOAM/BALSA WOOD RIB AND PERMANENTLY BOND IN PLACE

STEP 2
AFTER CURE, BOND IN GLASS FABRIC STRIPS AND USE FILLER TO FILL GAPS AND SURFACE IRREGULARITIES

NOTES

NOTES

SECTION 7: BUILDING THE WING

FIRST, A NOTE TO QUICKBUILDERS

All information necessary to complete the RV-7/7A QuickBuild Kit is contained in the standard Builder's Manual. The empennage, built from the Standard Kit, should be completed before starting the wings and fuselage. The skills learned during empennage construction are necessary during the rest of the project.

After completing the empennage, we suggest finishing the wings. They will not take long, and are relatively easy to store. The jig shown in the Builder's Manual is not required to align QuickBuild wings, but you may find it a convenient way to hold the wing while fitting and riveting.

Obviously, not all the information needed to build wings from the Standard Kit is necessary for wings built from the QuickBuild Kit. However, we still recommend reading the entire chapter to gain the "big picture." Once you understand the basics of wing building, you can extract the relevant information for the QuickBuild Kit.

Use the following sequence as a place to start.

- Install Wd-421L&R-PC bellcranks. See Builder's Manual section ATTACHING AILERONS TO THE WING and DWG 15A. Remove the top bracket to facilitate installing the bolt.
- Make the W-818 and W-716 pushrods. See Builder's Manual section ATTACHING AILERONS TO THE WING and DWG 15A.
- Install W-413L&R and W-414L&R aileron brackets on rear spar. See Builder's Manual section INSTALLING THE AILERON BRACKETS in the RIVETING THE WING SKIN Section and DWG 13A.
- Be sure lighting, wiring, and pitot line provisions are complete.
- Prepare and rivet the W-705 outboard bottom skin. See Builder's Manual sections RIVETING THE WING SKINS and FINISHING THE WING and DWG 12.
- Install the W-715 wingtip. See Builder's Manual section WING TIP INSTALLATION and DWG 12.
- Complete details of access panel in W-705. See DWG 12.
- Install the ailerons and flaps on the wing. See Builder's Manual sections FLAPS, ATTACHING AILERONS TO THE WING and DWGS 13A, 14A, 15A.

OVERVIEW

The wing assembly sequence begins with the construction of the main and rear spars. Leading edge and tank assemblies are then fitted to the main spar. The wing main ribs are then prepared and installed to the spars. The skeleton is placed in a holding fixture where the main skins are fitted. The wing is then checked for overall dimensions and twist. The leading edge and main skins are then taken off for dimpling, priming, and subassembly prior to final riveting on the wing. The bottom skins are left off until last. The internal parts of the wing (aileron and flap hangers, aileron and flap braces etc.) are installed. Riveting the lower outboard skin closes the wing.

GETTING READY

Before construction begins, spend some time building a few simple fixtures. Make a wing assembly stand by adding arms and supports to a vertical pair of 4X4s as shown on DWG 12A. Also on DWG 12A is a simple tool for aligning the ailerons and flaps.

The biggest fixture project is the wing stand shown on DWG 12A. If you take the time to build this before starting wing construction, you will have a convenient, safe place to store the finished wing panel. Some builders add custom details, like swiveling casters, to make the wing stand even more useful.

PREPARING THE MAIN SPAR

The main wing spar is supplied completely assembled and anodized for corrosion resistance. Carefully inspect the spar for shipping damage. Use a large marking pen to mark the orientation of the spar ("right top", "forward", "left bottom", etc.) and study the plans until you understand how the spars are installed. You do NOT want to build a wing upside down!

To begin wing construction, rivet the tank skin attach platenuts to the spar as shown in DWG 16A, Detail A.

Machine countersink (trying to dimple the 0.063 thick spar flange will result in severe distortion!) the platenut attach

holes in the W-706A spar flange. See Section 5E. Use a microstop countersink with a #30 pilot to countersink the screw holes in the spar to the proper depth for the #8 screw. The pilot will center in the countersunk platenut well enough to keep the hole round and concentric. (Tip: cut a #8 screw short so that it enters the K1100 nutplate easily and use it to gage the depth.)

Attach the K1000-06 platenuts for the W-822 access plate to the W-706A flange (note that the access plate uses #6 screws on the spar flange and #8 screws around the perimeter.) See DWG 12. Dimple the access plate for a #6 screw, then machine countersink the spar flange to fit the dimples. Use a #40 piloted countersink cutter to center in the platenut. See section 5E to determine the depth adjustment of the countersink.

Attach the two K1000-4 center section attach nutplates to the forward side of the spar. Countersink the W-706C doubler plate to allow the flush heads of the rivets to rest on the aft side of spar. This allows the doubler plate to fit flush against the F-704G vertical bars (DWG 11).

Spot prime all countersunk holes where the anodizing has been removed.

Fabricate the tie-down assembly (DWG 15A). Make the two W-726 spacers, but leave them un-drilled. Cut the W-731 Tie-down bar to length from the AEX stock provided and drill the match hole at the dimensions shown. Clamp the W-731 and W-726 spacers to the spar and slip a bolt through the location hole and the hole in the spar. Align the W-731 and back drill all the bolt holes through the spar.

Remove the tie-down and spacers from the spar, cleco or bolt them together and drill the holes for the platenut rivets. Use a platenut as a drill guide. Machine countersink the W-726 spacers, rivet the plate nuts, spacers and tie-down together and bolt the assembly to the spar. Note that the plate nuts are NOT riveted to the spar web. If a platenut must be replaced, the tiedown assembly can be removed and the repair made out on the bench, without drilling rivets out of the spar.

Remove the assembly, deburr and prime. Install the tiedown assembly and the W-823PP bellcrank brackets on the spar. The tie-down rings are not supplied in the kit, as they are simply 3/8 inch eyebolts available from most hardware stores. Weld the eyes closed to add strength. If you prefer you can order forged tiedown rings (p/n Bolt Eye 3/8x16TD in Van's Accessories Catalog.)

Drill the W-706-L spar for the stall warning system wire run. See OP46-02 Step 8 and OP46-02 Figure 3.

ASSEMBLING THE REAR SPAR

The W-707 rear spar assembly, shown on DWG 10A, is a "Z" section channel, reinforced where it joins the fuselage and at the aileron brackets.

Deburr the edges of the W-707A rear spar channel, and the W-707E and W-707F doubler plates. Trim the ends and deburr the edges of W-707G & D as shown on DWG 10A & DWG 38.

Begin rear spar assembly by clamping the W-707E and W-707F doubler plates to the spar. Vertical placement is correct when the flanges of the spar and the reinforcement plates are tight. Lateral placement for W-707F is determined by aligning the outboard edges of W-707F and the W-707A spar channel. To place W-707E measure the distance between the outboard edges of W-707E and W-707A (See DWG 10A).

Using the spar as a template, clamp, drill and cleco W-707E/F to the W-707A spar channel. Mark and cut out the holes for the aileron pushrods. You can use a Unibit to remove a major portion of the area, and then use a round file or a rotary cutter in a die grinder to remove the remaining portion. Carefully smooth and deburr the inside of the holes.

Cleco the W-707G reinforcement fork and the W-707D rear spar doubler plate to the W-707A spar channel and drill the rivet holes to full size. Note: this part bends during punching and can be straightened easily by hand.

Deburr, prime and prepare the rear spar components for riveting. Note that some of the holes in the W-707F are machine countersunk for flush rivets (DWG 10A, Detail A).

Once the reinforcement fork is riveted to the spar, it is difficult to dimple some of the holes in the upper flange of the spar. On the inboard top flange, for the length of the W-707G, drill the holes for the main wing skin to final size (#40) and dimple them before attaching W-707G.

Some rivets in the rear spar reinforcements also attach ribs, aileron brackets, aileron gap fairings and the flap braces. Tape over these holes so you do not inadvertently put a rivet in one.

Rivet the components of the rear spar together.

PREPARING THE WING RIBS

You will save time if you set up and prepare all the ribs for both wings at the same time.

Begin preparing the ribs by deburring the edges of the flanges and lightening holes. A small Scotchbrite wheel

mounted in a die grinder prepares the inside edges of the holes quickly and easily. Pay particular attention to the forward parts of the leading edge ribs. Remove all bumps around the notches to insure that the skin fits well.

Wing ribs come in seven flavors. Part numbers are marked on the ribs at the factory, but if you cleaned them off by mistake, they may still be identified:

- There are three types of main ribs, W-710, W-711 and W-712. At first glance they look identical, but they are not. W-710 is 0.032" thick. W-711 and W-712 are 0.025" thick. W-712 is slightly longer than W-711 and the 7/16" dia. hole near the front flange for the pitot tube line is omitted.
- There are two different leading edge ribs: W-00708 and W-709. The W-00708 rib is slightly (0.032") undersized around the perimeter to accommodate the W-00723 joint plate.
- Tank ribs differ in thickness and hole pattern. T-703 ribs, used on the ends of the tanks, are 0.032" thick. The internal T-704 ribs are 0.025" and have a pattern of large holes to allow the fuel to run from one bay to another. The holes in the upper side are for venting air, and are located at the high point of the tank in a three-point attitude and in cruise flight. DON'T CONFUSE LEADING EDGE AND TANK RIBS. They look much the same, but the tank ribs are shorter.

Ribs may be either "left" (suffix L, i.e.: W-709-L) or "right" (suffix R, i.e.: W-709-R). You may identify the "hand" of a rib by holding it with the leading edge away from you with the flange closest to the tooling holes toward the floor. If the flange is on your left, the rib is an "-L", if it is on the right, it is an "-R".

Adjust rib flanges 90° to the web using hand seamers.

The forming process leaves ribs bowed, particularly the leading edge ribs. Straighten the webs with fluting pliers. Place the center of each flute at the midpoint between the prepunched holes. Use a straightedge or holes in a wing skin to check for straightness of the line of rivet holes. The straighter the parts, the better they will fit.

Make provisions for running stall warning system wires (left wing only) and, if you intend to install them, wingtip position lights, strobes or landing lights. Drill holes in the ribs for grommets, or conduit sold in VAN'S ACCESSORIES CATALOG. Opening up the tooling holes works well. Be careful not to interfere with the pitot line or control systems. Leave the tooling hole in the outboard tip rib undrilled for now. The smaller hole is useful for aligning the aileron. The 7/16" hole in the inboard ribs of the left wing get plastic grommets for routing the pitot tube line.

ASSEMBLING THE WING SKELETON

MAIN RIB/SPAR ASSEMBLY

Cleco the W-710, W-711 and W-712 ribs to the main and rear spars. Be sure the proper ribs are in the right locations and that wire and pitot tube routings are aligned. The ribs do not have all their flanges facing the same way.

Drill the holes attaching the ribs to the spars to full size. Most of the ribs simply fit to the spar without modification. However, two W-709 ribs just outboard of the tiedown require two new rivet holes (one near the top, the other near the bottom). Drill these, using the holes in the spar as guides. The two holes left unused in the rib are simply abandoned. A similar situation applies to W-711-L & R in the wing walk, use the top & bottom holes at the rear spar and drill new holes using the rear spar as a guide.

Remove the ribs and do the necessary deburring and priming.

Reassemble the ribs and spars with clecoes.

Put protective tape on the W-706B/D spar flange bars to prevent bucking bar damage when installing the top and bottom most rivets. Rivet the main ribs to the front and rear spar, EXCEPT for the outboard W-712 rib, which is riveted to the rear spar, but not the main spar. Place the manufactured head of the rivet on the rib flange (side with thinnest material), to prevent distorting the parts.

WING STAND

Although the matched-hole process eliminates the need for the traditional wing jig, mounting the wing in a stand will make it easier to build. A stand allows access to both sides of the wing and makes it easy to take measurements and assure the wing is straight. The wing has no washout, twist or taper.

The stand (shown on DWG 12A) is simple; two vertical posts run from floor to ceiling. Horizontal arms of steel angle or wood, bolted to the posts, support the main spar. The size of the posts and arms is not important, but they must be sufficiently strong and rigid to support the wing.

Clamp or bolt the wing skeleton to the horizontal arms of the jig. To provide a mounting point on the outboard end of the wing, drill and bolt a temporary 5" long piece of aluminum angle, parallel to the spar web, to the outboard rib with 3/16" bolts. The small additional holes in the ribs will not compromise strength.

The center of the skeleton will sag toward the floor when it is mounted in the stand. To make installing and removing the skins easier, support the skeleton in the middle. Run a fishing line along the rivet holes in the main spar. Then adjust the middle of the skeleton with a 4x4 wood block and shims, screw jack, etc., (almost anything that will remain stable works) placed under a rib. Raise the skeleton just enough to bring the rivet holes even with the fishing line along the length of the spar.

FITTING THE WING SKINS

Wing skins are pre-punched with pilot holes for the ribs and spars. The vinyl can be left in place when fitting and drilling the main wing skins to prevent scratches (except on the inside of the leading edge and tank skins, where the vinyl should be removed before fitting.) Remove the vinyl before dimpling to prevent pounding trapped drill shavings into the skin with the dimple die.

FITTING THE MAIN SKINS

Cleco the forward row of holes in W-702 and W-703 skins to the matching holes in the main spar. Cleco the W702 and W-703 skins to the ribs using a cleco in every fourth hole.

Don't forget to insert the W-00727-1 wing walk doubler between the ribs and the W-702 skin. The main skins overlap at the eighth rib from the root. The outboard skin should fit on top of the inboard one.

Gently pull ribs into position if the matched holes do not align with the skin holes. Drill all the holes to final size.

Start drilling in the upper middle of the panel and work down and out toward the edges, work out any slack as you go.

Move the clecoes down one hole (into the drilled holes) and drill all the remaining holes.

Repeat the procedure for the W-704 and W-705 bottom skins.

Draw a couple of lines on the main skins that intersect at the center of the hole for the tiedown eye.

Remove the bottom main skins before fitting the leading edge and tank skins. Leave the top skins clecoed.

LEADING EDGE ASSEMBLY

BUILDING THE CRADLE

Construct a cradle as shown on DWG 12A to hold the tank and leading edge during construction. Don't waste time making the cradle perfect, since it simply holds the leading edge, and has no bearing on alignment. Use a W-709 rib to trace the shape. Pad the surfaces of the cradle with something soft to prevent skin scratches.

FITTING THE LEADING EDGE

Remove the vinyl from the inside surface of the W-701 leading edge skin.

Modify the W-701-L leading edge skin for the stall warning assembly. Complete OP46-02 Steps 1-4 and OP46-03 Steps 1-5.

Place the W-701 leading edge skin in the cradle. The ribs are much easier to install with it pre-bent to shape in the cradle.

Cleco the W-709 ribs into the W-701 Leading Edge Skin. Install the clecoes on the top first; working from the front to the rear. Then cleco the bottom, also working from the front to the rear. Cleco the VA-195F mount bracket to the W-701-L leading edge skin (OP46-04 Step 8). The most inboard rib (W-00708 Leading Edge Rib) will be installed later. Mark the ribs so they may be reinstalled in the same location.

Remove the leading edge assembly from the cradle and place it on the spar. Put clecoes through the spar into the ribs. Also cleco the W-701 Leading Edge Skin to the wing spar through about every third hole.

Slide the W-00708 Leading Edge Rib in place starting at the lower aft edges of the Leading edge skin. Slide the W-00723 splice plate between the leading edge skin and the W-00708 rib (The chamfered edges of W-00723 indicate the upper aft edge). You can pre-bend the W-00723 to make it fit better around the leading edge. Work the W-00723 Splice Plate into place between the W-701 Leading Edge Skin and W-00708 Leading edge rib. You can gently tap the rib or strip with a soft hammer to coax things into place.

Extend the lines for the tiedown eye onto the leading edge. They should intersect at the pre-punched hole but variations will occur. If necessary, file the hole in the correct direction to center it over the tiedown hole, then drill it full size with a Unibit.

Leave all of the clecoes in place and move on to the tank.

ASSEMBLING THE FUEL TANKS

The fuel tanks are also the inboard leading edge of the wing, so they are constructed in a manner similar to the outboard leading edge. However, the tank is removable so the tank ribs can not be permanently attached to the spar. The tank is attached to the wing two ways. Flush machine screws fasten the skin to the spar flanges and bolts hold the T-00712A-2 and T-00712B-2 fuel tank attach brackets (mounted on the rear tank baffle) to the spar web. The tank is also held to the fuselage by the T-405 attach angle.

Fuel tank construction and details are on DWG 16A.

INSTALLING TANK ATTACH ANGLE NUTPLATES

Rivet the nutplates to the T-00712B-2 angles.

Install the three nutplates on the aft side of the spar where the T-00712A-2 angle attaches.

FITTING THE TANK SKINS TO THE RIBS AND REAR BAFFLE

Complete any remaining rib preparation details. Bend flanges 90° and flute ribs. Use a square to check the flanges and a straight edge and/or skin to check the ribs for rivet hole alignment.

Make all T-711 A through D stiffeners as shown on DWG 16A. Round all stiffener corners, deburr edges, then cleco and final drill them to the T-701 skin.

Cleco the tank skin to the baffle (still fastened to the spar) and the wing spar. The fit between the spar, baffle, tank skin and leading edge should be perfect. If not, elongate the holes in the baffle inboard or outboard as necessary to allow the baffle holes to align with the T-701 holes when T-701 is clecoed to the spar.

Remove the T-701 skin and cleco all the tank ribs to the baffle. Drill the rib/baffle/attach bracket holes full size. Use a drill stop to prevent damaging the spar.

Remove the vinyl from the inside of the tank skin and cleco the skin to the ribs, baffle and spar.

Remove the clecoed tank assembly from the wing, and drill all rivet holes to final size. (Doing so off the wing prevents accidentally drilling into the spar).

Machine countersink the spanwise rows of holes in the T-701 tank skin (not the baffle) that attach the skin to the T-702 baffle. Have the baffle in place so that the pilot has a good hole to guide the countersink. This makes it easier to slide the baffle into position on final assembly.

Drill the spar attachment screw holes and the W-00723 screw holes to final size using a #19 drill.

Disassemble the tank, marking all parts so they may be easily returned to the same location.

Fabricate the T-405 tank attach angle and pre drill with the rivet holes per DWG 16A.

Clamp the T-405 and T-410 reinforcing plates in place on the end ribs and drill the attach holes.

If you plan to use the capacitive fuel gauge senders offered in the VAN'S AIRCRAFT ACCESSORIES CATALOG you should complete their installation at this point using the instructions supplied in the sender kit.

FINAL PREPARATIONS

Modify the inboard end ribs as shown in the right side view of DWG 16A. The large hole for the access cover is best cut using a flycutter on a drill press.

Stiffener ring T-407 and access plate T-708 are supplied pre-punched. (The T-708 access plate is designed to mount the Stewart-Warner float-type sender offered in VAN'S ACCESSORIES CATALOG. If you wish to install a different sender, the T-411 plate is available without the sender mounting provisions).

Clamp the T-708 cover plate on the rib with the flat forward edge aligned with the stiffener bead, and an equal distance to the top and bottom rib flanges. Drill all of the screw holes, clecoing as you go (be sure the hole for the fuel pick-up tube is oriented toward the top of the tank). Remove the T-708 and cleco the T-407 in place.

Drill all of the platenut rivet attach holes. Remove the T-407, deburr all holes, dimple the rivet holes in the rib, and machine countersink the rivet holes in the T-407 for the dimples. Rivet the T-407 and the platenuts in place. The gasket under the T-708 cover plate will seal these rivets, so they do not have to be set with tank sealant.

Fit and drill the T-00007B fuel cap flange. Use the cap (installed in the cap flange) as a guide for centering the

flange in the tank skin opening. Note that the cap flange has two slight bends in it to help it to conform to the curve of the tank skin. Make the T-714 clip from a scrap piece of aluminum and drill it for installation sharing one of the cap flange rivets. Countersink the top of the T-00007B to accept the dimples in the tank skin.

Center the VA-112 drain flange on the prepunched hole and drill it to the tank skin. Machine countersink the holes for the attach rivets.

Dimple the skins and ribs. Dimple the holes for screws with the C-frame tool and a hammer, instead of trying to form them with a rivet squeezer. It looks nicer.

Do not prime any area that will be on the inside of the tank. Fuel could have an adverse effect on the primer, or (worse) vice versa. At this point, all parts of the tank should be deburred, dimpled, and primed as necessary.

ASSEMBLING AND SEALING THE TANK

Plan on two or three work sessions to seal a tank. Working on both tanks at once will help to speed things up. See section 5S for more information. The tank is riveted together just like any other structure with one very important difference. Apply sealant between the parts to any seam through which fuel could conceivably leak. This includes every rivet. The recommended sealant, MC-236-B2 is available through VAN'S ACCESSORIES CATALOG.

Although the sealant used to seal the tanks is not particularly noxious, only use it and the solvents used in tank construction with adequate ventilation. Use a respirator, gloves (which also keep oil from your skin off the surfaces to be sealed) and protective cream when sealing the tanks. Why expose your skin and lungs if you can prevent it?

Roughen all mating surfaces using a scotchbrite pad. Don't be bashful; score the aluminum well, so the sealing compound will have more surface to grip.

Clean the manufacturing residues and oils off all the rivets by sloshing them in a jar of solvent and drying them on a clean rag. Clean the mating surfaces of the skin, stiffeners and ribs. Clean every surface that the sealer is applied to. Recommended cleaners include naphtha or MEK. Builders have also reported excellent results with etching using a light phosphoric acid (brand names include AlumaPrep or Twin Etch).

It is essential that the surface of the aluminum be clean when the sealer is applied. Not just kind-of-clean or clean enough. Clean.

After cleaning, do not pollute the areas to be sealed. Don't even touch them. Oils from your skin will affect the bond of the sealant.

The tank sealant should be mixed as accurately as possible. This is done by weight. Follow the instructions supplied with the sealant. When mixing sealant, do not mix too much at one time. A batch the size of four or five golf balls is usually enough for one work session. The sealant provides 45 to 90 minutes of working time (less in warmer temperatures). Measure by volume or weight as accurately as possible and mix thoroughly before applying. To use the sealant as soon a possible, have all the work well planned and tools all laid out. Have a container of acetone, MEK, or lacquer thinner nearby for the frequent tool cleanings necessary during riveting. You can peel away overflow on areas you want to keep clean by strategically applying plastic tape before spreading the sealant (such as along any areas of the skin that have to mate flush with the wing spar or W-00723 splice plate).

After thoroughly mixing the sealant, use Popsicle sticks to apply an approximately 1/16" thick layer to the parts being riveted. In the first work session rivet on the T-711 stiffeners. Back-riveting works well here, so spread a thin layer of sealant on the inside of the skin, covering the area the stiffener will contact, then insert the rivets into the skin from the outside and tape them in. Press the stiffener into place. Sealant will ooze out around all the stiffener edges. When the stiffener is firmly seated, back rivet it permanently into place. Even more sealant will squeeze out as the rivets set. Clean this away, making neat fillets around all the edges of the stiffener with the curved end of the Popsicle stick. Dab a bit of sealant over every rivet head.

Rivet the VA-112 drain flange, T-00007B fuel cap flange and T-714 clip to the skin, using sealant in the same way. Cover the aft tooling holes in the outboard T-703 end ribs by riveting on a small plate, or by filling the hole with an AN470AD6 rivet. (See Figs. 7-8, 7-11.) After each session clean everything that you do not want to have a permanent coat of sealant. It is much easier to clean up before the sealant sets.

For the next session, rivet all the interior ribs to the skin (if you can only do a few ribs at a time, that's fine.) Work in the “cradle." When assembling the tank, cleco all ribs to the skin. This keeps the assembly straight. You may want to start riveting with the rib next to the outboard one. After this rib is clecoed in place with sealant you can remove the outer end rib for easy riveting access. Remove the ribs one at a time, apply sealant, and rivet. When riveting the ribs to the skin work from the leading edge to the trailing edge.

Insert the rivets and set them with a squeezer or a rivet gun, as appropriate. Use the Popsicle sticks to form the squeezed-out sealant into fillets in the rib/skin joint. Apply extra sealant to the rivet heads.

Next, install the inboard end rib. After the rivets joining this rib to the skin are squeezed, install the T-405 and the T-410 (fitted to the inside contour of the skin as shown on DWG 16A) on the leading edge. Put a thin layer of sealant on the sealing surfaces. (If T-405 were installed on the rib before riveting the rib to the skin, the skin rivets around the leading edge would be very difficult to set.)

Seal and rivet the other T-410 to the outboard end rib. Three or four AN470 rivets is sufficient.

Apply a generous fillet of sealant around the inside of the end ribs where they join the skin, particularly at the very leading edge. Also make sure the outboard end rib aft tooling hole has been sealed. Finally, clean any excess sealant from the rear of the ribs and skin where the baffle will later rest and clean any sealant smeared on the outer surfaces. Once cured, it is difficult to remove.

CLOSING AND FINISHING THE TANK

If you are using a float type fuel sender, adjust and check it before closing the tank. Dimensions for the float arm of the IE F-385 B/C sender in VAN'S ACCESSORIES CATALOG are shown on DWG 16A. Make an electrical check with a 12-volt battery and a fuel gauge, or a multimeter should show about 32 ohms when the sender is in the "full" position and about 240 ohms in the “empty” position.

Install the fuel pick-up tube and position it so it lies on the bottom of the tank. Use a small amount of sealant to seal the rivet holes.

Check all final details before installing the baffle and closing the tank. Check that the tank vent line is in, and its outlet is at the tank high-point. Check the vent line bulkhead fitting to see that it is tight and that it has been installed with sealant.

Assured that everything is in order, apply sealant to the tank skin from the rivet holes forward. Upon installation the baffle acts as a squeegee and the bead of sealant will be pushed ahead as the baffle is moved forward. Use a maximum of 3/16' bead of sealant. Too much, and the thickness can start to build up, making the tank difficult to install on the wing. Put a bead of sealant along the inside edge of the flange on each end rib. Put a heavy glob of sealant where each corner of the baffle will meet the end ribs (this is one of the most common locations for leaks).

Put a very thin smear of sealant around each of the rivet holes on the back flanges of the T-703/4 ribs.

Important: You may have noticed that the tank ribs have a larger notch in the lower corner than in the top corner at the rear flange. This is to allow any water that may condense in the tank to run to the low point and be drained. Be careful not to allow the tank sealant to block off this path.

With the tank sitting in the cradle, install the T-702 rear baffle assembly by dropping it straight down onto the rear flanges of the ribs.

Put a cleco in every hole of the T-701 skin to T-702 baffle joint. After clecoing, inspect the skin to see if it is pillowed out between the clecoes. The contact surface of the tank baffle flange may require pressure to force out excess sealant. The easiest method is to apply a c-clamp or strong spring clamp between each set of rivets and squeeze out the excess. If you are unsure, clamp the flange in a couple of spots and see if it makes a difference.

Twirl the AD-41 H closed end blind rivets in sealant and set them in the top and bottom baffle-to-rear rib-flange holes. The T-00712A-2 and T-00712B-2 brackets are installed last. Check to be sure the platenuts have been installed on them because it is much more difficult to do once they are riveted to the tank. Put a very light smear of sealant over each hole for mounting the T-00712A-2 and T-00712B-2 brackets. Note that the brackets on each end of the tank use solid rivets, not blind rivets. While double-checking with DWGs 16A and 10A, cleco each T-00712A-2 and T-00712B-2 bracket in place. Be sure you get them oriented correctly because they will shortly be very difficult to change. Install the AD-42H blind rivets in the five T-00712B-2 brackets after twirling them in sealant as indicated in DWG 16A. This may require modifying a blind rivet tool by grinding enough of the puller “nozzle” away to get into the corner of the Z angle.

Finish all riveting and clean any excess sealant off the tank.

To mount the T-708 cover plate use an 1/8” inch thick bead of fuel tank sealant between the cover plate and the inboard rib. Dab a small blob of sealant on threads of each attach screw, insert into the holes, and tighten them sequentially until sealant bulges evenly about 1/32” from underneath the perimeter of the sender plate. Some builders may optionally seal the T-407 gasket to the tank with sealant as well. The sealant will also form a small gasket around each screw head.

Install the IE F-385 Sending Units with sealant using the appropriate hardware. DO NOT install the rubber gasket supplied by the manufacturer. Use the same procedure for sealing the sending unit as was accomplished above.

A continuous electrical path is necessary between the airframe and the sender plate so be sure that at least one of the screw heads is making metal to metal contact with the outside of the sender plate. Conduct a final electrical

continuity test for the sender units with an Ohm Meter by probing the tank body and the sender center screw to ensure proper operation.

Wait at least 24-48 hours and then conduct a fuel tank leak check using the FUEL TANK TEST KIT available in the VAN'S ACCESSORIES CATALOG.

RIVETING THE WING SKINS

There is a definite order in installing the wing skins. First, the leading edge (built off the wing) is installed. Then the top main skins are installed. The wing is then rigid enough to remove from the stand and install the ailerons, flaps and work on the internal details. After that is complete, the wing is laid, top down, on a large table and the bottom skins are riveted.

WING SKIN PREPARATION AND ASSEMBLY

Remove the skins, deburr and dimple them. Complete OP46-02 Steps 5-6 deburring and dimpling (rivet parts when riveting skins).

Prepare the skeleton while it is still fastened to the stand. Drill a 7/16" hole in the left W-701 outboard leading edge skin and the left main spar flange for the pitot tube fitting (see DWG 15A.)

Dimple the ribs with a hand squeezer. The 0.063 main spar channel is too thick to dimple so it is machine countersunk per section 5E.

Dimple the 0.040 rear spar and “touch up" the dimpled holes slightly with a sharp deburring bit or microstop countersink. This "touch up" operation removes just a small amount of metal to make the skin dimple fit better and is not critical, so it can be done by eye. The usual tendency is to remove too much metal, so use a light touch.

Deburr all holes in W-00723. Dimple the screw holes and the rivet holes for the rib and the platenut attachment. The holes for attaching to the rib and skin can be slightly touched up (like the rear spar) to gain a better fit between the skin, the splice plate, and the rib.

Cleco the main skins to the wing skeleton. The skins overlap, outboard skin over inboard. This means that the doubled skins will protrude above the aft edge of the tank skin at the spar. File the corners of these skins, starting at a point 3 or 4 inches from the corner, making each of them progressively thinner toward the edge. This will form a sort of “scarf joint” and lower the forward edge, making a clean joint with the tank skin. It is NOT necessary to scarf the whole width of the skin, just the corner.

This is the point of no return; the point where things start going together permanently. Make a close inspection to assure everything is clean and proper before continuing.

ASSEMBLING THE WING LEADING EDGE

Rivet the Leading Edge Assembly by fitting the skin into the cradle and then clecoing in the ribs and the W-00723 splice plate. After making sure that the holes at the aft end of the ribs are exactly aligned, rivet the aft most rivets on the top and bottom using a rivet squeezer. Finish the riveting by working from the rear towards the L.E. one hole at a time.

INSTALLING THE LEADING EDGE

Install the leading edge assembly on the wing skeleton. While the main skins are off, there is room to reach in and rivet the rib flanges to the spar web. This will require an offset rivet set. Remember the outboard W-709 and W-712 ribs are both riveted together in assembly with the W-706A spar web. After riveting the ribs to the spar, rivet the spanwise row of rivets, top and bottom, along the main spar web, using a rivet squeezer.

Install the fuel tank on the wing, with screws in every other hole, top, bottom and around the leading edge. Install about half the bolts in the Z-brackets.

RIVETING THE TOP SKINS

With the outboard leading edge riveted in place and the tank installed it is time to rivet the top main skins. While it is possible for one person to install the first set of main skins, it is much easier with two. Rivet the W-702 inboard skins first, because the outboard skins overlap them.

Begin by clecoing the inboard skin in position (wing walk doublers, too) and start riveting. To assure maximum skin tightness, rivet from the center rib of each skin outward towards the root and tip. Do this on both the inboard and

outboard skins, saving the double row of rivets at the lap joint until last.

Many builders find that they can get a nicer skin finish (especially when they are using less experienced helpers) if they back-rivet the wing skins. Use a large bucking bar laid over the rivet on the outside of the skin, and drive the head on the rivet from the inside using an extended back-rivet set available from some suppliers.

When the top main and leading edge skins are riveted on, remove the wing from the stand and put it on a padded worktable, top down. Block the wing so it doesn't rock around on the table.

If you are installing leading edge landing lights (p/n LL DW-01 in Van's Accessories Catalog) it is easiest to do it now, before the bottom skins are permanently installed.

INSTALLING THE AILERON BRACKETS

Assemble the W-413 and W-414 Aileron bracket assemblies as shown on DWG 10A. Install them on the rear spar by lining up the matched holes, drilling, deburring, and riveting.

INSTALLING THE FLAP BRACE AND AILERON GAP FAIRINGS

Drill, deburr, dimple where required, and rivet the W-721 flap brace (DWG 14A) to the rear spar.

QUICKBUILDER'S NOTE: *The W-721 must be attached to the rear spar with blind rivets. See the note on DWG 14A, Section B-B'.*

Drill the W-724 aileron gap fairing (DWG 13A) to the rear spar. Drill, deburr, and dimple where required, and rivet the W-724 aileron gap fairing to the rear spar.

RIVETING THE BOTTOM SKINS

The bottom skins are riveted while the wing lies top down on the bench. Begin with the inboard skin and rivet it to the rear spar, between the inboard wing walk ribs. This means pulling the skin back until you can reach the rear spar with a bucking bar. While it is possible for one person to rivet the bottom skins working solo if they use some sort of tape/rope/clamp system to peel the skin back, many builders find the job easier with a helper.

Be careful when pulling the skin back. If you try to bend it too sharply, you will get an unsightly, and irreparable, kink.

Work in an "L" pattern, riveting toward the tip along the rear spar, then about halfway up the wing rib. Before the skin is riveted all the way to the main spar, move to the next bay and repeat the process. After the second bay is partially riveted, complete the first. Riveting gets much easier as you move forward, because of the improved access through the larger holes in the ribs and the inspection openings. Once the inboard skin is riveted, the outboard is installed the same way, beginning on the inboard rib and working toward the tip.

Lay the skin back down after every bay or so and check to see that all the holes in the skin and the skeleton still align and that the skin is not "creeping" outboard.

AILERONS

The construction technique for RV-7/7A ailerons (DWG 13A) is similar to that of the elevators. The aileron uses ribs at the ends only; light angle stiffeners support the rest of the skin. The A-710 skin stiffeners are provided with the rivet holes pre-punched but not cut to length. The aileron skin is punched to match. These are match-drilled much like the stiffeners in the empennage. Cut and trim the stiffeners as shown on the drawing. Locate the stiffeners on the inside of the A-801-1PP rear aileron skin and drill.

Dimple the stiffener angles and skin. After priming (if desired), rivet the stiffeners onto the skin, preferably using the backriveting method described in Section . Following this, complete the trailing edge bend using the homemade bending brake used on the empennage. The bent skins must be straight up to the radius and the radius must be between 3/32" to 1/8". Match the degree of bend to the full size end view drawings. The upper and lower skin should just touch the spar when placed in position.

The A-403PP aileron spar is not symmetrical; the top and bottom flanges are bent to different angles. Check and label each spar for top, bottom, inboard and outboard. Make the A-408 aileron spar reinforcement brackets from supplied .040" material. Match-drill using spar holes as a guide and cleco as you go. Cleco the A-406-1 and A-407 aileron brackets in place and drill #12 for attach bolts. Label the parts, disassemble, deburr & prime as desired. Making sure that you leave the holes that will later attach the ribs empty, rivet the A-408 aileron spar reinforcement brackets on the spar along with the K1000-3 plate nut.

The wide tabs on the top of the A-704 nose ribs have no pre-punched holes, they will be match drilled from the nose skin. Flute the center of the tab slightly to remove any distortion from the manufacturing process. Use the nose skin holes as a check for straightness. Cleco and match drill the nose ribs to the spar.

Look closely! The A-705 aileron ribs are NOT symmetrical, so be sure you have them installed correctly. The tooling holes are nearer the bottom of the aileron. Cleco and match drill the A-705 main ribs to the spar.

Cleco the A-802PP leading edge skin and the A-801-1PP trailing edge skin to the spar with the A-409 counterbalance pipe in place. Match drill the skins to the skeleton including the #30 holes in the counterbalance pipe. The holes along the bottom of the spar are opened to #30 for the CS4-4 blind rivets. Remove the trailing edge portion and re-cleco the leading edge in place with the counterbalance pipe in position. Using a long 1/8" drill, go through the lower hole that attaches the A-704 nose rib to the spar and drill through the tab on the rib into the counterbalance pipe.

Disassemble the parts, deburr, dimple and prime as needed. Machine countersink the holes in the counterbalance pipe. The countersink need not be 120° to match that of the rivet heads. The .020" skin and the aluminum blind rivet will deform sufficiently to contour to a 100° countersunk hole.

Attach the nose ribs to the counterbalance with blind rivets. Bend the tab on the nose rib juse enough to clear the rivet tool.

Cleco the leading edge skin to the counterbalance/rib assembly, rivet the nose ribs to the to the spar. Cleco the aft skin to the spar. Leave out the main ribs and the clecos along the bottom of the spar to allow access to the inside. Rivet the leading edge skin and tariling edge skin to the top of the spar. Rivet the nose ribs to the the top half of the nose skin only. Insert the main ribs and rivet them to the spar and top of the aft skin. Install the A-406-1 and A-407 brackets.

Flip the assembly over , cleco it together and weight it down on a flat work surface. Blind rivet the counterbalance pipe to the leading edge skin. Keep checking that the aileron is flat. Rivet the bottom side of the nose rib to the skin. Rivet the bottom side of the main ribs to the aft skin. Last, blind rivet the leading edge and aft skins to the spar.

FLAPS

Flap details are shown on DWG 14A. The flaps are the easiest control surfaces on the RV-7/7A to build. The only jigging required is a level, flat surface at least 5' long and 1' wide. Easy or not, it is possible to build in an unacceptable twist, so work with care.

Prepare the FL-703 flap spars by deburring the lightening holes and polishing the edges.

Drill and cleco the FL-704 and FL-705 ribs to the spar then cleco the assemly to the FL-702 bottom skin. Make the FL-708 spacers that go between the end ribs and the bottom of the top skin. The aft edge of the ribs should contact the "rear spar" bent into the bottom skin. Thin shims between the aft end of rib and the rear spar are acceptable.

After making any necessary shims, drill the ribs to the rear spar.

Drill the ribs to the bottom skin. The line of rivets along the bottom of the spar holds the hinge that will connect the flap to the wing. Drill and cleco on the hinge as well. Pinning the two halves of hinge together while drilling will help hold the hinge straight.

Instead of dimpling the bottom of the spar, dimple the skin and machine countersink the spar, with the hinge clecoed on to serve as a guide for the countersink pilot. The soft hinge does not have to be countersunk or dimpled.

Fit the FL-701 top skin to the assembly. Cleco the top skin to the spar, align the holes along the ribs and drill these before drilling the line along the bottom of the flap.

Fabricate the FL-706A. Fit the FL-706A and FL-706B to the inboard rib and inboard end of the spar. Rivet the FL-706A to the spar with the AN rivets only, leaving the holes that will attach the rib open.

After the necessary dimpling, priming, etc., begin riveting the flap together. A cradle, made with simple V-blocks like those used in the empennage, is a useful aid. Put the flap in the cradle and remove the spar to gain access to the rear row of rivets that join the top and bottom skins. Rivet the interior ribs to the skins, but leave the end ribs clecoed.

Rivet FL-706B and the platenut to the inboard FL-704 rib, then rivet the rib to the skins...you must set these rivets before "closing the door" by putting the spar in place.

When all the ribs are riveted to the skins, rivet the spar to the ribs with blind rivets, then rivet the spanwise lines that join the spar and hinge to the skins. Finish riveting the end ribs.

Expect to trim the upper skin of the flap slightly when the wing is mated to the fuselage, but for now, leave it untouched.

NOTE: The bearing CM-4MS, shown on DWG 14A, is supplied in the fuselage kit, not in the wing kit.

ATTACHING AILERONS TO THE WING

Completely finish the flaps and ailerons before mounting them to the wing.

Set the wing, with the leading edge and the top main skins riveted on, on a workbench, topside down.

Assemble the W-716 and W-818 pushrods as shown in DWG 15A. Prime both pushrods inside and out. Cover the inside by pouring a small quantity of primer inside the rod and slowly swirling it around or by spraying into each end. Rivet the VA-4908P or VA-111 rod ends to the pushrod.

Make sure the primer is fully cured, then thread the rod-end bearings and jam nuts on. Temporarily tape the pushrod where it passes through the rear spar, so when aileron is removed the primer won't be scraped away.

Install the WD-421 bellcrank as shown on DWG 15A. The bushing in the WD-421 needs to be drilled to final size for the slip fit on the AN4 bolt. The bushing should be slightly longer than the WD-421 aileron bellcrank. It is held firmly between the bellcrank brackets with the bolt. The bellcrank rotates around the bushing, not the bolt. This is the same way that the stick assembly is done also. Lubricate the bushing with your favorite grease when assembling for the final time.

Connect the W-716 and W-818 pushrods to the WD-421 bellcrank. Use the W-730 bellcrank jig provided to set the bellcrank in the correct neutral position. Use the alignment tool you built at the beginning of the wing construction to position the aileron in the neutral position. Clamp the aileron in this position and adjust the rod end bearings on the W-818 push rod until the pivot bolts at the bellcrank slip in smoothly. Tighten the jam nuts and label the push rod right or left as appropriate. Final adjustments will be made to the W-716 push rod later, when the wing is installed on the fuselage.

ATTACHING FLAPS TO THE WING

There are two good methods of installing the flap hinge pin. The choice is yours.

Drill a small hole in the W-413 aileron hinge bracket assembly for the flap hinge pin to just go through. You will not be able to get this hole exactly in line with the flap hinge line, but this is a good thing. Drill the hole in the approximate position and when you insert the hinge pin for the flap, the pin will spring into position after being pushed all the way through and not be able to come out on its own. You may have to disconnect the aileron pushrod in the wing to remove this pin after the aircraft is fully assembled. This will allow you to swing the aileron out of the way for pin removal.

An alternative method is to remove one hinge eye at the center of the flap hinge and two hinge eyes at the center of the wing hinge. This will allow you to get two hinge pins in from the center of the flap, one in each direction. Bend a small portion of the hinge pin at a right angle to grasp with pliers as you slide the pin into place. With the flap hanging down the hinge is accessible from the opening at the top. Push the bent portion of the pins forward to lie on the inside of the skin. Drill two small holes in the skin and safety the hinge pins in place.

FINISHING THE WING

INSTALLING THE PITOT LINE AND WIRES

Install the pitot line and fittings shown on DWG 15A. Install SB437-4 snap bushings in the 7/16" holes for the Pilot line in W-710 and W-711. Put the low profile face of the bushing on the flange side of the rib, to ease access to the skin rivets later.

Complete the stall warning assembly instructions OP46-04 Steps 1-7 and OP46-05 Steps 1-6. Complete Op46-06 Steps 1-8 when installing the electrical system.

Double check that you have done everything else inside the wing that you wish to do such as installing wiring for wing tip lights, installing a wing leveler servo, etc., before closing up the wing. If you have not decided on some of these items, riveting the bottom skins can wait until much later in the project.

WING TIP INSTALLATION

Delay wing tip installation until late in the construction process, preferably until the aircraft is nearing final assembly. This prevents the possibility of damage from handling and gives every opportunity for the installation of lights, wing

tip antennae, etc.

The tips may be installed with the wing lying down on a table or with a wing positioned in a cradle style storage fixture. See DWG 12A.

The aileron control system is used to neutrally position the aileron, which helps to position the wingtip. Use the W-730 Adjustment Fixture to locate the aileron in its neutral position and hold them in place with a bungee cord.

Sand or file the flange on the W-715 tip so it is an even depth and width all around.

Portions of the aft end of the W-715 tip must be trimmed away to provide clearance from the aileron and W-414 Aileron Hinge Bracket. Leave a gap between the aileron and the tip as shown on DWG 9.

Slip the W-715 tip into place. Push it forward so it is tight in the wing leading edge and align the trailing edge with the trailing edge of the aileron. An assistant is helpful.

Drill the W-715 tip using a #40 drill. Begin at the leading edge and work to the back. Alternate holes from the top to the bottom. If you are unhappy with the placement of the tip, adjust it slightly when the holes are drilled to full size.

Swing the aileron out of the way and slip the W-412 tip rib (DWG 12) into place. Mark the location of the rib trailing edge on the tip.

Remove the tip and lay out the rivet lines (top and bottom) 5/16" from the edge. Cleco the W-715 tip back on the wing and slip the W-412 tip rib back in place. The flange edge must be flush with the tip edge.

Locate the rib chordwise so it fits without distorting the tip.

Drill and cleco the W-412 tip rib to the W-715 tip. Remove the tip and machine countersink it. Rivet the rib in place.

The W-715 tip may be riveted or screwed to the wing (DWG 12.) The choice usually depends on what kind of access is necessary to service lights, power supplies, etc.

If you decide to use the rivets the tip must be reinforced with a strip of aluminum to keep the rivets from cracking the fiberglass. Drill (#40) the aluminum reinforcement strips to the W-715 tip using the existing holes.

Scuff the aluminum reinforcement strip and W-715 tip with some 80-100 grit sandpaper. Bond the strip to the tip with resin (polyester or epoxy). Hold the strip in place with clecoes. Remove the clecoes before the resin is fully hardened.

When cured, cleco the W-715 tips back on the wing and drill out to full size. Remove the tips and machine countersink the fiberglass to accept a 1/8" dimple.

Dimple the skins on the wing and blind rivet the W-715 tip on. This step may be postponed until later to permit easier access.

If you are using screws and platenuts the platenuts may be riveted directly to the fiberglass. You may delete the reinforcement strip. Screws and platenuts for this installation are not provided in the kit.

BULKHEAD ASSEMBLY

NOTE: *Although the F-704 bulkhead shown on DWG 11 is a fuselage part, it is provided in the wing kit so that it will remain with the correct wing spars. We recommend delaying construction until work on the fuselage begins.*

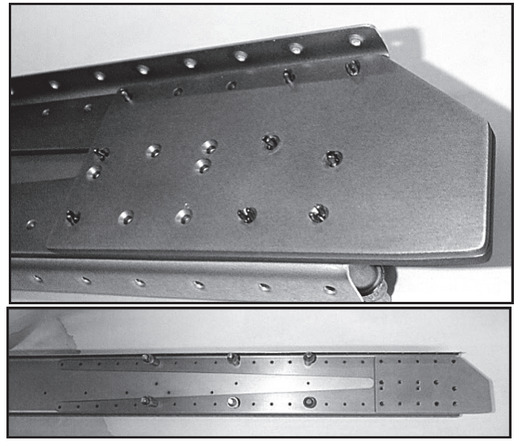


Fig. 7-1. The root end of the rear spar. Note that the flanges are already dimpled...it is hard to get a squeezer on them if the doublers are already installed. (RV-9/9A spar shown)

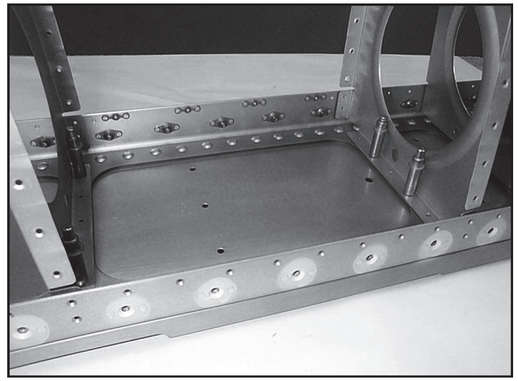


Fig. 7-2. Main ribs are fitted and drilled to the main spar.

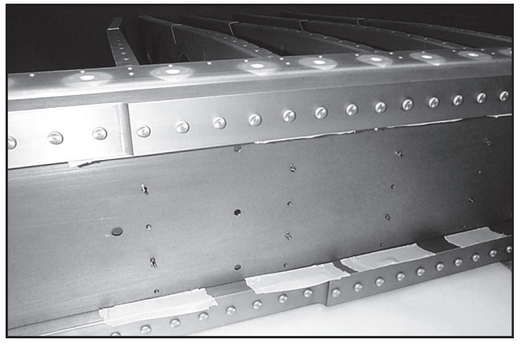


Fig. 7-3. Tape protects the main spar bars from damage when the ribs are riveted.

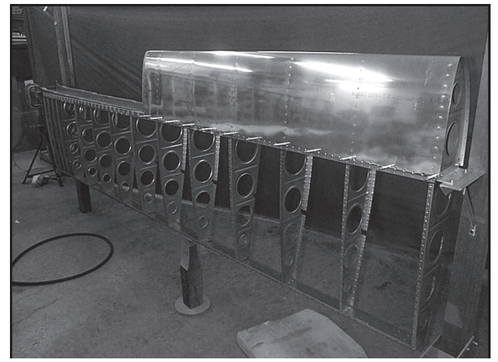


Fig. 7-4. A pair of posts and brackets hold the wing in a convenient position. The posts under the rear spar keep the structure from sagging. Here the leading edge is fitted to the wing skeleton.

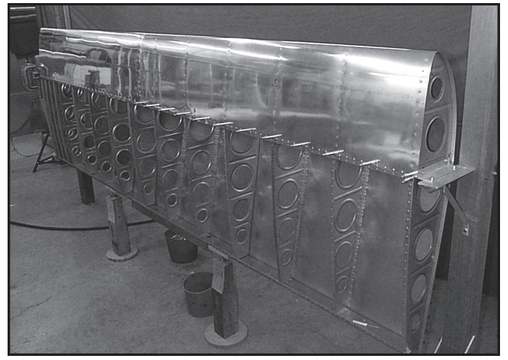


Fig. 7-5: The tank and top main skins are fitted.

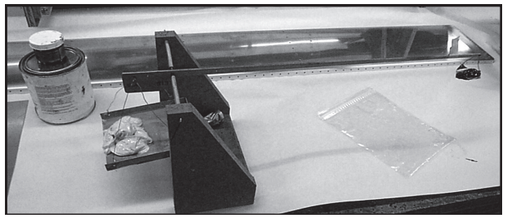


Fig. 7-7. Tank sealant is mixed in a shopbuilt 10:1 balance.

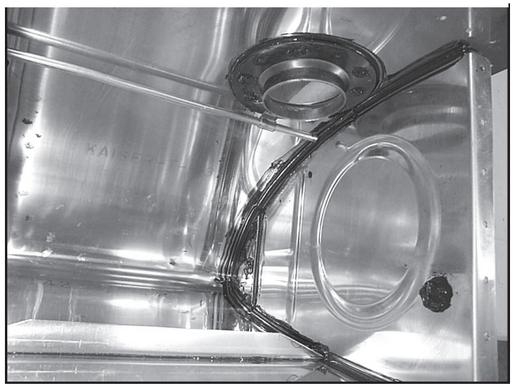


Fig. 7-8. The interior of the tank at the outboard end. The T-410 reinforcement helps seal around the nose. The blob on the rib is a 316" rivet set in the tooling hole and covered with sealant. The filler neck and vent line are also visible.

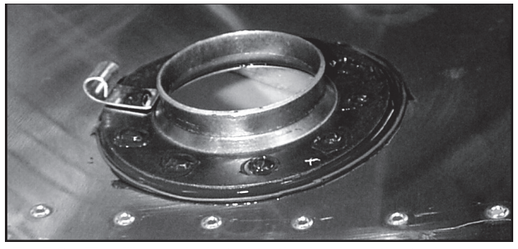


Fig 7-9. The filler neck riveted to the inside of the tank skin. A common rivet holds the T-914 clip to secure the vent line.

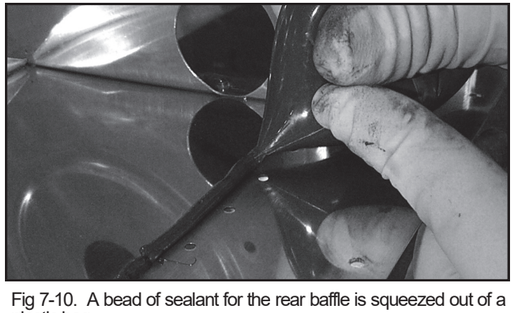


Fig 7-10. A bead of sealant for the rear baffle is squeezed out of a plastic bag.

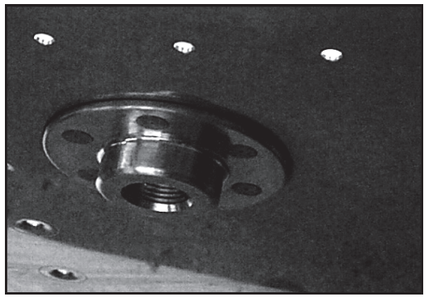


Fig.7-11. The VA-112 drain flange riveted to the outside of the tank skin.

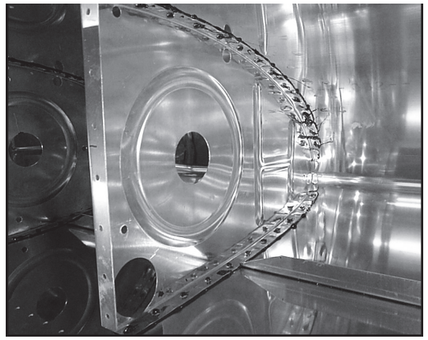
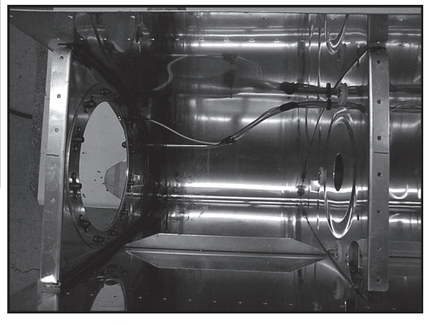


Fig. 7-12. An interior fuel tank rib, riveted and sealed.



Above: Fig 7-13. Details of the inboard bay. The access cover with the fuel sender attached will cover the large hole on the inboard rib. The vent line is looped forward to clear the sender float.

NOTES

SECTION 8. BUILDING THE FUSELAGE

INTRODUCTION

The RV-7 fuselage is a semi-monocoque structure. The skins carry a majority of the load and they are held in place with a combination of bulkheads and longerons (also called stringers).

All the ribs, bulkheads and skins are pre-punched at Van's factory. No jigs or alignment fixtures are required ... when the holes align, the fuselage must be straight. All that is required is three sturdy sawhorses to support the fuselage as it is assembled and a clean, level table used to assemble the bulkheads.

A NOTE TO QUICKBUILDERS

Obviously, not all the information needed to build the fuselage from the Standard Kit is necessary for a fuselage built from the QuickBuild Kit. However, we still recommend reading the entire chapter to gain the "big picture." Once you understand the basics of fuselage building, you can extract the relevant information for the QuickBuild Kit.

STRAIGHTENING, FLUTING AND PRIMING

Seam and flute the flanges of the ribs and bulkheads. If you are the kind of person who eats their vegetables first, you can finish all the ribs and bulkheads now. Otherwise, you may finish them as you need them.

Not all flanges are seamed to exactly 90°. The aft end of the fuselage is a cone, so the bulkhead flanges should match the angle of the skin. It is hard to get the perfect angle unless the bulkheads are in place and you can sight down them. For now, get them as close as possible. The perfect adjustment can be applied later when the bulkheads are all in place.

From here on we will assume that you know enough to deburr, dimple/countersink, and prime everything as necessary before assembly. We will only mention these chores if there is a special order or technique that should be used.

PREPARING THE BULKHEADS

ASSEMBLING THE F-601 FIREWALL

The firewall is a stainless steel bulkhead, reinforced by aluminum angle. Steel brackets, fitted on each corner, provide a means of attaching the longerons and supporting the engine mount.

Stainless steel has a couple of nasty qualities. First, edges can be very sharp. Second, it will quickly dull your drills, unibits, and deburring tools. When drilling stainless, use regular twist drills for holes 1/8" or smaller. Use a unibit on all larger holes. Use plenty of lubricant (we like Boelube) with either, and keep the drill speed low. Paying attention to the best drill/feed speeds, combined with Boelube, will allow your cutters to last the life of the project. Without them, you will be buying a new cutter every 5 to 10 holes.

Begin the firewall by making the F-601J angles from AA6-187x2x2 1/2 stock, as shown on DWG 19.

Position and cleco all pre-punched or drilled stiffeners, spacers, gussets and weldments to the matching holes in the F-601A-2 firewall. Drill and cleco the remaining holes, using F-601A-2 as a guide.

Fabricate the F-601P spacers and F-601E stiffener and install them per DWG 19. Note that you need to round some edges of F-601J and the ends of F-601N-L&R to fit the inside radius of the aluminum angle they rest upon. There is no need to make this curve exact -- just remove enough of the corner to allow the edges of the brackets to rest on the flanges of the angle.

Square F-601J-L&R with the F-601N and F-601M stiffeners. Align F-601J-L/R horizontally by nesting their inboard face with the outboard face of F-601N-L/R. Use the dimension given on DWG 19 for vertical alignment. Clamp F-601J-L&R and underlying shims F-601H-1 and F-601G-1 lightly in place and align the pre-punched holes. Then tighten the clamps and back-drill F-601J through the firewall.

The brake lines require an F-6122-1 bracket (RV-7A) or F-601TD plate (RV-7) riveted to the firewall. This bracket holds the fittings that connect the flexible brake hoses from the master cylinders to the solid brake lines leading to the wheels. Drill F-6122-1 or F-601TD to F-601A-2 as shown on DWG 19, Firewall Bulkhead Rear View.

Cleco the firewall recess (necessary to provide room for the oil filter and prop governor) F-601K-1 in the square hole centered in the F-601A-2 bulkhead. Drill all holes to full size.

Fit and drill the F-601Z Fuel Pump Doubler to the lower firewall. Rivet it to the firewall. Note that the nutplates are on the forward side of the firewall and the rivets holding them penetrate both the F-601A-2 stainless firewall and the F-601Z doubler.

Disassemble the firewall, dimple F-601A-2 and F-601K-1, then machine countersink the underlying stiffeners and spacers. The firewall is built using flush head rivets, with the flush heads on the forward side. This gives a smooth

surface, making the firewall easy to clean and easy to fit brackets, etc.

Rivet all the components of the firewall together, except the F-601K-1 recess. Leaving the recess out will allow a good access through the firewall and make installing the rudder pedal brace much easier.

Drill the top two engine mount attachment holes using the holes in WD-602-L-1 & -R-1 as guides. Make sure the drill remains perpendicular to the firewall while drilling so that the bit exits centered on the pre-punched hole in the firewall. A block drilled in a drill-press and held flush against the flat on WD-602-L-1 & -R-1 can help maintain perpendicularity.

The firewall keeps fumes and liquids in the engine compartment from entering the cabin. Some of bent corners have unavoidable openings, especially around the firewall recess and the lower corners of the firewall. Seal all openings with fuel tank sealant after skinning the fuselage.

ASSEMBLING THE F-704 BULKHEAD

The F-704 bulkhead is a massive assembly and there's a reason: it is the heart of the fuselage. It transfers most of the loads carried by the airplane. Deburr and prime all of the pieces that need it. The F-704 was drilled in a fixture, in assembly with the wing spars to ensure an exact fit. Important pieces are marked so they may be returned to their proper location.

The F-704 bulkhead is shown on DWG 11.

Drill the holes that will receive snap bushings in F-704A/B/C/D to full size.

Attach the F-704C-L&R Center Sections to the F-704A forward bulkhead and the F-704D-L&R Center Sections to the F-704B aft bulkhead. Assemble the components with clecos and put a NAS1307 bolt through at least one hole on both top and bottom to align the parts exactly. On the aft F-704B, locate the F-704G shear bars with bolts and clamp them in place. Drill the rivet holes to final size, then disassemble, debur and dimple as necessary. Note that the rivets attaching the F-704G bars have flush heads on the forward side.

Fabricate the F-633 Control Column Mounts. Drill the first bolt to hole to the dimensions shown, then bolt the F-633 to the aft F-704. Square it carefully and back-drill the second hole through the pre-punched hole in the bulkhead. After the holes are drilled, you may trim away the area shown (on the bolted leg of the angle, not the leg with the bearing in it!) to save weight.

Now is a good time, while the bulkhead is wide open, to fit the Wd-610 control column and Wd-611/612 control stick bases. These are bolted together as shown on DWG 38. Once the control stick assembly is fitted it may be removed as a unit, leaving the mounts bolted to the bulkhead, and stored.

Countersink all the nutplate rivet holes on the top flanges of F-704A/B. Rivet on all nutplates.

Prepare the F-782B-L&R and F-783B-L&R Cover Support Ribs. Drill them to the bulkhead, then remove them and install the nutplates. Drill the snap bushing holes to full size.

Fabricate the F-704M Web Stiffeners and drill them to the F-704A.

Rivet the Cover Support Ribs and Web Stiffeners to F-704A.

Make the F-904J Center Section Spacers from the rigid aluminum tube provided. The ends are squared by chucking them in a drill press and spinning them gently against a piece of sandpaper or fine file held flat on the drill press table.

Make some spacer blocks from dense wood or particleboard to hold the halves of the center bulkhead assemblies the correct distance apart. The thickness of these spacers must be 1.438" (1 7/16") to match the thickness of the spar. Drill the blocks (the holes may be oversize) to allow the bolts to run through the spacers.

Bolt the two center bulkhead assemblies together around the spacers for a trial fit. Do not rivet the F-704H side plates on now. They will be riveted to the center section after being riveted to the side skins. It is a strange order but it allows some potentially difficult rivets to be set easily.

When you are assured everything fits correctly, remove the bolts and spacers so the bulkhead is once again two separate halves, fore and aft. Store all the bolts and spacers in a bag and tape the bag to the bulkhead.

ASSEMBLING THE F-705 BULKHEAD

The F-705 bulkhead serves several purposes. It supports the seat backs, strengthens the open cockpit and provides the attachment for the rear wing spar. Details are shown on DWG 20.

Mark a lengthwise centerline on the rear face of the bar. Locate and clamp the F-705B, the F-605C Bar Doublers and the F-705H Spacers to the F-705A Rear Spar Attach Bulkhead. Drill the assembly using the prepunched holes in the F-705A as a guide.

Drill the F-634 seat belt anchors to the F-705 lower bulkhead assembly. One of each pair of anchors should be drilled first. Bolt it to the F-705A, then put a 3/16" shim between it and the other anchor and clamp the three pieces together. Clamp the flange of the unbolted anchor to the bulkhead. Drill the anchor using the prepunched hole in the bulkhead as a guide. In some cases, the flange of the seat belt anchor comes close to an adjoining rivet or bolt hole. Grind or file the flange of the seat belt anchor to allow for bolt or rivet heads as necessary. Be careful to

preserve a 2 diameter edge allowance from the center of the anchor bolt hole to the edge of the anchor flange.

Disassemble and prepare the F-705A lower bulkhead for riveting. Fabricate the F-705G angles (for the tip -up canopy only) and drill the snap bushing holes to full size. **Quick builders, remove the F-705G for the slider canopy.**

Drill and rivet the F-705J Angle, the F-705K Plate and the F-705-L seat adjustment supports to the F-705F Channel.

Drill the snap bushing holes and install the nutplates on F-705D. Cleco the F-705A, D and F bulkhead components together.

If you are planning a tip up canopy, cut a slot into the F-705G angle, using the slot in F-705D&F as a guide. These slots provide room for the canopy latch fingers when the canopy is closed.

Before riveting the F-705 bulkhead assembly together, see the NOTES on DWG 20 for the various holes that must be left open so other pieces may be attached later. Cover these holes with tape. Also note the holes that must have flush rivets installed and be sure they are machine countersunk.

Rivet the F-705 bulkhead together.

Fit and drill the F-661EF flap actuator bearing blocks. You may drill out the bearing blocks with a #10 drill if necessary to fit the bolts. Once the blocks are fitted, remove and store them. They will interfere with skin riveting, so they will be bolted on permanently when the flaps are installed.

Bolt the seat belt anchors and F-705H spacer to the lower bulkhead.

ASSEMBLING THE F-706 BULKHEAD AND BELLCRANK SUPPORT RIBS

Bulkhead details are shown on DWG 21. The F-706 ring bulkhead is made of three pieces. The F-729 bellcrank rib, F-728 Bellcrank Channel, F-730 Plate and F-729C Angle all attach to the aft side of the F-706B Bulkhead Bottom (see DWG 26.)

Use a unibit to enlarge the rudder cable holes on all these bulkheads..

Make the F-729C angle shown on DWG 26.

Drill and rivet the F-729A bellcrank rib and F-729B angle together. Be sure to drill the 1/4" hole for the bellcrank pivot bolt.

Drill the F-728A Bellcrank Channel to the F-728B angle, but do not rivet them together yet. Be sure to drill the ¼" hole for the bellcrank pivot bolt.

Begin assembling the bulkhead by drilling the F-730 plate, F-728, F-729C and F-729 rib to the F-706B Bulkhead Bottom. After deburring, rivet the assembly shown in Detail A of DWG 26 together, except for the F-728 channel. Leave that clecoed for now.

Fit and rivet the F-706A-L&R bulkhead halves to the F-706B bulkhead bottom. Leave the top joined with clecos. Drill and cleco the F-728 channel to the pre-punched location hole on the top of the F-706A bulkhead.

ASSEMBLING THE F-707, F-708, 709, and 710 BULKHEADS

See DWG 21. The F-707 and 708 bulkheads are simple two piece bulkheads. Align the tooling holes and rivet them together.

F-711 BULKHEAD

The F-711 is a double bulkhead. The front half is F-711A and the back half is F-711B.

The protruding F-711C bars will attach to the horizontal stabilizer. The F-711C bars may be tapered as shown on drawing 21 if you are building an RV-7A. Mark the centerline of the F-711C bars. Cleco the F-711A&B bulkheads together, using the holes that are not common with the bars. Clamp the bars against the F-711A forward bulkhead, with the lines showing in all the pre-punched holes, then drill using the prepunched holes as a guide.

Both F-711 Bulkheads must have the upper portions trimmed away to allow the elevator pushrod to pass through. Trim to the marks on the bulkheads.

After the usual preparation, rivet the bulkheads and bars together to form the finished F-711 Bulkhead. See drawing 21 for rivet call-outs and other assembly details.

F-712 BULKHEAD

The F-712 is also a double bulkhead and again F-712A is the front and F-712B is the rear. They must be riveted together before the fuselage is assembled. Note that flush rivets are used with the flush side aft. The aft surface must be smooth so the vertical stabilizer spar will fit. For RV-7A builders, the aft tiedown will be fitted later, in assembly with the vertical stabilizer.

BENDING THE LONGERONS

This section will require more of an artist's touch and a little finesse. The F-718 longerons (see DWG 18) must curve, bend, and twist to form the necessary shape of the fuselage. Aluminum angle can do maddening things when you try to bend it. If you bend it in one dimension, it will also move in another. You must persevere. Correctly bent longerons are fundamental to an accurate fuselage.

Begin by finding the AA6-125 longeron angles (shipped in your wing spar box). Measure and trim them to the correct length - see Note 2, DWG 18. Triple check before you cut! Trim the horizontal face on the aft end of the angle as shown on Detail C, DWG 18.

You will obviously be bending a left and right version of the F-718 longeron. It is easy to get confused and bend one incorrectly, so mark the longerons plainly for front, rear, top and side.

Lay the longerons side-by-side on the floor with the ends matching. Mark the starting and ending point of the shallow curve, looking down. This bend follows a line 0.032” inside the outside edge of the F-721B Aft Canopy Deck. Mark the location of the sharp downward bend, in side view. This bend occurs at the front end of the F-721B.

BENDING THE SHALLOW CURVE

Bend the F-718 longeron angle in a sturdy vise mounted to a solid, stationary table. Pad the jaws to protect the longerons from gouges and scratches.

The general idea is to hold the angle in the vise, pull on the free end and establish a small "pre-load" on the angle and then give it a small-to-medium whack with a rubber hammer to produce the bend. Several small, progressive bends will form the curve.

Cut the template from DWG 17 and glue it to a piece of stiff cardboard or aluminum. This serves as your guide while bending the longeron. Make both sides useable so it will work on both a left and a right longeron.

Clamp the angle in the vise so the end of the jaw is one inch aft of the aft mark. Start bending at the mark. Push the forward end of the longeron in the correct direction, hold it there, and hit it right at the end of the vise jaw with the rubber mallet until it bends a few degrees. Move it an inch and repeat the process until you get to the other mark. Check it often against the template to prevent overbending.

Keep coaxing the angle until it matches the curve of the template. You can clamp the angle in a six-inch vise without removing any of the bend, so it is easy to add more bend.

Remember to check that the angle has not bent out of plane (up or down) as you were applying the sideways load - it is quite common to get vertical bow while you're bending a horizontal curve. If this happens, rotate the longeron 90°, clamp it in the vise and bend it back straight with your hands. You can call it a night when the curve of the F-718 longeron matches the curve on the template within a 1/16" all around and the angle sits flat on the table within a 1/16".

Tape a piece of 0.032” aluminum to the outboard surface of the longeron and fit the F-721B aft deck to the top of the longeron. Carefully establish the fore/aft position. The shim will simulate the F-770 side skin. When the outside edge of the side rail matches the outboard surface of the shim, drill the F-721B to the longeron. Leave it clecoed for now.

MAKING THE SHARP DOWNWARD BEND

The front of the F-718 longeron needs the sharp bend and twist applied. The bend is done using the same method as the curve; you just don't move the longeron. The angle will really want to curve off axis on this bend. Check this bend by using the F-770 forward side skin as a template. The angle should match the upper portion of the skin within about a quarter of an inch.

TWISTING THE FORWARD END OF THE LONGERON

The twist is applied with a big crescent wrench. Clamp the longeron in the vise, with the point of the downward bend at the end of the vice jaw. Grab the end of the angle and give it a twist. Keep going until you have the twist shown on View A-A', DWG 18.

FINISHING THE J-CHANNEL

Cut the F-786A, B, & C J-channel to length and prepare the ends as shown on DWG 18. A cutting disk in a die grinder works well here too.

AFT FUSELAGE ASSEMBLY

Now for the fun part: putting some of the big assemblies together.

Set up three sawhorses so they are all at the same height and level.

Begin the assembly by clecoing the F-779 Tailcone Skin to the F-711 and F-712 bulkheads (DWG 26).

If you are building an RV-7, the WD-409 tail spring mount must be fitted between F-711 and F-712. Also, the F-779 skin must be relieved to allow the tail spring mount tube to protrude aft and down. See drawing 27 for WD-409 installation details. The “mouse-hole” in the bottom of F-712 may be enlarged as necessary to allow the tube and weld fillet of WD-409 to fit. The single hole in the forward part of the F-779 centerline is for access to the tail spring nut. Ignore this hole on the RV-7A and open the hole for a socket on the RV-7.

The WD-409 forward plate upper edge should be used to square the tail spring mount with the F-711 bulkhead assembly. Drill through F-711 and WD-409 for the AN4 bolts using the pre-punched holes in F-711 as drill guides. Drill through F-712 and WD-409 for the two “keeper” rivets only; the three bolt holes will be match-drilled later while attaching the vertical stabilizer. If there are any gaps between WD-409 and the two bulkheads, a shim should be installed between F-711 and WD-409. After fitting and match-drilling WD-409 to F-711 and F-712, remove WD-409.

Lay the F-778 Aft Bottom Skin across two of the sawhorses, with the outside surface down. Reach underneath and cleco the F-707 and F-708 bulkheads to the inside of the skin.

Mark the outside face of the lower 4 J-channels with a lengthwise centerline. Slide the lower 4 J-channels into the slots in the bulkheads, leaving them loose for now.

Slide the assembly to the edge of the sawhorses and cleco the F-773 side skins to the bulkheads.

Cleco the F-706 bulkhead to the assembly.

Cleco the F-729A bellcrank rib to the bottom skin.

Now add the F-711/F-712/F-779 assembly and cleco in the F-710 bulkhead.

With all the skins in place check to make sure there is no twist in the fuselage by hanging a plumb bob on bulkheads on each end. The tooling holes are on center, so if the plumb line falls past the center of the top and bottom holes, on both bulkheads, the fuselage is straight. Check before you drill!

Double check the J channels for proper position and drill them to the skins. It works best to drill every fourth or fifth hole and cleco. Work from one end to the other. When the J-channel is located, drill the remaining holes.

Drill all of the remaining holes (except the ones for the F-706 bulkhead and the F-718 longerons) to final size.

NOTE: see DWG 27A for the position of the F-792 rudder stop. One hole must be left open to match with the drilled hole in the rudder stop. Mark this hole or tape over it so that it will not be riveted or dimpled.

When drilling is complete, remove the skins. Debur the structure and skins, dimple as required, and cleco the rear fuselage back together.

Rivet F-712 bulkhead to F-779.

RV-7 Only: Attach WD-409 to the F-712 assembly using keeper rivets previously drilled.

Rivet the F-711 bulkhead assembly to F-779 and bolt WD-409 (RV-7 Only) to the F-711 assembly.

Rivet the F-779 and F-778 bottom skins to the bulkheads and J-channel.

Rivet the F-773 skins to the bulkheads up to the upper J-channel, and to the J-channel itself, but no higher. The top of the skins must be able to bend away from the upper sections of the bulkheads so the main longerons can be inserted later.

PREPARING THE CENTER FUSELAGE

The center fuselage is shown on DWG 22. Skins are shown on DWG 28.

Make four F-916C spacers from aluminum plate as shown on DWG 22.

Modify one F-716-L and one F-716-R Seat Rib by adding the F-716B Seat Rib Access Plate and cutting the rib. The top of the ribs must be removable to install the control system.

Modify one F-716-R and F-716-L Seat Access Rib by enlarging the lightening hole in the forward portion as shown. The extra space is needed to allow the controls to move.

Install the nutplates on all the seat ribs. Screws generally fit quite tight in nutplates, and because there isn't much room for a screwdriver on the outboard edges of the floor skins, it is acceptable to run an 8-32 tap through the nutplates. This will make it easier to install the screws. Be careful and use a lubricant on the tap.

Attach the rear half of F-704 center section bulkhead to the F-716 and F-715 seat ribs. Be sure you have the modified ribs in the proper place. F-716 ribs may be clecoed, but the F-715 seat ribs are not drilled to the center section until later, so hold them in place with clamps for now.

If you are going to install the optional step(s) cut the F-725 baggage ribs with a 1 5/8" hole saw using the prepunched hole as a guide.

Cleco the F-725, 726, and 727 baggage ribs to the F-705 rear spar bulkhead.

Cleco the F-705 bulkhead and ribs to the aft ends of the F-715/716 seat ribs. Insert the F-916C spacers at the necessary stations.

Cleco the F-776 center bottom skin to the center fuselage assembly. The skin holds the F-715 and F-716 seat ribs in correct alignment.

Drill everything to final size except for the aft two rows (spanwise) on the F-776 center bottom skin. Fit and drill the F-623 corner ribs. Flute the F-623 as necessary to fit the skins, and if you are installing steps, trim the flange to clear the step tube. Make the F-623A forward and aft attach straps.

Once again, fit the front half of the F-704 bulkhead to the rear half. Use the pre-fit bolts and spacers you made earlier to hold the bulkhead together.

Now, drill the holes on the forward edge of F-776 to size.

NOTE. See DWG 28. Rivets at the intersection of the spanwise row across the forward F-704 bulkhead and the fore-and-aft lines along the stiffener are shown as AN426AD3-6. Machine countersink these holes through the F-776 skin and into the bulkhead. Rivets through these holes will later attach the floor stiffeners and a smooth inside surface will help fit the stiffeners property.

Once the bottom skin is clecoed on, fit and drill the F-704H side doublers to the center section.

Remove the clecos and prepare the parts for riveting. Do not dimple the holes in the aft edge of the F-776 bottom center skin. They will match up with the F-706 bulkhead and F-778 bottom aft skin later when the two fuselage halves are brought together.

Dimple the holes (in the skin and the ribs) that will later match up with the lower aft tabs on the F-725, 726, and 727 baggage ribs.

ASSEMBLING THE CENTER FUSELAGE

After all the preparation, it's time to rivet and bolt the skeleton of the center fuselage together. Details are shown on DWG 25.

Draw a centerline on the bottom flange of the F-715 ribs.

Start at the aft face of the F-704 bulkhead and install the F-716-L&R ribs. Use bolts and rivets as shown on DWG 22.

Turn the center fuselage upside down and rivet on the F-776 center bottom skin on the skeleton. Remember to leave the holes for rivets common to the F-772 Forward Bottom Skin open.

Do not rivet the F-623 corner ribs on yet.

Turn the assembly upright and cleco in the F-742-L&R, F-747-L&R, F-739, and F-740 baggage and seat skins. See DWGs 25 and 29. Drill all of the holes, except for those through the F-715 outer seat rib, to final size.

Drill the F-715 outer seat rib to the F-704 bulkhead. Also drill it to the F-776 centering the centerline on the bottom flange in the holes in the bottom skin. Position the top of the rib so the distance between the outside of the web and the outer edge of the seat skin is 0.032” (use a bit of scrap for a spacer.) This means a thin strip of flange will be visible past the edge of the seat skin when viewed from the top.

The seat and baggage skins should be left clecoed in place to help keep the fuselage stiff and straight during the assembly.

JOINING THE REAR AND CENTER FUSELAGE ASSEMBLIES

It's time to join the aft and center sections of the fuselage. Place the tailcone assembly upside down on a couple of sawhorses. Add another sawhorse on the forward side of the tailcone assembly approximately where the F-704 bulkhead will rest.

Set the F-718 longeron assemblies on either side of the aft fuselage. Remove just enough clecoes from the F-773 side skins to allow the longeron to be slipped into the notches in the bulkheads. Align the vertical leg of aft end of the longeron with the aft end of the flange of F-712.

The longerons must be notched to fit around the F-711C bars as shown on DWG 18.

NOTE: *NOTCH THE LONGERONS, NOT THE F-711C BARS!*

With the longerons in place re-cleco the side skins to the bulkheads. Add a few clamps to keep the longerons aligned with the top of the side skin.

Place the center fuselage in position. Place the top of the F-704Cs so they rest on the third sawhorse. Slip the F-725, 726, and 727 baggage ribs and the F-776 center bottom skin into place over the F-706 bulkhead and F-778 aft bottom skin.

Cleco the F-725, 726, and 727 baggage ribs to the F-706 bulkhead from the rear. Cleco the F-776 center bottom skin to the F-706 and the F-778 aft bottom skin.

The F-770 forward side skins are fitted next. (If you are going to install a step, use the holesaw to drill the F-770 where the tube of the step will pass though. Pilot holes show the location. If you are not installing a step, dimple these holes and fill them with 'rivets to nowhere'). Cleco the F-770 forward side skins to the F-704, F-705, and F-706 bulkheads, and the F-773 aft side skins. It may be necessary to raise or lower the tailcone slightly to align the holes.

Use a straight edge to mark the flanges of the F-623 corner ribs where the step comes through. Use the F-770 forward side skin and F-725 baggage rib as a guide. Remove the ribs and trim them on the table.

Check the forward ends of the main longerons. The longerons should follow the top edge of the F-770 side skin. If they do not, adjust the bend/twist in the longeron until they do.

Fit and drill the F-720 armrests. You may flute lightly between the holes in the armrest to make it match the holes in the fuselage side skin. After drilling, remove and store the armrests. They are installed after the side skins are riveted on and the seat floors are installed. Do not install the LP4-3 blind rivet until the F-704Ks are installed.

Remove the F-770 forward side skins.

The conical bend at the lower aft end of the F-770 skin must to be rolled to fit the aft fuselage. Clamp the F-770 to the table with a couple of C-clamps and a length of angle. Arrange the skin so the bend line rests between the edge of the angle and the edge of the table.

Drill a piece of scrap AA6-125 angle to match the lower edge of the skin and cleco it to the skin, using clecoes in every hole. The bend of the skin is very tight -a sharp 90° bend - on the forward end, and opens to a gentle curve at the aft end. Clamp visegrips to the aft end of the angle and use a twisting, rolling motion to start the curve. At the same time, use a strong push with the thumb of the other hand to form the tight bend at the forward end. It may take several tries and trial fits to form a bend that makes a smooth transition to the rear fuselage. Be patient and take the work in small steps.

Make and install the F-623A Rib Attach Strips that fasten F-623 to F-705. See View C-C', DWG 22.

Cleco the F-770 skins back on the fuselage.

At this point all the skins below the main longerons and aft of F-704 should be clecoed to the fuselage skeleton. Clamp the skins aft of F-704 to the longerons, being sure to that the corner of the longeron is flush with the edge of the skins. Begin drilling all the holes through the skins and the longerons, starting at the tail and working forward.

NOTE on the F-773 side skins that there is a "rivet between rivets" several places along the main longerons. These rivets are used to fasten the skin and longeron during construction. The rest of the holes are left open and used when the top fuselage skins are installed.

ADDING THE FORWARD FUSELAGE

At F-704, clamp the longerons even with the upper edge of the F-770 skin. Now check the forward edge of the F-770 ... the skins should extend 3/4" past the forward edge of the longerons. If the longerons are slightly short, there is no problem, but if they are closer than 3/4", trim them back with a die grinder and cutting disc.

Drill the remaining holes connecting the longerons to the F-770 skin.

Make the four F-904-L straps shown in Detail D, DWG 23.

Remove the forward six or seven clecos from the longerons and set the firewall in place. The rear facing "fingers" of the WD-602 brackets rest on the inside of the longeron angles. Clamp the firewall to the longeron.

Draw a centerline on the flange of the aluminum firewall angle. Cleco the F-772 Forward Bottom Skin to the F-704 bulkhead. Clamp the skin to the firewall with the line centered in the 2nd row from the front edge. Drill a hole on each side of the fuselage, through the skin and angle. This will set the distance between the firewall and the F-704 bulkhead.

Slip some AN470AD4 rivets into all the holes in the skin and longeron between the firewall and the aft end of the WD-602. At this point, these holes have not been drilled through the steel brackets and the firewall is heavy enough to cause some sag in the longerons and make the holes mis-align.

Now, take a break for a few minutes. When you return recheck that:

1. The forward face of the firewall is 5/8" aft of the forward edge of the F-770 skin.

2. The webs of the longeron angles are clamped tightly to the Wd-602 brackets.

3. The 1/8" holes in the F-770 skin and longerons are still aligned -in other words, 1/8” rivets slip easily into the holes.

When all these things have come to pass, drill the F-770 skin to the flanges of the firewall, starting at the top longeron and working toward the bottom.

Add another clamp or two to the longeron/bracket assembly and continue the holes already in the longeron and skin through the steel brackets. Put a cleco in each hole as you drill it.

Drill the F-772 skin to the flange of the firewall and the aluminum firewall angle. Cleco in place the FF-00098 Cowl Attach Plate and FF-00099 Cowl Attach Shims and drill through the skin and into these parts to “clean-up” the

holes. The location and orientation of the attach shims and plates are found on DWG 28, BOTTOM VIEW, SECTION A-A, and F-772 FWD BOTTOM SKIN.

If you are building an RV-7A, remove the F-772 lower skin and use the template shown on DWG 34A to locate the holes for the landing gear sockets and brake lines. Enlarge these holes as shown. Some of the forward flange of the F-704 must also be removed for gear leg socket clearance.

INSTALLING THE AUXILARY LONGERONS AND FORWARD BULKHEADS

Draw lengthwise centerlines on Auxiliary Longerons F-713-R&L. Trial fit the longerons between the firewall brackets and the F-704 bulkhead. To fit properly, the longeron must be twisted slightly and the aft end must be filed at an angle to butt against the F-704.

Clamp the forward end of the F-713 and wiggle the aft end until the centerline appears in the pre-punched holes in the F-770 side skin. Drill and cleco.

Make the two F-719B Angle Clips shown on DWG 23. Use them to help fit the F-719R&L Forward Skin Stiffeners to the skin in the same manner as the F-713 longerons. Note that the joggled end of the F-719 goes aft and laps over the edge of the F-704 bulkhead as shown in Sect H-H'.

Make the F-717-R&L Lower Longerons. These are simply lengths of AA6-125 x 1 x 1¼ angle. The aft end is cut at an angle to butt against the vertical side of F-704, and 4 1/8” of one leg of the angle is removed as shown on the plans. This is for clearance of the F-7114 gusset (RV-7) or the WD-721 landing gear mount (RV-7A). See DWG 34 or 34A. To mate with the curving forward fuselage, this longeron must have a bit of twist. Clamp the longeron in a sturdy vise with the forward 3-7/8" captured between the jaws.

Use a large padded crescent wrench on the vertical leg of the angle to twist it outboard. Work in small steps and fit the longeron to the fuselage until it "nests" well with the Wd-603 bracket (see Section K-K') and butts against the forward edge of the F-704 bulkhead (see Section N-N'.) The vertex of the longeron should parallel the lower edge of the F-770 side skin. About 1/8” of the longeron will be visible, extending below the edge of the skin.

When the longeron fits in Wd-603, clamp the assembly and drill the four vertical bolts shown in Detail L, Detail A and the Side View of DWG 23.

Clamp the aft end of the longeron to the F-704 bulkhead for now.

Before drilling holes for the rivets that join the lower longerons and auxiliary longerons to the Wd-603 brackets, the F-684 gussets must be fitted. These require some careful edge filing to fit really well, but this is an important juncture, so make sure all the parts fit before riveting. The forward edge of F-684 should be 1/8” aft of the firewall bulkhead and the lower edge should align with the lower edge of the F-713 Aux. Longeron. Adjust the bend angle if necessary to make the gusset lie flat inside the Wd-603 bracket and the vertical firewall angle. See Section K-K', DWG 23.

Clamp the assembly, drill as shown on Detail A, and cleco. The holes in the skin will act as guides.

INSTALLING THE FORWARD BULKHEADS

Adjust the flanges of the F-902-L&R Forward Bulkheads until the web is perpendicular to the aircraft centerline. Check by using a straightedge between the two bulkhead webs to see that they are parallel. Straighten the bulkheads as necessary with flutes between the rivet holes. Open the hole for the rudder cable to 5/8”

Rivet the nutplates to the aft side of the F-902 bulkhead. These will later hold clamps securing the fuel vent line.

Cleco the F-7101 Gear Attach Web to the F-704 bulkhead. This should rest the web of the F-902 against the forward flange of the F-7101. Make any small adjustments necessary, then drill and cleco the F-902 to the F-7101 and the skin.

Adjust the top and bottom tabs of F-902 as necessary to fit the longerons, drill and cleco.

Make the F-796C & D Spacers as shown on DWG 38. Drill the top 3/32” hole in the spacers at the dimensions shown, but leave the other holes undrilled for now.

Make the F-796B reinforcement angle (DWG 38) and drill only the top hole. Drill the 3/16” hole to #30 for now.

Study drawing 38, Detail F to understand the fit of the spacers and angle with the bulkhead flange and longerons.

Put a centerline on the outboard face of the F-796B angle and cleco it on the inside of the longerons using the upper pilot hole drilled in the angle. When the centerline on the angle is visible through the lowest hole in the side skin, drill and cleco it to the fuselage. Match-drill the remaining holes through the angle using the holes in the skin as guides. Drill as straight as possible so as to minimize any hole position error due to the gap between the skin and angle.

Remove the F-796B. Cleco the F-796C & D spacers to the F-796B angle. Align part edges and match-drill all the holes through F-796C & D using the holes in F-796B as guides.

Cleco the angle and spacers back in the fuselage. Small hole misalignments may be cleaned-up by running a #40 drill through the part stack-up. Large hole misalignment may be cleaned-up by running a #30 drill through the stack-up and installing 1/8 inch rivets instead of 3/32 inch rivets. Remove the parts and set aside for later installation.

INSTALLING THE RUDDER AND BRAKE PEDALS

DWG 37 shows details of installing the rudder and brake pedal assemblies. This is best done while access is still available.

Assemble the F-6117-L&R Brake Pedals.

The Wd-655R&L Rudder Pedal Assemblies are assembled with the brake and master cylinders bolted on as shown on the Exploded View of DWG 37. The F-6116 Side Bearing Blocks are slipped over the end of the rudder pedal tubes and the assemblies are dropped into the fuselage from above. Note that the right side pedal assembly is forward of the left side.

The exact fore-and-aft location of the F-6116 bearing blocks is left to the builder. We recommend drilling several attachment hole patterns so the location can be changed easily if it becomes necessary. Remember to maintain at least two hole diameters between the edges of the holes.

Bolt the rudder pedal assemblies to the longerons with bolts through the side bearing blocks. Trim the F-6118 Rudder Pedal Brace as shown. The extra length of the notch in the bottom flange will accommodate the F601K Firewall Recess. Fit the F-6115 Center Bearing Block around the Wd-655 rudder pedal tubes and bolt it to the brace. Clamp the brace against F-601 upright firewall stiffener and drill. You may find it easier to drill from the inboard face of the F-601, reaching through the open hole for the F-601K recess. Plan your holes so the rivets don't interfere with rivets that attach the recess coming through the other leg of F-601N.

Remove and store the rudder pedal/brake pedal assemblies.

INSTALLING THE FLOOR STIFFENERS

The floor stiffeners are shown on DWG 23.

Cleco the F-772 forward bottom skin back on the fuselage.

Draw centerlines on the back of the F-772B-R&L Floor Stiffeners. These must be fitted to the inside surface of the F-772 skin, so it helps to have a helper to shift the stiffeners while you watch for the centerlines through the holes in the skin.

When the floor stiffeners are located, drill them to the skin, firewall, and center section bulkhead.

The center floor stiffeners are also drilled to the bottom of the F-783B-L&R Cover Support Ribs and F-601J angles on the firewall. Make sure the stiffener is firmly against the floor and bulkheads before using an angle drill to make these holes.

THE CABIN

FRAMING THE BAGGAGE AREA

See DWGs 25 and 29. The inside of the baggage area sidewall is partially covered with two panels. The aft is permanent, but the forward panel must be removable to give access to the flap mechanism. These panels are supported by two ribs, one vertical, one horizontal.

Fit the F-724 vertical rib by clecoing it to the F-770 side skin.

Install the nutplates on the F-722 horizontal ribs then drill and cleco them to the side skins.

Cleco the F-750 aft baggage side covers to the F-722 and F-724 ribs.

Adjust the top and bottom flanges of F-724 to the longeron and the F-623 rib, and drill them.

RIVETING THE FORWARD SIDE SKINS

Before the F-770 forward side skins can be riveted to the fuselage framework, there is a laundry list of small tasks that must be completed. You may have done some already. If not, complete them now.

Remove the skin.

Rivet the F-684 Gussets to the vertical firewall angles as shown on DWG 23, Detail A.

Rivet the F-7101 Gear Attach Web to the F-902 bulkhead (DWG 23, Sect G-G'.)

Rivet the F-719 and F-719B Stiffener and Angle Clip to the vertical angle of the firewall.

'Pre-rivet' the F-704H Center Section Side Plate (DWG 11) to the F-770 skin. A few key rivets are set at this time, because they will be very difficult to reach when the skin is installed on the fuselage. These rivets are right next to the spar entry cut-out. Set the upper five rivets forward of the spar cut-out, leaving the lowest one open ... it will be riveted when the skin goes on. Set the six rivets aft of the spar cut-out.

Complete the necessary dimpling or countersinking on the F-770 skin and underlying structure. (See Section 5E and Figure 5-4.) NOTE that the outboard five rivets holding the F-772 and F-776 Bottom Skins to the F-704A Forward Bulkhead must be installed "double-flush". See drawing 28. The flush heads rest on the inside of the F-

704 flange are necessary to provide clearance for the RV-7A main gear leg mounts that will be bolted into this location later. It is recommended that RV-7 builders install rivets the same way to retain the possibility of taildragger to tri-gear conversion.

When preparations are complete, rivet the F-770 side skins to the fuselage. We recommend starting at the F-704 bulkhead and working fore and aft. Finish riveting the F-772 skins. Don't forget to include the hinges and the FF-00098 Attach Plate and FF-00099 Attach Shim (see DWGs 28 and 45) when riveting the skins to the firewall.

Complete any riveting on the aft fuselage that has not been finished yet. Remember to rivet the skins to the main longerons with only the rivets specified! The rest of the holes must be left open to attach the top skins.

ROLLING OVER THE 'CANOE'

After the all the skins are riveted on, roll the fuselage right side up and set it at a convenient working height on a pair of sawhorses. Level the fuselage at the center section, both lengthwise, along the longerons, and sideways, across the longerons. Secure the fuselage so that it stays that way.

See DWG 26. Clamp the F-714 aft deck to the longerons, using clamps through the forward lightening holes and rear rectangular opening. Place a level across the rear deck, near F-710. It should read level ... if it doesn't, loosen the clamps and twist the fuselage slightly until it does. Take your time with this step. Once the aft deck is riveted to the longerons, the fuselage is torsionally rigid, and any twist built into it will be there forever.

When the fuselage is straight, re-clamp the aft deck and drill it to the longerons.

After deburring, etc., rivet aft deck to the fuselage.

FINISHING THE FORWARD FUSELAGE AND LONGERON DETAILS

INSTALLING THE SIDE RAILS and GUSSETS.

See DWG 25. The F-721B side rails have already been drilled to the longerons. Trim the F-757 gussets to the shape required by your canopy and try them for fit by sliding them into the slot in F-721B. File and radius the outside edge until the pre-punched holes in the F-757 match the holes in the F-705 bulkhead. Remove as little metal as possible.

Drill and cleco the pre-punched holes to fix the F-757 in position, then drill the holes through the longeron and the outboard portion of F-757.

Rivet both side rails, canopy decks and gussets to the longerons. Carefully file the decks and rails to fit the contour of the side skin.

INSTALLING THE F-695 FORWARD FUSELAGE GUSSETS

The F-695 gussets attach the main longerons to the angle frame of the firewall. They are shown on DWG 23.

Drill the holes in the gussets, then clamp the gussets to the longeron and horizontal angle of the firewall. Drill the gusset to the firewall and the longeron.

After final preparations, rivet the gussets to the fuselage.

INSTALLING THE SHOULDER HARNESS ANCHORS

RV-7/7A shoulder harnesses are secured to the aft fuselage longerons by a stainless steel cable. This provides a direct load path. Fit and drill the F-636 shoulder harness anchors as shown on DWG 26, detail D. Do not bolt them in just yet, because they will interfere with riveting the top fuselage skins to the longerons.

FINISHING THE BELLCRANK SUPPORT

See DWG 26. Drill the F-728A vertical channel to the F-706 bulkhead, then remove the channel. Fit, drill and rivet the F-728B angle to the channel, then re-install the channel permanently in the fuselage. It will require a narrow or notched bucking bar to set the rivets attaching it to the top of the bulkhead. If you don't have one that will work, you may use blind rivets as shown.

Fabricate the F-635 Bellcrank by riveting the components around the VA-146 flange bearing. Make the tubular F-635C spacers and fit the bellcrank in the fuselage. Square the ends of the spacers and fit them precisely between the area washers on each side of the bellcrank and the support ribs on either side. The bellcrank should be centered between the ribs and rotate smoothly, with no side-to-side play.

Remove the bellcrank, washers and spacers and store.

FITTING THE TOP AFT FUSELAGE SKINS

INSTALLING THE GUSSET PLATES

The F-656-L&R gusset plates tie the F-706 and F-707 bulkheads to the main longerons. See DWG 26. Clamp the

gussets to the longeron. Cleco the gussets to the bulkhead and use the pre-punched holes to drill them to both the bulkhead and the longeron.

Rivet them any time.

FITTING THE AFT TOP SKIN

The aft fuselage is shown on DWG 26. Adjust and check the flanges of the bulkheads to an angle that will lie smoothly against the skin. You can simulate the skin with a straightedge or tight thread.

Make the two F-786A Top Fuselage J-Stringers. Draw a centerline on the upper faces and tape them to the F-706, 707 and 708 bulkheads.

Cleco the F-775 Rear Top Skin to the F-707 and F-708 bulkheads and to the main longerons. The longeron holes were drilled already, when the lower side skins were installed.

Drill and cleco the skin to the bulkheads, starting with the intersections of the J-stringers and the bulkheads.

FITTING THE FORWARD AFT TOP SKIN

Cleco the F-787 Stiffener Rib between the F-706 and F-707 Bulkheads.

Cleco the F-774 Forward Top Skin (tip-up canopy) or the F-7112 Forward Top Skin (sliding canopy) to the F-707 and F-706 bulkheads. As you move to the forward part of the skin, slip F-788 between the skin and the bulkhead and rib and continue clecoing.

There are four holes in the F-774 Forward Top Skin that are not in the F-706 bulkhead or the F-788 gusset. Match-drill the gusset and the bulkhead using the holes in the skin as a drill guide.

Drill the skin to the bulkheads, F-787/788 and J-stringers.

Now that both skins are on and clecoed to both bulkheads and longerons, fit the F-709 Bulkhead. Insert the bulkhead underneath the aft top skin and press it firmly against the inside of the skin. Cleco it to the F-714 aft deck, then drill it to the skin.

Remove the clecoes on the right side of the F-774 (7112) and F-775 skins and lift them up to expose the F-787 stiffener rib. Fabricate the F-707B clip shown on DWG 26. Clamp it to the F-707 bulkhead and F-787 rib. Drill it to the F-707 bulkhead using the pre-punched holes as a guide. When it is clecoed to the bulkhead, drill it to the rib. You may rivet F-707B to F-787, but do not rivet F-707 until the aft top skins are riveted – F-787/F-707B blocks access to one of the skin rivets.

Rivet the F-787 to the F-707B clip, but not to the F-707 bulkhead.

FITTING THE F-6111 RIBS (SLIDER ONLY)

Cleco the F-7112 skin in place. Trim the F-6111 ribs to length. The ribs are not attached to the longeron at the bottom and have one rivet common to the F-705 bulkhead at the top. The rib must be twisted and possibly fluted to achieve the proper shape. See DWG 41.

FINISHING THE INSIDE OF THE CABIN.

THE BAGGAGE COMPARTMENT

See DWG 29. Drill and rivet the F-750-L&R Aft Baggage Side Covers to the inside of the fuselage.

Now is the time to install the steps if you are building a -7A. See the separate instructions shipped with the steps.

If the F-747 baggage floors have been removed, cleco them back in. After drilling, deburring, and dimpling for the inboard nutplates, rivet them in place. Don't forget to rivet the nutplates as well. Leave the forward row of rivets out for now, as these are common to the F-742 Aft Seat Floors which will be installed shortly.

While the top skins are still clecoed to the fuselage, fit and drill the F-751 and F-652 corrugated baggage bulkheads to the F-706 bulkhead. The lower F-751 bulkhead has pre-punched holes across the bottom that can be used as guides, but the holes up the sides must be located and drilled in assembly. The upper F-652 bulkhead must be trimmed as shown on DWG 29 and drilled in assembly with F-706.

Remove the baggage bulkheads and install the nutplates on F-706. Notch F-652 and install the F-6114B&C cable wear blocks.

Temporarily install the baggage bulkheads on F-706. If any of the screws are particularly difficult to get into the nutplates, especially along the bottom where they are a bit difficult to reach, you can run an 8-32 tap through the nutplate.

Fit the F-748 Baggage Tunnel Cover.

Fit the F-749 Forward Baggage Side Covers. This will require twisting it into position with the horizontal flange under the baggage floor. (Yes, it can be done.) This cover must be removable to allow access to the flap links, so

it is held to the fuselage frame with screws. We find the optional tie-down ring holders shown in Detail D, DWG 29, to be useful.

Adjust the flanges until F-749 fits correctly, match drill the necessary holes and rivet on the nutplates. Remove the aft top skins for deburring and dimpling. There is no particular rush to rivet these skins on ... in fact, having them off simplifies several operations in the rear fuselage, so store them carefully away.

AFT SEAT FLOORS

See DWG 30. The seats attach to the aft seat floors with piano hinges. The seat back position is changed by simply pulling the pin and repositioning the back in another hinge segment.

Prepare the F-742-L&R Aft Seat Floors by drilling them to the floor ribs and fitting the F-637E hinges as shown in DWG 30. Note that the F-637E hinges have eyelets on both ends and two eyelets trimmed away in the middle. The aft edge of F-742 may go on top of the baggage floor, or between the baggage floor and the F-705 bulkhead.

Rivet the aft seat floor assemblies to the floor ribs.

FORWARD SEAT FLOORS and CONTROL ROD TUNNEL

See DWGS 25 and 30. Fit and drill the F-739 and F-740 Forward Seat Floors to the seat ribs. These floors must be removable to gain access to the control system, so they attach to the ribs with screws. The left floor (F-740) goes on first, with the wider right floor (F-739) on top.

Make the F-741A-L&R Tunnel support covers and the F-741B from material as shown on DWG 30. Drill holes in the lower flanges of the support only. These holes must match the holes in the floors, so measure carefully.

Cleco the supports securely to the floor and clamp the F-741B Tunnel Cover to the top flanges of the supports. Slide the cover forward until it contacts the slanted floor. Drill and cleco the single forward hole to the floor. Check to see that the edges of the cover and the support flanges are even, then drill the holes connecting the cover to the supports.

Rivet the tunnel cover to the supports.

Remove the tunnel cover and forward seat floors. Install the nutplates in the seat ribs and around the stick cut-outs in the floors. Don't forget the nutplate for the tunnel cover.

Re-install the floors with enough screws to hold them securely.

SEAT BACKS

The seat backs are made as shown on DWG 30. The upright angle supports are made from 0.125 angle material (not 0.063!). The seat backs are very simple, but once the hinges are mounted on the bottom, they become "right" and "left." Be sure to make one of each.

The F-638 Seat Back Braces are trimmed on the ends and the optional lightening holes cut on the drill press with a hole saw or flycutter.

FORWARD COVERS

Several covers are installed in the forward fuselage to protect fuel lines, cover the electric fuel boost pump and direct cabin heat. See drawing 34. These are removable for maintenance.

Fit the F-982E Access Plate and F-982D Heat Baffle to the F-782C Center Cabin Cover. Rivet the baffle and necessary nutplates to F-782C.

Insert the F-782C between the center floor reinforcement angles and the F-601N vertical angles on the firewall. Check to see that an even amount of the horizontal section of F-782C is exposed above the floor angles. Don't force it down too far…the flanges will be forced inboard by the radius of the angles and a poor fit will result. You may wish to put a simple wood spacer between the cabin floor and the center cabin cover to ensure that this won't happen.

Rivet the nutplates to the F-983A Fuel Valve Plate and screw it to the F-704 bulkhead. Slide the F-983C Fuel Valve Cover underneath the plate and fasten it to the F-783B cover support ribs and the fuel valve plate.

Adjust the F-782C fore/aft until it mates with the bottom of the F-983C, Fuel Valve Cover. Cleco the two parts together.

Fit the forward section of the F-782C to the firewall and F-601K-1 firewall recess. Recheck the height of the F-782C and drill it to the floor stiffener angles. Finish drilling it to the firewall as well.

Remove the fuel valve cover and center cabin cover components and install the necessary nutplates. If you are installing electric elevator trim, the triangular flange on top of the F-983A may be trimmed away. Leave it if you are installing manual trim…it will be needed to hold the trim cable.

THE ELECTRIC FLAPS

Electric flap actuation is standard on the RV-7/7A. The power comes from a sealed linear actuator assembly between the seat backs, driving the flaps through a welded steel actuator and pushrods connected to the inboard end of the flaps. The flap mechanism is shown on DWG 33.

Begin by drilling the holes in the clevis ends of WD-613-EF Flap Actuator Weldment to ¼".

Drill the holes in the F-680 Block and saw it in half. Notch the corner of the block.

Install the flap actuator weldment in the baggage compartment using bearing blocks F-661-EF on the F-705 uprights and F-680 in the center. The forward corner of the F-748 Cover must be notched to clear the F-680 block, so it can be removed without removing the block. Use the holes in the F-680 block as a template to drill the floor.

Make the F-785B Attach Angle and the F-767 Attach Plate. Pre-drill the angle, but don't drill the attach plate.

Fit and rivet the F-785B attach angle to the bottom of the F-785A Backrest Brace.

Note: The F-758 and F-767 brackets replace the EF-603 and EF-604 brackets that are contained in the electric flap kit parts bag for the RV-7/7A.

Fit and rivet the F-758 Brackets to the bottom end of the F-00766A-1 Channel.

Temporarily screw the F-00766A-1 assembly to the floor and clamp the F-767 attach plate to the top of the channel. Clamp the attach plate to the crosspiece of the F-705 bulkhead and adjust it until it aligns with the pre-punched holes in the bulkhead. Drill the F-767 to both the F-00766A-1 and the bulkhead.

Remove the channel and finish F-767 by fitting the nutplates and riveting it to the top of F-00766A-1.

Prepare the F-00766C-1-L and -R Attach Brackets. Install the nutplates and the attach brackets along the sides of the F-00766A-1. Re-install the F-00766A-1 assembly in the fuselage.

Install the F-785A assembly in the fuselage. Match-drill the four #20 screw holes in the F-785A coincident with F-00766C-1 attach brackets. Match-drill the F-785A to the F-705 bulkhead.

Begin fitting the F-00760-1 Flap Actuator Covers. Match the holes with nutplates in the F-00766A-1 channel, cleco, and match-drill the rear row of holes in the F-785A. Drill the backrest, using holes in the side cover as a guide.

Remove the F-785A from the fuselage. Install the nutplates. Dimple the four #20 holes for a #8 screw. Install the two aft nutplates to each F-00766C-1. Re-install the F-785A. Attach the F-785A to the F-00766C-1 brackets. See Section A-A'.

Use a 12v battery connected to the two larger wires to run the linear actuator until the shaft is fully retracted. Reversing the leads will make the motor run the other way. The three smaller wires are for the linear actuator position potentiometer. See wire color code table on Page 8-24.

Install the CM-4M Rod End Bearing and jam nut on the end of the linear actuator shaft. Adjust the rod end bearing to set the linear actuator assembly overall length and axially align it with the base mounting hole.

Run the linear actuator until the shaft is half way between its travel stops. Install the linear actuator. See Section A-A'. Bolt the linear actuator to the WD-613-EF actuator arm, using the washers shown to center it in the clevis. See Section B-B'.

The final details of wiring and adjusting the F-759 Pushrods are left until the wings and fuselage are joined.

INSTALLING THE LANDING GEAR MOUNTS (RV-7A ONLY)

The main landing gear mount installation is shown on DWG 34A.

Before fitting and bolting the mount to the fuselage, the upper gear leg alignment bolt hole must be completed. Make sure that the inside of the mount tube and the knob on upper end of the gear leg are clean and have no burrs around the holes.

Slide the gear leg into the mount and align the hole. Match drill the leg to the mount using a 0.311" drill bit. Remove the leg and clean up any burrs.

Install the WD-721 landing gear supports to the forward side of F-704. It is acceptable to slightly enlarge the elliptical openings if/as required for the landing gear weldments to pass through the floor as well as the flange of the main spar. Also, it is acceptable to slightly adjust the angle of the WD-721 flange that mates-up to the vertical leg of the lower longeron at its aft end. One other area of possible adjustment is the forward pointing brace tube of the WD-721 weldment.

It is acceptable to open holes in the WD-721 that don't line up with the main spar holes. **Do not drill through the spar,** but mark the holes, remove the weldment and use a round file to remove just the area of interference.

Don't forget the additional washer between the mount and the lower part of the spar as called out on the plans.

If you have a gap of 1/16" of less it is acceptable to pull it tight to the longeron with the bolts. If more than 1/16", use a spacer made from aluminum scrap or rebend the brace tube slightly as required.

Drill 3/16" diameter holes through F-770 and F-7101, 7 places per side using pre-punched holes in WD-721 as drill guides.

WING/FUSELAGE ASSEMBLY

During this phase of construction it is necessary to assemble the wings to the fuselage for a number of reasons including drilling the rear spar/center section attach, finishing the aileron and flap control mechanisms, installing the wing tank/fuselage attach brackets, fabricating and fitting fuel & vent lines, and installation of wing root fairings. If you are working in a small shop it is acceptable to install, then remove, one wing at a time.

Before installing the wing, mark on the W-704 the screw locations at each unused rivet space on the bottom flange of the W-710 root rib. Then mark a straight line from the hole location toward the wing tip and make a measured mark 3" outboard from the intended screw location. This will allow you to measure back to the same point on the overlapping F-776 fuselage skin.

If your wing tips have been permanently attached to the wings and/or your shop dimensions are such that the aileron pushrods cannot be inserted from the tips of the wings, the W-716 pushrods must be loosely placed in the wing lightening holes from the root before the wing panels are "plugged-in" to the fuselage.

Actual installation of the wing panels should be very simple, as the spars have been fitted and drilled at the factory. It is helpful to file a slight bevel on the root ends of the spar to assist getting it started sliding through the slot in the fuselage bulkhead, and to prevent it from scratching and galling the bulkhead bars as it slides through. Support the inboard ends of the wings when inserting to prevent the bottom of the spar from dragging along the inside of the fuselage bottom skin. As the wings are pushed in near center, be sure that the fuselage center bottom skin (which overhangs the fuselage) doesn't catch on the wing skin. When bringing the spar into its exact position, lining up the bolt holes in the bulkhead and spar, it is often helpful to use drift pins. This could be a disposable hardware store bolt with the end rounded or tapered on a grinder. Gently driving this lubricated pin into a nearly aligned hole will center the bulkhead/spar hole so that the bolts can be installed without excessive force It is recommended that 7/16" and ¼" hardware store bolts be used for test fitting to prevent damage to the holes and NAS bolts. Install the bolts as called-out on DWG 11. For fitting purposes, it is only necessary to install four 7/16" bolts, one top and one bottom for each wing panel. Of course, when permanently installing the wings all the bolts called-out on DWG 11 must be installed.

NOTE: When installing the wing for the last time, lubricate the NAS bolts with LPS #1, 2 or 3 (available in a spray can). In lieu of that a light coat of ordinary motor oil will do. Do not lubricate the threaded portion of the bolt as this will influence the torque wrench reading.

SETTING THE WING INCIDENCE

With the main spar bolted in place, the next step is the attachment of the rear spars. Level the fuselage, both laterally and longitudinally, using the top surface of the F-718 longerons between F-704 and F-705 as a datum surface. Then square the wing with the fuselage. This is done by measuring from corresponding points on the wing tips to a common centerline point of the aft fuselage. Equate these distances at the same time checking that the wings have no forward or aft sweep. This can be done by dropping 4 plumb lines from the wing leading edges (2 on each wing at inboard and outboard points) to see that they all fall in a straight line. Mark this position with a vertical line at the rear spar attach, on both rear spar and center section.

Now the very important incidence angle must be measured and set. This is done by using a level and spacer blocks as shown in DWG 38. Verify that the fuselage is level. Rest one end of a level on the forward spar just forward of the skin butt joint and the other end on a spacer placed directly over the rear spar web. Shift the rear of the wing up or down to center the level. The spacer size has been calculated to provide the desired 1° positive incidence angle. Check several points along the span of the wing to verify the level reading. Clamp the root in place and check the other side in the same manner. See DWG 38, Section H-H.

It is extremely important that there is at least 5/8" from fastener center to the edge of the part, in both the rear spar and F-705. If unable to maintain proper edge distance, call Van's Aircraft for assistance before proceeding further.

Initially drill an undersize hole starting with no more than a 1/4" drill. Then progressively enlarge the hole to 5/16" which should provide a close fit for an AN5 bolt. Drilling with a long stiff drill bit is a good idea because it can be held straighter for a truer hole.

The overlapping portions of the F-776 bottom skin are screwed to the bottom of the wing when the wings are installed to stay. Holes for these screws must be drilled now. Use the reference lines to locate the hole positions. When the wing is removed, these holes are dimpled for #8 screws. K1100-08 platenuts are riveted to the inside flange of the root rib.

The F-796A Fuel Tank Attach Brackets are fitted to the fuselage as shown on DWG 38, Detail F. The bracket should have the main web adjusted by bending so that it mates flush to the fuselage side and to the T-405 angle bracket on the fuel tank. See DWG 38, Section E-E. Clamp the F-796A angle firmly to the T-405 bracket on the fuel tank. Check to see that it rests firmly against the fuselage and drill the attach holes.

After the F-796A is bolted, at least temporarily, to the fuselage, the clamp can be removed. Locate the center of the 1/4" hole on the flange of the angle. Double check to be sure you have sufficient edge distance on both T-405 and F-796A. Drill the 1/4" hole through T-405.

Finish the bracket installation after the wings are removed by installing the nutplate on T-405 as shown in DWG 38 Detail F and Section E-E. Note the orientation of the platenut. It is important.

Assemble F-759 Flap Pushrods as shown on DWG 33. Bolt the F-759 to both the flaps and the WD-605-EF flap control weldment. Rob a battery from your car or lawn tractor and connect it to the flap motor. Run the motor up and down while checking for any possible interference in the flap linkage. The hole in the fuselage skin may be enlarged as necessary to avoid interfering with the pushrod.

Install the F-799 wing root fairing as shown on DWG 38, Wing Root Fairing Installation Detail, and Section G-G.

Install the WD-610 control column, WD-611/WD-612 control sticks, and F-665 control column pushrod as shown on DWG 38. Use the W-730 bellcrank jig to hold the WD-421 bellcrank in its neutral position as shown on DWG 15A. Install and adjust the W-818 aileron-to-bellcrank pushrod such that the aileron is in the neutral position when the bellcrank is held in its neutral position. Install and adjust the W-716 bellcrank-to-stick pushrod such that the sticks are in their neutral positions (vertical) when the bellcrank is held in its neutral position.

INSTALLING CABIN SYSTEMS

Installing the brake, fuel tank vent, and fuel systems inside the cabin is much easier when the forward fuselage is still open. The brake and rudder pedals have already been fitted, but the brake lines and hoses must still be finished and installed. The fuel lines are made from aluminum tubing, flared on the ends to mate with AN fittings. Details of these systems are shown on DWG 36 for the RV-7 and on DWG 36A for the RV-7A.

- The routings and fitting details are so well depicted on DWG 36/36A that step-by-step instructions would be redundant. Here are a few general hints, however:
- Install the fuel and fuel vent lines before putting the rudder/brake system in to stay.
- Study the Standard Aircraft Handbook or a similar publication to learn the correct method of cutting and flaring the ends of aluminum tube. A tubing cutter and flaring tool will be necessary. Flares on aircraft fittings are typically 37°. Do NOT use automotive 45° flaring tools or fittings!
- A lever type tubing bender makes neat bends without collapsing the tube. It takes a little practice to learn the bend allowances and techniques, but the results are better than trying to hand-bend tight corners.
- Remember to put the bushings/grommets, sleeves, and nuts on the aluminum tube before you flare the ends. The sleeves particularly will not go around any but the gentlest curves. If you forget, you will usually have to cut the flared end off to get the fittings on.
- A drop of oil on the flaring and bending tools makes the operation much smoother and easier.
- Use Fuel Lube (a sealing paste available in supply catalogs) when installing AN fittings with pipe threads. Do not use Teflon tape!

After the fuel vent and fuel supply line installations are complete, the wings can be removed from the fuselage, the rib flanges, skins, and fairings dimpled, and nutplates installed.

FITTING THE EMPENNAGE

DRILLING THE ELEVATOR HORNS

The elevators were fitted to the horizontal stabilizer during construction, but the lower bolt hole in the elevator horns (to which the pushrod attaches) has not been drilled yet. These holes are best drilled with the elevators mounted to the stabilizer. This hole must be exactly perpendicular to the horns. If it isn't, when the bolt installing the pushrod is tightened, one horn will be pulled forward and the other aft, mis-aligning the counterbalance arms.

Clamp the horizontal stabilizer to the bench with the hinges hanging over the edge. Mount the elevators on the stabilizer. Align the elevator counterweight arms to the stabilizer tips and clamp them so they will not move. Measure the distance between the inside faces of the elevator horns.

The horns are individually welded and seldom does one side match the other exactly. Usually the mis-match is slight. Determine which horn is aft, then remove that elevator and drill a #30 pilot hole in the horn at the dimensions shown on DWG 27A, Side View.

Make an aluminum or hard wood block that fits exactly between inside faces of the horns. The exact size of the block is unimportant, but the two outside faces must be parallel. Use a drill press to make a #30 hole perpendicular to the faces of the block.

Remount the elevator and fix the counterweight arm to the stabilizer. Clamp the block between the horns and align the hole in the block with the hole in the one horn. Use the block as a guide to drill the other horn. Once pilot holes have been drilled in both horns, enlarge them to full size. This can be done one horn at a time.

INSTALLING THE TAILCONE STIFFENERS (RV-7 ONLY)

Position a F-00773A Tailcone Stiffener as a drill template on the outside of the F-773-L Aft Side Skin in the same position as the stiffener will be installed. See Detail B on DWG 27.

Match-Drill #40 all the holes in the stiffener into the side skin. Deburr and dimple the holes in the side skin then rivet the stiffener to the inside of the side skin using the rivet callouts on DWG 28. Repeat this procedure on the right side of the aircraft to install the remaining stiffener.

FITTING THE HORIZONTAL STABILIZER

Clamp the horizontal stabilizer to the aft fuselage. The stabilizer must be perpendicular to the longitudinal centerline of the fuselage. Pre-position the inboard edges of the skins parallel to the longerons. Check by running a tape measure from the outboard end of the stab to the corner of the firewall. Use similar points on both sides of the airplane and adjust the stabilizer until the measurements are equal.

Once the stabilizer is located, it is time to drill the holes though the HS-714 attach angle on the forward spar.

The outboard holes must go through the fuselage longerons, the F-710C spacer and F-710B angle (see Detail B, DWG 27A). These parts are underneath the F-714 deck and invisible. Take careful measurements and locate these bolts as accurately as possible. Remember: the vertical leg of the longeron is 1/8" thick and the bolt must center in the available 5/8” of the horizontal leg.

When the HS-714 angle has been drilled, make the F-798 shims, slip them between the deck and the angle and use the holes as guides to drill the shims.

Temporarily bolt the forward spar and shims to the fuselage. Use a 3/16" spacer and slide it between the rear spar of the stabilizer and the aft deck. This will set the spacing necessary to obtain the desired 0° incidence. Check this by measuring from the deck to the chordwise centerline of the inboard stabilizer ribs. The measurements should be the same, fore and aft.

When the stabilizer is located, drill the bolt holes though the F-711C bars and the rear spar of the stabilizer.

INSTALLING THE PUSHROD

While the stabilizer is still bolted to the fuselage, pin the elevators in place and clamp the counterbalance arms to the stabilizer.

Install the F-635 Bellcrank and spacer assembly between the F-728 and F-729 ribs (DWG 26).

Make the F-790 Pushrod as shown on DWG 38. Because the pushrod effectively becomes an enclosed unit with no practical possibility of internal inspection, we recommend priming the inside of the tube. Pour liquid primer into one end and swirl it toward the other, coating the entire inside of the tube. An alternative method is to spray primer into one end of the tube, then turn the tube around and spray into the other end. Let the primer cure thoroughly, then rivet the primed VA-101 pushrod ends in the tube with the MSP-42 high strength blind rivets. The primer must be dry before installing the rod end bearings. We have seen wet primer migrate into the rod end bearing and freeze the bearing. You can make a simple pattern out of a strip of stiff paper. Wrap it around the outside of the tube, trim it until the ends just meet, then flatten it out and mark the pattern of 8 evenly spaced holes. Wrap it around the tube again and transfer the spacing to the tube.

Thread the jam nuts onto the rod-end bearing shanks, then thread the rod-end bearings into both ends of the pushrod.

Temporarily bolt the pushrod to the F-635 bellcrank and the elevator horns. Put the F-635 bellcrank in the neutral position, i.e., with the bolt holes for the pushrods vertical. You can come very close by inserting a 3/8" socket through the hole in the F-728 rib and fitting it over the head of the lower bolt, but because socket wall thicknesses are not standardized, there may still be some error, so double check.

With the F-635 in its neutral position and the elevator in trail, the length of F-790 should allow some adjustment both ways in the rod ends.

NOTE: In the final installation, both rod-ends must have over half the thread engaged, making it impossible for a bearing to back off the push-rod if both ends are pinned.

Adjust the pushrod length and tighten the jam nuts against the pushrod ends. Remove the pushrod and store.

MANUAL TRIM CABLE INSTALLATION

The RV manual trim control is a functional, though unconventional, vernier control. A vernier is a control cable that rotates for fine adjustment, but has a button that “unlocks” the threads and allows rapid push-pull movement. Most of us have encountered verniers in other airplanes where they are commonly used as throttle, prop, or mixture controls. Because the trim is very effective, it is conceivable that rapid trim application while the airplane is traveling at high speed could produce high G loads, possibly even destructive loads. Because of this remote possibility, the

rapid push-pull action of the cable should be disabled, leaving the rotational vernier action as the only way to move the trim tab.

Pry up the rubber button with a small screwdriver. Work carefully because the button is held with and adhesive and it is possible to damage the handle. When the rubber button is out, remove the plunger shaft. Without this shaft, the vernier control cannot be released and all action will be limited to the twist screw function.

Replace the rubber button with a 1" chrome snap-in hole plug from the local hardware store.

The trim cable is installed from the cabin end, starting through the center console and then routing it aft through the fairlead holes in the bulkheads. See DWG 32 or 32A.

NOTE: If you are planning on a fuel injected engine, order the longer 191" length cable for clearance around the high pressure fuel pump and filter. (7/7A F.I. PUMP INSTAL KIT)

Snap-in bushings of 7/16 I.D. are used as fairleads in all of the bulkheads and webs through which the trim cable passes, except at the root rib and rear spar of the horizontal stabilizer. The hole through the root rib is at an acute angle not suited for a bushing, and the holes through the rear spar must be of minimum size, not large enough for a bushing. Use RTV Silicone Rubber to form a protective gasket around the trim cable in these passages.

Feed the cable through the fuselage and horizontal stabilizer and then through the elevator spar and out through the opening in the elevator bottom skin.

Drill the Wd-415 to the E-616PP cover plate. When the cable is completely in with its aft end hanging free under the elevator, the Wd-415 Anchor Nut is threaded onto the cable. With this anchor clecoed in place, the clevis end is threaded onto the shaft (just over half depth) and trim tab travel can be tested. Desired down travel of the tab (nose up trim) is 35 degrees, and up travel is 25 degrees.

The two inch travel of the control cable is sufficient for this total travel, but it may be necessary to adjust the position of the cable by threading the Wd-415 anchor in or out before it is finally riveted on. Even then, a little adjustment is available in the clevis end fitting.

ELECTRIC TRIM INSTALLATION

The installation of the Electric Elevator Trim (option ordered on the Empennage Kit) and Electric Aileron Trim (option ordered on the Fuselage Kit) systems are covered in those specific subkit instructions.

FITTING THE VERTICAL STABILIZER

Temporarily clamp the F-781 attach plate to the forward spar of the horizontal stabilizer.

Trim the VS-702 front spar as shown on DWG 27A.

Clamp the rear spar of the vertical stabilizer to the back of the F-712 bulkhead, centering it in the bulkhead. Set the height using the dimension shown between the longeron and the hinge bracket.

Take measurements from the tip of the vertical stabilizer to both tips of the horizontal. Adjust the vertical stabilizer until the measurements are equal and the stabilizer is truly vertical.

Drill the bolt holes through the stabilizer and the F-712D Up Elevator Stop. Install bolts temporarily.

Place a straight edge along the back of the vertical stabilizer hinge brackets. The hingeline must remain straight, so hold the straight edge there and double check while clamping the vertical stabilizer front spar to the F-781 attach plate. If the rear spar bends aft at the top when the front spar is clamped, the vertical spar may be mounted on the rear of the F-781 plate. If necessary, you can make a shim to put between the F-781 and the vertical stabilizer spar. If the rear spar bends forward, make a shim to go between the F-781 and the front spar of the vertical stabilizer. Note that the F-781 has a joggle built into it that will offset the front of the vertical stabilizer slightly to the left. Proper offset places the bottom of the leading edge of the vertical stabilizer ¼ inch to the left of the fuselage centerline.

When the vertical stabilizer is properly aligned, drill the front spar to the F-781, using the pre-punched holes as guides.

NOTE that because the stabilizer is offset, the rear spar no longer fits flush against the F-712D angle. Use a single washer, superglued to the forward face of the spar, as a spacer. See View A-A, DWG 27A.

Drill the bottom of the rear spar to the F-712 bulkhead. See DWG 27 for RV-7, see DWG 27A for RV-7A. For now, drill #30.

RV-7A Only: Make the F-712E Tie-down bar shown on DWG 21.

Remove the vertical stabilizer.

RV-7A Only: Drill the tie-down hole in the F-779 skin to 5/8". Mark and drill the rivets that will attach the F-712E tie-down bar to the bulkhead.

Draw centerlines on the aft surface of the F-712E tie-down bar and insert the tiedown into the fuselage. Adjust the

centerlines until they fall in the center of the holes drilled in the bulkhead. Clamp and drill the tie-down bar, using the drilled holes as guides.

Countersink the rear bulkhead and rivet the tie-down bar to the bulkhead.

Re-install the vertical stabilizer and drill the bolt holes to full size.

Temporarily bolt the vertical stabilizer to the horizontal stabilizer and rear bulkhead.

FITTING THE RUDDER

The rudder must swing freely. The gap between the counterbalance arm and the top of the vertical stabilizer should be even. If the rod end bearings were not installed and adjusted during empennage construction, do it now.

Thread the rod end bearings and jam nuts into the rudder spar. Measure from the center of the pivot bolt hole to the forward face of the spar. As a starting point you may use these measurements:

- Top: 51/64"
- Middle 63/64'
- Bottom 1 3/64"

Adjust these measurements as necessary to make the rudder swing without binding.

Make the F-792 L&R rudder stops shown on DWG 27A. Align the drilled hole with the pre-punched hole in the fuselage skin that was left open when the rear fuselage was riveted. Once the stop is clecoed and clamped, the rest of the holes may be drilled in assembly.

Measure the rudder deflection. The proper 35° degree swing is attained when the clearance between the inboard trailing edge of the elevator skin and rudder skin is 1 1/8" when measured perpendicular to the rudder skin with the elevator in the neutral position. File the rudder stops if necessary to achieve this dimension.

Rivet the rudder stops to the fuselage.

Now that the vertical stabilizer, horizontal stabilizer, elevators, and rudder have been installed now is a good time to install the empennage fairing. See drawing 44 for the empennage fairing installation details. See Section 5.18.

FINISHING THE FORWARD FUSELAGE

SOME THINGS TO THINK ABOUT

At this point, the cabin area is open to the sky. Except for the cross bar of the F-705 bulkhead, no permanently installed part crosses the cabin area. Before you begin upper fuselage construction, consider how the interior will be finished. All Van's demonstrator airplanes are simply painted with a high quality semi-gloss paint on the floor and sides. The only upholstered surfaces are the seat cushions. This rather spartan approach may not be for you. If you plan carpets and sidewall upholstery, now is the time to make and store patterns. It will be much easier than crawling around under the canopy and between the rudder pedals.

If you intend to paint the interior, it is still the time. Remove all the removable covers and panels and paint them separately. Mask and paint the interior as desired. Paint adds weight of course, so carefully consider what surfaces will be visible…do the seatbacks need to be painted, for instance, if they are always covered with cushions?

CONSTRUCTING THE CABIN FRAME (TIP-UP CANOPY ONLY)

The cabin frame serves as a join between the movable canopy and fixed windows over the baggage compartment. More importantly, it provides roll-over protection to the occupants. It is built from thick aluminum channels, formed in curves and riveted into a bow. The cabin frame is shown on DWG 39.

Cut the access holes in the aft F-631A channels, using a hole saw or fly-cutter in a drill press.

Make the various mounting angles shown on DWG 39. Remember to make lefts and rights when required!

Make the F-631E Plates.

Carefully study the cross section drawing, Section A-A'. Clamp the two aft F-631 channels (the ones with the big holes) to a flat surface and check both the width and height dimensions. Double check the width by measuring the fuselage…remember to allow for the thickness of the F-631C brackets. The forward edge of the frame assembly, including these brackets, should match the width of the fuselage as shown in View C-C', DWG 40. The butt ends of the channels can separate slightly to achieve the correct width.

Center F-631E on the center joint and drill the plate to the channels.

While the rear channels are clecoed and clamped to the bench, prepare, fit and clamp the lower F-631B inner strap to the lower flange of the channels. Begin drilling from the center and work toward both ends. The strap will try to

rise out of position as it goes around the curve, so check often to see that it is still held firmly against the web of the channel.

Repeat the process with the upper F-631B strap.

Clamp the other pair of F-631 channels to the assembly on the bench and drill the holes through the straps. When the entire bow is clecoed together, drill the second F-631E plate at the joint. Although this will be installed inside the channel, it can be drilled from the outside.

Stand the bow on a table and measure the height at the center as shown on DWG 39, Rear View. File the ends of the bow if necessary.

Disassemble the frame for deburring, and while it is apart, fit and drill the F-732D Angle to the rear half.

Rivet the frame together, including the F-732D angle.

INSTALLING THE CABIN FRAME

Place the cabin frame flat on the table, with the large holes up.

Clamp the F-631C angles to the outside surface of the frame.

Clamp the F-631D angles inside the frame.

Clamp the two sets of angles together and drill the keeper rivet holes, using the holes drilled when F-631D was made as guides. Remove the angles, deburr and rivet them together to form channels with a offset bottoms.

Locate the F-631C/D channels on the fuselage at the F-705 bulkhead as shown in the Side View of DWG 40. Drill and bolt the channels to the fuselage, through F-705F and F-705G. This will leave the aft end of F-631C protruding outside the contour of the fuselage. Trim and file the projecting part of the bracket away as shown in View C-C', DWG 40. The skin must fit smoothly on the outside face of the bracket.

If it isn't already, cleco the F-774 skin and F-788 gusset to the fuselage.

Clamp the cabin frame assembly to the brackets on the fuselage. Cleco the F-732A Channel and F-732F spacer between the frame and the F-706 bulkhead as a brace. Match-drill #30 and cleco through the F-774 skin, F-788 gusset, F-706 bulkhead, F-732F spacer and F-732A channel.

Match-drill #30 through the two tabs on the F-732A into the F-706 Bulkhead. Match-drill the forward end of F-732A to the F-732D angles.

Use the two pre-punched holes in the forward "tongue" of the F-774 skin to locate the forward screw holes that join the F-774 skin, the F-631C bracket and the cabin frame. See Note 1 on DWG 40 for the sequence of drilling these holes. Leave them at #30 for now, so that clecos will hold.

Peel back the skin, cleco the bracket to the frame through the holes you just drilled, then drill the aft screw holes, using the holes in F-631C as guides. In the finished airplane, the forward holes will be visible from the outside, but the skin will hide the aft screws.

Remove the skin and finish drilling the screw and bolt holes at the base of the cabin frame. Tap the frame as shown and temporarily install the screws and bolts attaching the frame to the fuselage. Match-drill #30 through the forward row of holes in the F-732 spacer and through the F-732A channel.

Because it is easier to work on many things in the cabin and fuselage if the rear skins and cabin frame are not in the way, once these components are fitted and ready to install, they may be removed and stored.

INSTALLING THE FRONT DECK (TIP-UP CANOPY ONLY)

The structure between the instrument panel and the firewall, above the main longerons, differs, depending on which canopy has been chosen. Be sure you are reading the directions for the canopy on your airplane.

Details of the upper forward fuselage for the tip-up canopy are shown on DWG 24A.

Begin by making the F-721C, F-743B, F-768C and F-703C angle brackets. Be careful to make left and right pairs when necessary.

Make the F-703B Angle and fit it, along with the F-703C angles, to the F-703 instrument panel. You can either rivet the angles to the panel now, or leave it until later…. the decision may rest on exactly how you plan to cut the holes for the instruments. If you are sending the panel out for custom work, perhaps involving machine or laser cutting, it will probably be better to leave the angle clecoed, so the flat panel is available to the cutting machine.

Assemble the components of the center F-768 subpanel. Locate and drill the hat-section F-697 Channel to the aft face of the F-768A Center Subpanel. Pre-punched holes in the subpanel serve as guides. The upper two rivets on the right hand flange also hold the F-643-1 Forward Fuselage Channel, so fit that as well.

Drill the F-644R&L forward fuselage channel to the flanges of the F-768A.

Drill the F-746 engine cable control bracket to the bottom of the F-768A.

Drill the F-768C seal support to the F-768A. Note that the flange of the seal support is lower than the flange of the

subpanel (see Detail D) to allow for the thickness of the seal.

Prepare and rivet the forward fuselage channel, center sub panel and hat-section together. Note that flush head rivets are used (flush heads outboard) to join the F-644 stub ribs to the F-768A subpanel. Leave the F-746 engine control bracket clecoed for now…you may want to vary the spacing between the clamps holding the engine control cables, and it is much easier to install these nutplates out on the bench. See Note 1, DWG 24A.

Install the platenuts on the aft flange of the F-745-L&R Forward Fuselage Ribs.

Fit and rivet the F-768D Seal Support Angles to the F-768-L&R Outboard Subpanels.

Drill each F-768B outboard subpanel to the appropriate F-745 rib. Note that the two upper rivets are flush, with the flush heads inboard. Dimple the subpanel and rib and rivet them together with the flush rivets only. This will form two rather floppy subassemblies.

Insert the outboard subassemblies into the fuselage, with the notch in F-768 fitting around the longeron. Cleco the outboard subpanels to the forward flange of the F-721A deck and the F-902 bulkhead. Slip the center subassembly between them and cleco the structure together. Cleco the ribs to the firewall.

Fit and drill the F-743B bracket (connecting the F-643-1 to the firewall) to the channel only.

Mark centerlines on the F-643-1 and firewall flange.

Fit and drill the F-771 Forward Top Skin (DWG 28) to the firewall, ribs and subpanel. When the F-643-1 is clecoed to the skin, drill the F-743B angle through the firewall. Also fit the F-721A Forward Canopy Decks to the longerons. These will require some gentle hand twisting to fit well. Cleco them to the subpanels and align them with the longerons. The aft ends must be filed to fit the F-721B canopy decks. When the F-721A is removed for de-burring, bend the flange on the leading edge of the F-721B inboard to rest against the inside of the F-721A. Drill these components together.

Fit and drill the F-721C and F-721D attach angles to the panel and the F-721A deck. Rivet the nutplates to the angles and then remove the panel and install the angles to the deck.

Temporarily screw the instrument panel to the aft flanges of the ribs.

Fit and drill the F-793-L&R Vent Brackets to the fuselage. Fit the SV-2 Adapter and fresh air vent/nozzle of your choice (See Van's Aircraft web store for available fresh air vent options: SV-6 or SV-7).

Depending on which task you intend to do next, you may either leave the structure clecoed in place or remove it. You will probably want to at least "rough-in" avionics and instrument installations before permanently riveting the entire upper forward fuselage assembly.

INSTALLING THE FRONT DECK (SLIDING CANOPY ONLY)

The structure between the instrument panel and the firewall, above the main longerons, differs, depending on which canopy has been chosen. Be sure you are reading the directions for the canopy on your airplane.

Details of the upper forward fuselage for the sliding canopy are shown on DWG 24.

Make the F-7103C-L&R Attach Angles that go on the back of the F-7103 Instrument Panel. See View B-B, DWG 24. Leave the angles clecoed to the panel.

Make the F-7109 Plate, the F-7108B Angle, F-7108C and F-721D Attach Angle.

Drill and rivet the F-7109 plate and F-7108B angle to the F-7108A Center Forward Fuselage Rib.

Drill the F-746 engine control bracket to the F-7105A subpanel, but leave it clecoed for now…you may want to vary the spacing between the clamps holding the engine control cables, and it is much easier to install these nutplates out on the bench. See Note 1, DWG 24.

Twist the F-7105A subpanel and fit the F-7108 rib through the center of it…the guy who designed it swears it is possible. Cleco the rib to the firewall.

Cleco the F-7107-L&R Ribs to the firewall and F-7105. Add the F-7105B Outboard Subpanels and the instrument panel, so the entire structure between the panel and firewall is clecoed in place.

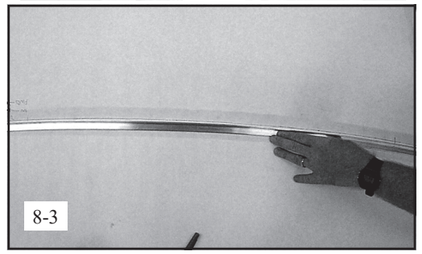
Fit and drill the F-7106 Forward Top Skin to the forward fuselage. Also fit the F-721A Forward Canopy Decks to the longerons. These will require some gently hand twisting to fit well. Cleco them to the subpanels and align them with the longerons. The aft ends must be filed to fit the F-721B canopy decks. When the F-721A is removed for de-burring, bend the flange on the leading edge of the F-721B inboard to rest against the inside of the F-721A. Drill these components together.

Fit and drill the F-721C and F-721D attach angles to the panel and the F-721A deck. Rivet the nutplates to the angles and then remove the panel and install the angles to the deck.

Fit and drill the F-793-L&R Vent Brackets to the fuselage, and, if you have them, fit the SV-2 Adapter and fresh air vent/nozzle. See Van's Aircraft web store for available fresh air vent options: SV-6 or SV-7.


8-1

8-2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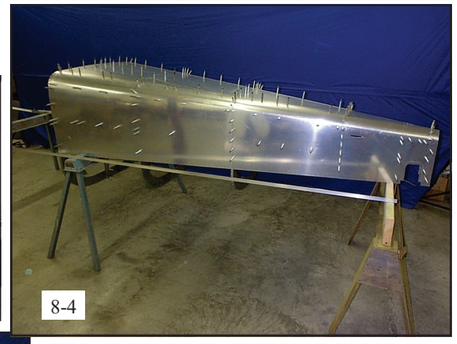
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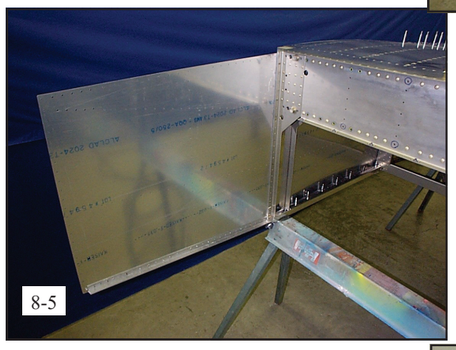
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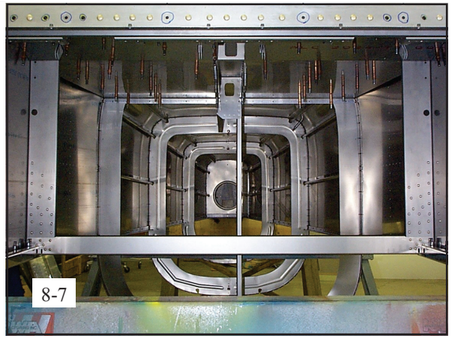
8-6

Fig 8-1. Bending the longeron in a vise.
Fig 8-2. Twisting the longeron.
Fig 8-3. Checking the longeron against the template.
Fig 8-4. The aft fuselage bulkheads and skins riveted together.
Fig 8-5. The forward side skin attached to the forward fuselage.
Fig 8-6. The longerons inserted.
Fig 8-7. Interior of the tailcone with floor ribs clecoed in place.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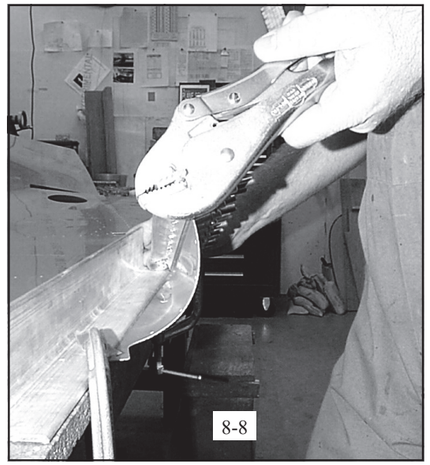
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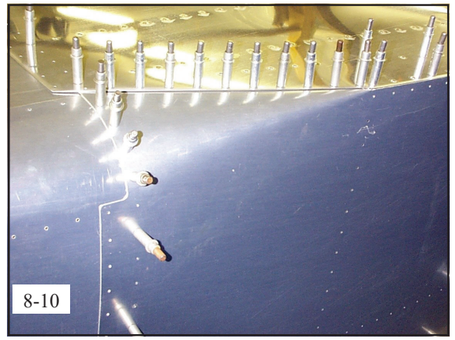
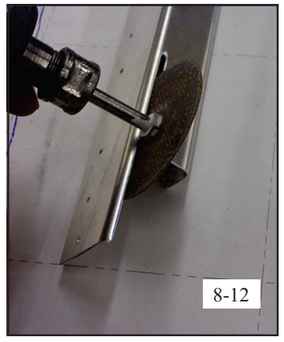

8-10


8-11

Figs 8-8-11: Various stages of the conical bend on the F-970 side skin. The forward end is bent almost to a sharp corner, but be cautious...if you try to do too much it will crack.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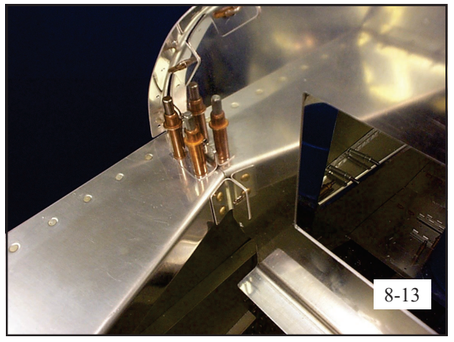
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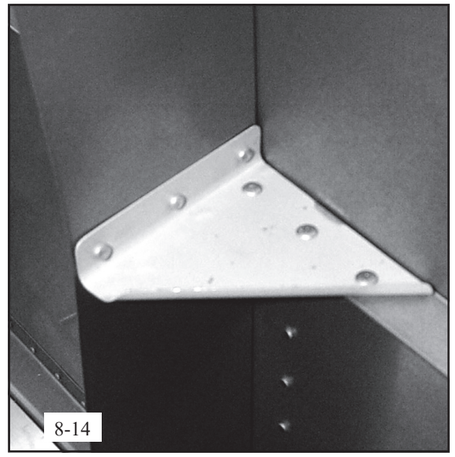
Fig 8-12. Slotting the aft end of the F-721B canopy deck.

Fig 8-13. The forward end of F-721B butted against F-721A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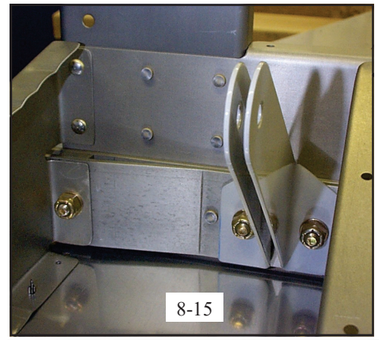
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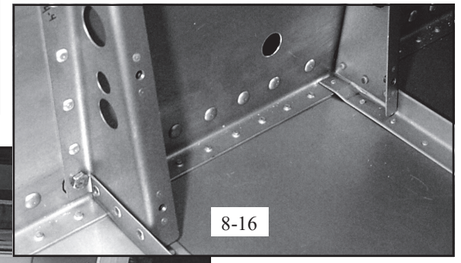
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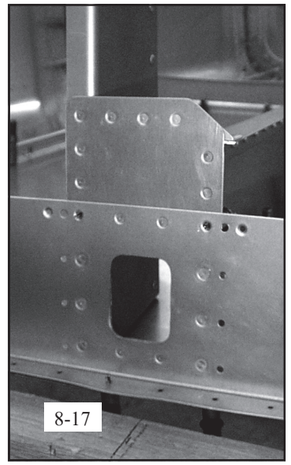
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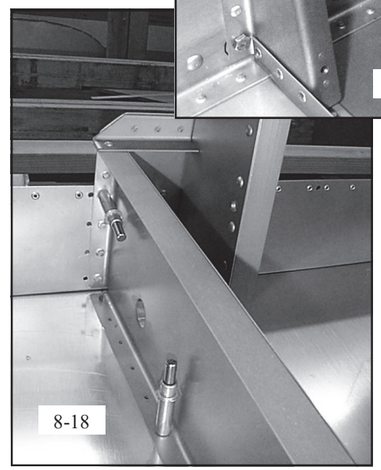
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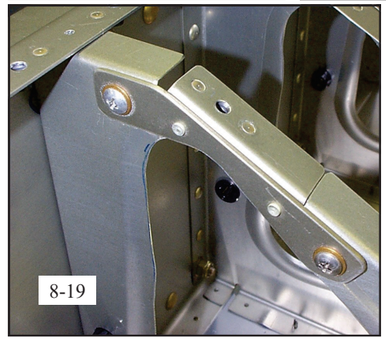

8-19

ES-FA-PA-270-12-5 Flap Linear Actuator Wire Color Codes

Motor + (Extend actuator when +V is applied) 18 ga. - Blue
Motor – (Retract actuator when +V is applied) 18 ga. - Brown
POT Wiper 26 ga. - Red
POT 5VDC 26 ga. - Yellow
POT GND 26 ga. - White

Fig 8-14. The F-656 gusset.
Fig 8-15. The F-634 seat belt anchor.
Fig 8-16. The F-838B cover support rib.
Fig 8-17/18. Details of the F-729/730/705 junction.
Fig 8-19. The modified F-916 floor rib

SECTION 9: FITTING THE CANOPY

OVERVIEW

The RV-7/7A has been designed to accept either a forward hinged, tip-up canopy bubble or a sliding canopy with a fixed windshield. The fuselage structure differs slightly between the two styles. Be sure you are following the directions for the proper canopy.

Fitting the canopy is one of the most demanding construction jobs in building an airplane -- any airplane. The big plexiglass bubble is fragile and difficult to handle. The geometry is not always obvious. The fit must be correct to prevent aggravating air and water leaks.

Take your time and work with patience and persistence.

PLEXIGLASS TIPS

The plexiglass canopy bubble is one of the most expensive and fragile components in the kit. Mis-handling and cracking it is one of the most disappointing, gumption-robbing experiences a homebuilder can have. Here are a few plexiglass tips.

Plexiglass is dramatically less brittle when it is warm. Do not try and work on the canopy in a cold shop. Cutting or drilling Plexiglass in temperatures under 60º F is asking for trouble. Heat the shop to 75-80º -- it may be uncomfortable to you, but your canopy loves it.

Regular twist drills have tips that tend to fracture Plexiglass. Special Plexiglass drills are available from tool suppliers. We have also found that a small Unibit makes excellent holes in warm Plexi. Using a regular twist drill to enlarge a pre-drilled hole is almost guaranteed to crack a canopy.

Do NOT try and use a saw of any kind. You might get away with it once or twice, but eventually you will crack the bubble. Cutting discs, supplied with the kit, do an excellent job when used in a high-speed die grinder. They will also cut fingers without a second thought, so support your work well and use two hands to guide the grinder. Die grinders turn at very high rpm and can throw chips and dust at un-dodgable velocities. Eye, ear, and respiratory protection is essential!

TIP-UP CANOPY INSTALLATION (slider instructions start on page 8)

INSTALLING THE FORWARD FUSELAGE RIBS & CANOPY RELEASE MECHANISM

DRILLING THE CANOPY HINGE BLOCKS TO THE RIBS

Making the canopy fit the fuselage precisely is easier if the canopy frame is fitted before the rotation points are drilled in curved hinges. The rotation points are located on the fuselage first, then transferred to the hinges themselves. To locate the hinge points on the fuselage, the spacers and bearing blocks that will receive the canopy hinges must be fitted and drilled in place.

Make the C-617, C-618, and C-619 spacers as shown on DWG 47.

Temporarily remove the F-644 ribs. Clamp the C-617 block to the F-745 rib with the aft surface of the block flush to the aft edge of the rib and the top surface of the block just low enough to clear the skin when it is installed. Drill two shallow #12 pilot holes into the block using the two pre-punched 3/16” holes in F-745 as a guide. Drill only about 1/16" deep into the block.

Remove the block and finish drilling the holes in a drill press using a #10 drill. (Be sure the drill press table is level and square). UHMW plastic tends to expand when drilling and then shrink back after the drill is removed. A #10 bit will produce a hole that will be a slip fit for an AN3 bolt.

Clamp the C-617 and C-618 blocks together, with the forward and top edges flush. Use the holes in C-617 to drill C -618.

While the two blocks are joined, carefully measure the location of the ¼” hole for the canopy hinge pivot bolt and drill it through both blocks.

Repeat the procedure with the other C-617/C-618 blocks.

Reinstall the C-617 blocks on the F-745 ribs with temporary bolts.

Drill the ¼” holes in the F-745 ribs, using the holes in the C-617 as a guide.

Pull a .251" reamer backwards through the block and rib a few times to get a nice slip fit on the modified AN43B pins.

Drill the upper hole in the C-619 spacer to the measurements shown on DWG 47. Be sure to maintain the bolt hole edge distance because this spacer will be used later as a guide/stop for positioning the canopy frame. Clamp the C -619 spacer to the C-617 block, insert a bolt through the hole and drill the second bolt hole.

The F-644 ribs were drilled but not riveted to the F-768 bulkhead during fuselage construction. Now they must be match drilled to the block assembly. Cleco the F-644 ribs to the F-768 bulkhead. Insert the C-617/618/619 assembly between F-644 and F-745 and slide bolts through the holes until they contact the face of F-644. Clamp the ribs and blocks together, using just enough pressure to hold the clamp in place.

Cleco the F-771 front top skin in place to maintain the proper position of the F-644 ribs. Do not cleco the portion of skin that is outboard of the F-745 ribs so the skin may be lifted to provide access for drilling.

If the holes in F-771 skin and F-644 ribs don’t align, insert thin aluminum shims between the inboard face of C-617 and F-644 until they do. When the assembly comes apart later, you can make a full size shim of the correct thickness.

When the F-771 is clecoed to the F-644 rib, tighten the clamp. Peel up the outboard portion of the skin, remove one bolt from the assembly and drill F-644 through the hole. Reinsert the bolt, all the way through F-644 this time, and continue until all the holes are drilled.

INSTALLING THE CANOPY RELEASE

Make the C-620 bearing block shown on DWG 47. Drill the bolt holes to the dimensions shown.

Fabricate and/or install the canopy release mechanism components C-620, C-621, C-622, Wd-618, Wd-619, Wd-620, and the modified AN43B-16 bolts. See DWG 47. The entire pushrod/bellcrank assembly can be pre-assembled on the bench, with all its clevis pins, thin washers, and cotter pins. This will allow you to install it in one piece without having to lie on your back installing cotter pins, etc. Experiment with installing the assembly with the top skin removed so it will be familiar when it is time to install it after the skin is riveted on.

When drilling the Wd-618 to the Wd-619 be sure the arm on the Wd-619 is “clocked” to the correct position (with the ears on the Wd-619 pointed outboard) and that the elevation is correct. It must center vertically as it swings through the pre-punched cutout in the F-768 bulkhead.

Fit the mechanism to the forward fuselage and align the C-620 bearing block on the F-697 channel. The horizontal position is determined by the side-to-side pushrods. The vertical position is determined by the fore-and-aft pushrod. Clamp the block to the channel and work the mechanism. Adjust the block position if necessary to align the pushrods and eliminate any binding. When the block position is correct, drill the C-620 to the F-697 using the holes pre-drilled in the block as guides.

Note: If you intend to have in-flight canopy jettison capability you must notch a portion of the F-771 skin above each hinge slot to allow the canopy frame to be pushed up and away from the fuselage. See DWG 28, Detail F. These notches can then be covered with a sacrificial cover plate bonded in place lightly enough that it will not exceed your (probably adrenaline-enhanced) ability to break the bond should you ever have to push it open.

RIVETING THE UPPER FORWARD FUSELAGE

Once the above work is completed the upper forward fuselage structure can be riveted at any time, though we recommend that you delay it as long as possible. This will provide much better access to the cockpit area for all of the systems installation, wiring, instrument panel work, etc.

When you are ready to assemble the forward fuselage structure, first rivet the F-768C seal strips to the F-768A and F-768B sub-panel (leave open any rivet holes that share other parts). Rivet the plate nuts to the F-697 and then rivet the F-697 and the F-643-1 to the F-768A.

Rivet the F-745 ribs to each F-768B sub-panel (only at the 2 top holes requiring AN426 rivets). An F-768B with its associated F-745 rib (your choice, left or right) can now be riveted to the F-768A. Now before riveting the other F-768B you must fit the whole assembly into the fuselage and cleco it in place. See DWG 24A. You can now finish all of the other riveting in any order you choose, though it is easier to rivet the F-721C & D attach angles to the F-721A before it is riveted to the fuselage. If you are using the optional map box kit, now is a good time to complete the installation.

INSTALLING THE PRIMARY CANOPY LATCH

INSTALLING THE SIDE HANDLE

Use the Tip-Up Canopy Latch Hole Pattern template on DWG 48, Detail D to locate and drill holes in the forward side skin for the latch handle. Use a small file to slot between the holes…this will be visible, so work carefully.

Use a straight edge and check the C-607 Latch Handle for straightness. The 1/8” thick material often distorts slightly in the punching process. Clamp it in a vise and lightly tap in the appropriate locations to get it as straight as possible.

File/deburr the edges of C-607 and C-609. Finish the interior of the hooks with a small jeweler’s file.

Fabricate the lower C-712 angle as shown on DWG 48. Use particular care to accurately locate the two 3/16" diameter holes in C-712.

Temporarily bolt C-607 and C-609 to the lower C-712 angle. The aft outboard portion of C-607 has two straight, parallel edges offset .032 from each other. C-607 should mate to the lower C-712 so one of the edges is flush with the outboard face of C-712 and the other edge is protruding by .032. C-609 should mate to the C-712 angle so it rotates enough to disengage before interfering with the forward surface of C-607.

Fabricate the upper C-712 angle. Clamp the angles together and ensure that the outer faces of the two angles are flush before drilling the 3/16" diameter holes.

Temporarily bolt the C-607 and C-609 between the two C-712 angles. We use UHMW tape applied to the upper/lower faces of the C-712 angles to prevent C-607 & C-609 from scraping the angles as they rotate. Use an .016 spacer and a piece of heavy paper (to allow for the of UHMW tape) between the inside faces of angles and C-607 and C-609. This will provide some clearance and prevent binding.

Position and drill the C-712/C-607/C-609 sub-assembly to the forward side skin. Use the C-607 to align the sub-assembly with the slots in the skin.

Machine countersink the C-712 rivet holes, dimple the forward fuselage skin and rivet the angles to the skin.

Follow the instructions supplied with the VA-104 knob and install it on the C-607.

Bolt the C-607 to the C-712 angles. Drill a hole in C-609 and in the main spar bulkhead for C-616 wire core.

Install the C-607/C-609 latch handle, then insert the C-616 wire core into the C-615 spring and hook it into the holes on the fuselage and latch.

INSTALLING THE AFT CANOPY LATCH

The Wd-617 Canopy Latch spans the cockpit behind the seats and operates canopy latch fingers on each side of the canopy frame. It is shown on DWGs 48 and 49.

Bend the latch hooks (if necessary) until they fit through the oval holes in the F-705 bulkhead.

Mark lines on each C-611 block for the vertical position of the bolt holes. Fit a C-611 block to each end of the Wd-617 and install it into the fuselage. Fit the hooks in the F-705 oval holes and clamp the blocks in position so that the bolt position lines are visible through the pre-punched holes in F-705 (see DWG 20).

Using the holes in the bulkhead as guides, drill holes in the C-611 blocks about 1/16" deep with a #30 drill to mark its location. Remove the blocks and finish drilling the holes in a drill press. Then enlarge the holes in the blocks with a #10 drill bit. Enlarge the bolt holes in the F-705 bulkhead with a #12 drill. Bolt the Wd-617 and the two C-611 blocks into the fuselage.

Install the two VS-411 brackets to the F-705 bulkhead.

Install the C-605 and the two C-606 links. The links will require a slight twist and small bends on the ends to make them align with the angular difference between the arm on the Wd-617 and the C-605.

This all sounds complicated but it should be readily apparent when you begin bolting the parts together.

Finally make the C-710 push rod assembly as shown in DWG 48. Drill the ends of the tube with a #3 drill and tap them with 1/4 - 28 threads at each end to accept the rod ends.

FITTING THE CANOPY FRAME TO THE FUSELAGE

PREPARING THE FRAME AND FITTING THE CANOPY SKIN

If the instrument panel and avionics are installed, remove them for safekeeping while the frame is fitted.

Install the C-617, C-618, & C-619 blocks.

Draw a black pen center line on the aft tube of the Wd-716 fwd canopy frame weldment.

Use a ¼" to ½"wide strip of UHMW tape (not in the kit, available from Van's catalog) along the inner surface of the forward edge of the C-702 skin to prevent it and the F-768 sub-panel flanges from rubbing on each other when opening and closing. The tape should be attached flush with the forward edge of the skin before beginning the installation process.

When the forward ribs of the Wd-716 canopy frame assembly are manufactured, the flanges do not form to the necessary 90 degrees. Use a file or belt sander to remove some material on the aft edge of the upper flange so it is 90º when checked with a square. Only the portion from the center to about 3" outboard of each hinge bracket should be modified. Outboard of that, the fuselage widens and the flange should be a little under-bent.

Cleco the C-702 forward top skin to the Wd-716 fwd canopy frame weldment. Verify that you can see the pen line on the Wd-716 aft tube through the aft row of holes, then begin drilling and clecoing from the center out to each side with a #40 bit (they will be opened up to #30 later on).

Double check that there are no bumps around the notches in the F-768A or F-768B flanges that would prevent the skin from smoothly laying down. File as necessary to make the skin fit smoothly.

Fit the forward canopy frame/canopy skin assembly on the fuselage (you might want to protect the fuselage side rails with paper/tape from now on if they are already painted) and check the fit. The frame width at the aft tube may need to be adjusted slightly to match the fuselage width. This can be done by adding more curve to the aft tube at the ends (bend it around something round) or straightening them slightly (push it against a table top).

Tape the canopy frame/canopy skin assembly back on the fuselage, pulling it down tight on the fuselage. Butt the forward edge of the C-702 canopy skin up to the aft edge of the F-771 forward fuselage top skin. Then slide the canopy skin slightly aft and slip some .020 or .032 spacers between the skins. When the canopy frame is in the correct position, the two skin edges will have a slight gap across the full width of the fuselage.

Pre-drill the hole pattern into the C-614 center splice plate using #40 holes. See DWG 47. Fit C-614 to the Wd-716 canopy frame and drill the holes to the two frame ribs (only use a # 40 bit at this time to allow for slight adjustments later if required).

Drill two rows of #40 holes through Wd-716 that run aft from each hinge point using the pre-punched holes in the C-702 skin as a guide.

Remove all chips from between canopy skin and canopy frame and re-cleco.

Now drill #30 through the pre-punched holes in the tabs on each hinge bracket into the fwd canopy frame ribs. Remove the frame. Remove the skin.

Deburr all holes. Re-cleco the skin to the frame and put it back on the fuselage.

Retape with duct tape to pull everything back down tight.

Double check that you are happy with the fit and if so drill the holes in the C-614 splice plate to #30.

Disassemble deburr and rivet the 1/8" rivets in the frame splice plate and hinge angles. Note that some of the rivets are AN426 flush on the fwd side. See DWG 47, View D-D.

Re-cleco the canopy skin to the frame and fit the frame back to the fuselage.

DRILLING THE HINGE BRACKETS

Be sure you have installed the second of two AN3 bolts through F-745, C-617, C-618, C-619, and F-644 after riveting on the F-771 skin. Use a ¼" drill bit in an angle drill to back drill through the C-617 block and into the Wd-716 hinge brackets to mark the hinge pin location. You do not have to drill all the way through the Wd-716 hinge brackets. Drill just deep enough to make the full diameter of the drill bit. Remove the frame from the fuselage and finish drilling the ¼" holes all the way through the brackets as straight as you can.

With the hole finished to 1/4 " enlarge it for the bushing. This is most accurately done by carefully drilling the hole to 23/64" and then reaming to .375 with a straight reamer. A sharp new 3/8 drill bit can also be used to take the hole to final size if a reamer isn't available. Deburr the holes and then press in the bushings using flush set in a rivet squeezer.

Reinstall the previously made release mechanism in the fuselage.

Attach the Wd-620 handle temporarily to make it easier to engage the pins when installing and removing the frame the 100 or so times you will do it while fitting the canopy.

FITTING THE CANOPY FRAME TO THE FUSELAGE AND CABIN FRAME

Reinstall the canopy frame on the fuselage (without the canopy skin clecoed on) and engage the release pins.

The canopy installation is designed with a very tight clearance between the Wd-716 frame and the F-768C seal support angle. See DWG 24A. Trim the seal support angle just enough to allow the frame to pivot without scraping.

Cleco the C-702 canopy skin to the Wd-716 canopy frame using clecos in all the holes.

Make four spacers 7/8" thick and four 1/8" thick. They can be made of what ever material you like (we used aluminum bar for the thin ones and blocks of wood cut on the band saw for the thick ones) but they should be accurate for thickness. The 1/8" spacers should be approx. 1" X 2", and the 7/8" spacers should be approx. 2" X 4". The 1/8" spacers will be used under the Wd-725 canopy side rails, and the 7/8" spacers will be used between the F-631A ribs and the F-631 roll bar.

The F-631A ribs must have the flange angles re-adjusted to about 92.5 degrees (as formed they are only about 88 degrees) and then fluted to make them straight. Adjust the flute spacing to allow for the eventual screw pattern that will attach the canopy.

Fit and drill the C-704 splice plate (DWG 49) to one (for now) of the F-631As. Later the splice plate will be clecoed to the front of the frame to locate the holes in the other half.

Lay the Wd-725 canopy side rails in place on the fuselage to check the fit. The goal is to have the curve of Wd-725

exactly match the longitudinal curve of the fuselage and align vertically with the fuselage side when checked with a straight edge. As supplied, the curve is usually very close along the bottom but more curve will probably be required along the joggle at the top. This is improved by lightly bending the rail across any heavy round object.

The fwd ends of the Wd-725 canopy side rails may need to be adjusted/modified where they mate to the Wd-716. Squeeze the upper bend with flush sets in a rivet squeezer and then finish the adjustment with a hand seamer. The goal is to get a smooth transition from the Wd-725, rolling inboard to the Wd-716.

Lay out and pre-drill the rivet pattern in the C-613 splice plates using a #40 drill. See DWG 48.

Layout and pre-drill the rivet pattern in the angle bracket welded to the aft end of each Wd-725, using a #40 drill.

Tape the 7/8" spacers to the aft side of the F-631A ribs. Clamp the ribs to the forward side of the F-631 cabin frame.

Clamp each Wd-725 to the fuselage sides using the 1/8" spacers between the bottom of Wd-725 and the F-721 aft canopy deck. The aft surface of Wd-725 mates to the forward surface of the F-631A ribs. Use a piece of .032 scrap to simulate the C-603 canopy skirt thickness. The correct position of the Wd-725 is with the C-603 skin flush with the side of the fuselage (see DWG 48, Sect B-B and C-C). Drill the welded angle to the F-631A ribs.

Clamp the C-613 splice plates to the Wd-716 and the Wd-725 with the bottom flanges of Wd-716 and Wd-725 aligned (see DWG 48.) The lower flange on the C-613 nests tightly to the lower flange of the Wd-725. The forward portion of the flange that angles away from the Wd-716 will be later filled with a wedge shaped spacer.

FINISHING THE FRAME

When you are happy with the alignment of the frame sides to the fuselage, drill the holes from the C-613 through the Wd-725 and the Wd-716. Do not drill the two holes through the Wd-725 upper flange and Wd-716 aft tab at this time. Drill the holes only through Wd-725/Wd-716 and C-613. While drilling, be sure to peel back the C-702 skin slightly where it overlaps the splice plate holes so you don't drill into it.

Remove the C-613s and Wd-725s from the Wd-716 and remove the Wd-716 from the fuselage.

Un-cleco the C-702 skin from Wd-716.

Re-cleco the C-613's to the Wd-725's and the Wd-716.

Make the C-723 spacer wedges. See DWG 48.

Clamp a piece of scrap angle along the bottom edge of the side of the frame to make sure it is straight and then drill the 2 holes through the Wd-716, C-613, and the C-723 wedge.

Disassemble, deburr, and machine countersink for the AN426 rivets.

Re-cleco and reclamp with the angle to be sure it is straight, and rivet the canopy frame together, except at the joint of the F-631As. This will be final drilled and riveted a little later.

Reinstall the frame on the fuselage and cleco on the C-702 skin.

FITTING THE PLEXIGLASS CANOPY

It is now time to start cutting the canopy. Put away the prayer beads…this isn't as bad as you may have feared.

Keep the vinyl plastic on the canopy for as long as possible to protect it from any accumulation of dirt and grit that can cause scratches during installation. It is very difficult to remove this without causing scratches. If you get to a point where you have to remove the vinyl, replace it with some stretch-on plastic wrap from the kitchen. This will help keep it protected until the airplane is ready to fly.

Before doing any cutting, mark a centerline on the vinyl down the middle of the canopy from front to back. This will aid in aligning to the fuselage and keeping the two parts aligned with each other once the canopy is cut.

The initial trim removes just the excess flange around the front, and the clamping areas along the sides and the back. Use this cutting on unused portions of the canopy as an opportunity to practice making clean straight lines. Go ahead and mark lines with a straight edge and practice following them as well as you can.

Before the canopy is moved/handled you must finish on the edges at least to the point of removing any nicks and rounding the sharp edges. These are all stress risers that can be the origin of a crack.

Put some masking tape on the roll bar and the F-631 rib flanges to prevent scratching the canopy. Mark a center line around the circumference of the cabin frame. This will be the eventual split line between the front and back portions of the canopy.

Set the canopy in place on the fuselage to check the fit. The canopy will eventually go behind the "ears" on the C-702 skin but for now, put some tape on the ears to prevent scratching and let them rest inside the canopy.

You now should be able to see what the frame shape has to be at the fwd end of the Wd-725 side rails where they intersect the Wd-716. The joggled flange on the Wd-725 and the tab on the Wd-716 need to begin rolling inboard to allow for the shape of the canopy at this point. Remove the canopy and adjust as necessary, then refit the canopy.

The initial trimming should work towards a flush fit of the windscreen portion at the front to the C-702 skin. WHEN CHECKING THE FIT OF THE CANOPY TO THE FRAME, THE CANOPY MUST BE (AS MUCH AS POSSIBLE) CLAMPED/HELD WHERE IT WILL BE IN WHEN IT IS FINALLY SCREWED ON TO THE FRAME.

Pull the canopy sides in to the frame when checking the overall fit. The goal is to get the canopy to fit nicely to the C-702 skin while it is pulled in to the Wd-725 side channels, is touching around the sides of the roll bar, and contacts the F-632A approx. 1.5 " forward of the F-606 bulkhead. In final position the base of the windscreen will be approximately 1.75" aft of the forward edge of C-702.

Do not attempt to do any trimming to final size, other than around the base of the windscreen, until after you have split it the canopy at the roll bar. The molded shape of the canopy results in a slight duck tail upturn at the very back (trimmed off later) and a curve in the top where it goes over the roll bar. This will prevent it from laying down flush on the top of the cabin frame and canopy frame until it is separated into two pieces.

When you have gotten the fit to be somewhat close (it doesn't need to be perfect: it actually becomes much easier to deal with once the canopy is split) it is time to mark the split line. The split point goes right down the middle of the F-631 roll bar. Don't forget to pull the canopy in tight on the sides when marking the line.

At this time you should also temporarily cleco on the F-774 aft top skin and mark the window cutout on the canopy. Immediately mark "do not cut at this line". The line is useful for repositioning the canopy, but you must remember to leave an extra flange for attaching the window to the skin. Mark a line about 1.25" outside of the "do not cut" line for doing a rough cut to final size.

Remove the canopy from the fuselage. Attach (nail, screw, etc.) blocks to the table top or edges to hold the canopy and keep it from spreading as it rests on the table. By restraining its sides in this manner will hold its shape and you can be work on it safely.

It is a very good idea to have a helper with this step to help manage the progressively floppier canopy.

Cut the canopy into the front and back pieces. You may begin cutting at any point comfortable for you. However, if the cut begins on the bottom edge, we suggest that before the cut progresses more than a foot, the edge be taped or clamped back together in order to hold the shape as well as possible while continuing the cut. Similarly, the top center should either be the last portion cut, or should be taped together before completing the side cuts. The object here is to prevent the rear of the canopy from sagging down and damaging the last part of the cut. Finish these edges before moving/handling the pieces.

Put the fwd portion back on the fuselage and mark for the final trimming. Because it is more flexible now it should lay down flush all around the roll bar. It will probably not match up exactly to the center split line on the roll bar but don't worry, this will be taken care of with a little bit of final trim adjustment. You can also double-check the fit once more at the fwd end of the Wd-725. Remove the canopy, make any other adjustments necessary, then drill and rivet the tabs on the Wd-716 to the Wd-725s.

DRILLING THE CANOPY TO THE CANOPY FRAME

Reinstall the canopy on the frame.

With the canopy at its final position, lightly clamp it to the roll bar. Now unclamp the F-631 frame ribs and move them so that they make contact with the interior of the canopy and then re-clamp them to the roll bar.

Using a helper, carefully remove the canopy so as not to disturb the position of the F-631 ribs.

Carefully drill the remaining holes through the F-631 rib and the C-704 splice plate.

With everything clecoed, refit the canopy, tape it with duct tape at the front, clamp or tape it to the roll bar at the back. Mark the final trim along the Wd-725 joggle, and note any small adjustments that you want to make where the base of the windscreen mates with the C-702 skin.

Remove the canopy and do the final trim along the sides and front. Once again, finish the edges before handling or moving.

Locate and mark all the screw hole locations on the canopy frame. When drilling the canopy you can pre-drill all of the holes in the frame #40 and then drill through the canopy to them with a plexi bit. The canopy is transparent of course, and it is relatively easy to hit the holes already in the frame. Alternatively, you can drill the hole in the canopy (using a special 1/8" plexiglass bit) until the tip of the bit makes a mark on the frame. The holes in the frame will be drilled with a regular bit when the plexiglass is removed.

Either way, it is very important that you have the canopy pulled down tight when you drill the first few holes, at least on the side you are drilling. These holes will "lock in" the canopy position, so you must have the canopy in the correct position.

With the canopy taped at the front and clamped or taped at the back, begin by drilling 3 or 4 holes at the top center of the F-631 rib bow to help lock-in the position. Now with a helper pulling the canopy tight on one entire side drill some holes 6 - 8 " apart around the rear bow and the sides to lock it down. Do the same on the other side. Finish drilling all remaining holes.

Mark the aft edge of the canopy for final trimming to match the split line on the roll bar. Remove the canopy and

frame as an assembly from the fuselage.

Do the final trimming on the back edge of the canopy. Note: more may be required later to provide clearance from the aft portion, and to allow for it to swing opened and closed.

FITTING THE REAR WINDOW

Trim the aft canopy window portion to the line previously marked and finish the edge.

Mark all of the screw holes on the aft top skin and the roll bar. Be sure that you make the screw pattern fit within the rivet pattern already in the roll bar.

The aft window should be now put in place and positioned so that it reaches the split line on the roll bar (be sure that you are pushing it fully tight to the aft top skin (remember the shape change). You will probably have excess on the roll bar over the top but that will be trimmed/adjusted later.

Lightly clamp the window to the cabin frame. Make sure that it is pushed tightly to the inside of the aft top skin.

Begin drilling at the top middle of the aft top skin and the top middle of the roll bar. Alternating back and forth, clecoing as you go to pull the window tight to the roll bar and skin as you work your way down.

Repeat on the other side.

Mark the window along the split line on the roll bar for final trimming.

Remove the window, trim the forward edge along the split line, and finish the edge.

The holes in the roll bar should be enlarged with a #35 drill and tapped for a 6-32 screw.

Remove the aft top skin. Lay it flat on some scrap .025 material and trace the window shape to cutout the backing strip for the screws.

The window screw holes in the aft top skin should be enlarged with a #27 drill and dimpled for a #6 screw.

Because of the expansion rate of plexiglass, it is good practice to make fastener holes in plexiglass canopy slightly larger than the diameter of the fasteners themselves. Remove the canopy from the frame and machine countersink all the holes for either #6 screw heads or a #6 dimple (Use a piece of .032 or .025 aluminum, as appropriate, dimpled for 6-32 screw to test the fit.) Check the drawing and mark the holes for the correct countersinking depth before you start cutting. After countersinking, enlarge all the holes in the plexi with a 5/32" plexi drill or the 5/32" step on a Unibit. Countersinking before enlarging the holes permits you to use a standard countersinking bit with a #30 pilot. Immediately debur all holes to prevent cracks.

Enlarge all screw holes in the frame with a #27 drill and then debur.

All holes in the aft window that screw to the roll bar should be machine countersunk for a 6-32 screw head, then enlarged as described for the canopy. All holes in the aft window that match with holes in the aft top skin should be machine countersunk, using piece of .025 dimpled for 6-32 screw to test the fit, then enlarged.

FITTING THE SIDE SKIRTS

It is time to fit and drill the C-603 canopy side skirts. Replace the frame on the fuselage, tape it down and attach the canopy bubble with three screws evenly spaced along each side of the frame. The screws are installed through the canopy bubble and Wd-725 only. This allows the final canopy bubble and frame shape to be held without clecos interfering with the side skirts.

The bottom edge of the C-603 side skirts butts to the top of the fuselage side skin and the top edge is trimmed even with the top edge of Wd-725. The front edge butts up to the aft edge of the C-702 canopy skin, and the aft edge fits to the forward edge of F-774 with an approximately 1/16" gap.

Lay out the hole pattern for the AN426AD3 rivets that attach C-603 and Wd-725. Drill and cleco C-603 to the canopy frame. Remove the canopy and frame from the fuselage, and back-drill the row of screw holes through the canopy frame, canopy, and into the C-603 side skirt. See DWG 48, Section C-C.

Remove the C-603 side skirts, remove the screws holding the canopy to the frame, remove the canopy, and remove the C-702 canopy skin.

Debur, dimple/machine countersink all holes, and rivet the skins to the frame. Now is a good time to paint the canopy frame with whatever interior finish paint you have chosen.

Place the canopy bubble on the frame assembly and install all screws, washers, and nuts.

FITTING THE LATCH FINGERS AND SAFETY LATCH TO THE FRAME

Now that the canopy has been fitted and attached to the canopy frame, it is time to complete the canopy latch mechanism by attaching the Wd-622 canopy lugs to the bottom of the aft surface of the frame.

Re-install the canopy/frame assembly on the fuselage.

You will need to work from inside the cabin. Clamp the Wd-622 canopy lug to the aft end of the canopy frame as

shown in DWG 48, View D-D. Lower the canopy and engage the lug with the latch fingers by moving the canopy latch mechanism to the closed and latched position. The lug is held in position inside the "hook" portion of Wd-617 from the bottom. Mart its position using the holes that pre-drilled in the aft ends of the Wd-725 canopy side rails. The Wd-622 canopy lugs should be clecoed to the frame initially using #30 holes, and the canopy latch functionality checked before enlarging the holes to 3/16 and installing bolts, washers, and nuts. The Wd-622 lug placement can be "cheated" up when the holes are enlarged if the canopy did not latch as tightly as desired. The "hooks" of the Wd -617 can be deepened slightly, or the lugs can be "cheated" down if the canopy latches too tightly. You should be able to feel the latch engage the lug when you work the latch handle, but you should not have to force the handle closed.

The Wd-621 Aft Canopy Handle is installed next. Insert the shaft of the canopy handle into mount block C-608. Position the handle/block assembly on the forward face of the C-631A frame as shown in DWG 49, View A-A. Mark, drill, and countersink the four holes as shown. Bolt the block to frame C-631A with AN509 flush head bolts. Install the 3/8" washer and cotter pin to hold the handle in the block.

The canopy handle serves several purposes. The primary one is as a convenient handle for raising and lowering the canopy. It also functions as a safety hold-down latch, and to hold the canopy partially open in a "Taxi" position. To function as a safety latch, the handle is turned fore and aft as shown on DWG 48. If the pilot forgets to latch the canopy before take-off, this handle will restrain the canopy from lifting open, at least at low flying speeds. When the canopy is opened about 3 1/2 inches, and the handle rotated fore-and-aft with the tip end aft, this tip will rest on top of the F-631 cabin frame, thus holding the canopy slightly open and providing cabin ventilation while taxiing.

INSTALLING THE SLIDING CANOPY

After the empennage, the sliding canopy probably raises more questions than any other installation. Fitting a structure of welded steel spaghetti to a hand-built fuselage is an exercise in patience and perseverance. Given the inevitable variations between individual frames, roll-bars and fuselages, it is not possible to give dimensions that will work every time. Instead, we caution builders to slow down and work carefully from "first principles." The amount of effort and time you spend on preliminary positioning and alignment, adjusting both the canopy frame and the canopy skirts, makes a big difference to the quality of the final fit of the canopy.

The RV-6/6A Sliding Canopy Assembly consists of two main components; the Windscreen/roll bar assembly which is fixed to the fuselage, and the Sliding Canopy Frame/Plexiglass canopy which moves fore and aft.

The windshield frame also serves as an overturn structure or "roll bar". It consists of a formed steel tube weldment with a flanged base which is bolted to the fuselage upper longerons and cockpit rails. The roll bar also includes a center brace which attaches to the upper forward fuselage. The windscreen is screwed to the roll bar and bonded to the top fuselage skin with an epoxy/fiberglass base molding.

The sliding canopy frame of is made of welded steel tubing and moves on nylon rollers and slide blocks. The canopy is trimmed and attached to the steel tube frame with blind rivets and machine screws. Aluminum skirts are used to fair the bottom and rear of the canopy to the fuselage.

The canopy has three contact points with the fuselage; two rollers at the lower forward corners of the canopy frame, and one slider block at the rear top of the canopy frame. The rollers move in extruded aluminum tracks and the rear slider block moves on a builder-fabricated guide track.

The sliding canopy is held closed with an over-center spring-loaded hook latch operated by an internal/external handle. This handle is also used for sliding the canopy open or closed. There are two pins at the rear base of the canopy just aft of the canopy tracks which engage nylon blocks mounted on the fuselage. The front of the sliding canopy is held down by a molded fiberglass lip on the windscreen. The pins and lip serve as passive hold-downs, so operating the sliding canopy requires just one latch and one hand.

INSTALLING THE ROLL BAR

Lay out and drill #40 pilot holes for the 3/16" and ¼" bolts through the F-721B Aft Canopy Decks shown on DWG 42, Detail A. Drill the aft pilot hole through both the upper surface of F-721B and the lower flange of F-721B.

The C-668 spacers are needed to provide a flat surface for the nuts and bolts that attach the roll bar to the longerons. See DWG 42, Section D-D. Modify the C-668 spacers provided in the kit as shown on DWG 42, C-668 Detail Views. When done, you should have a forward left, forward right, aft left, and aft right spacer. Mark centerlines on the upper surface of each spacer. Hold the spacers, one at a time, in place against the bottom surface of F-721B and nested tightly against the inboard edge of the longeron with the fastener centerline mark visible through the #40 pilot holes drilled earlier. Drill #40 through the pilot holes just enough (about 3/32" deep) to make a good center point for finish drilling the holes through the spacers off of the fuselage. Remove the spacers. Use a drill press to drill the #40 holes all the way through the spacers. Then finish-drill the holes to final size. Make sure you put the correct size hole in the correct spacer! #12 for the forward two spacers, ¼" for the aft two spacers.

Place the Wd-641 Roll Bar on the fuselage in the position shown on DWG 42, View C-C. The roll bar should have 7/32" gap between the fuselage sides and the outer edges of the bar. If the gap is within 1/16" of desired, you can push or pull it into position, otherwise you should bend it slightly to make it fit within 1/16". It can be adjusted quite

easily by hooking one end behind something and pulling (to make it wider) or by putting one end on the floor and leaning on the other (to make it narrower). Go sloooowly. It is easy to do too much.

Once you have the width close, clamp the roll bar in the proper position of the fuselage (vise grips work well) and using a #40 bit, back-drill the 4 bolt holes up from the bottom using the pre-drilled pilot holes in F-721B as guides. The aft two holes are back-drilled using the holes in the F-721B flanges as well as the holes through the upper surfaces.

Remove the roll bar. Drill the holes up to final size in both the roll bar and in the aft canopy decks. Remember, #12 for the forward holes, ¼" for the aft holes. Use a unibit for the F-721B holes to keep the holes from wandering. De-burr all holes.

Install bolts/nuts/washers to hold the roll bar in place for further fitting. With the nuts tightened, double-check that the roll bar is square to the fuselage longerons. See DWG 42, View C-C. Use shims if/as required.

Insert the forward end of the Wd-643-SS Roll Bar Brace through the pre-punched slot in the F-7106 forward top skin. The tab of the roll bar brace fits between the F-7108A Rib and the F-7108B Angle. Carefully use a screwdriver to pry the rib and angle apart when inserting the tab. See DWG 24.

Trim the upper/aft end of Wd-643-SS as required to mate with the receptacle in Wd-641. Clamp the tube in place and drill a 1/4" hole through its upper end joining the roll bar. See DWG 43, Detail B. Using the pre-punched holes in the F-7108 rib as guides, drill two 3/16" holes through the plate in the Wd-643-SS lower end. Remove Wd-643-SS, de-burr holes, and trim the bottom of the roll bar brace to leave 3/8" edge distance. See DWG 42, View E-E. Install bolts/nuts/washers to hold the roll bar brace in place for further fitting.

FITTING THE SLIDER FRAME

Assemble the Wd-644/C-658 roller assemblies (see DWG 41, Detail A) and insert them into the tubes of the Wd-640 Canopy Frame. Light clamping pressure with a small C-clamp will hold them in -- do not drill them to the frame until all canopy fitting adjustment have been made.

Cut the C-657 Canopy Tracks to length as shown on DWG 41. Lay-out and pre-drill screw holes using a #40 bit. See DWG 42, Sliding Canopy Top View for screw hole spacing. Clamp the C-657 canopy tracks onto the F-721B Aft Canopy Decks.

Drill the hole through C-661 per DWG 43, C-661 Detail View. Position the C-661 rear slider block under the receptacle on the rear center of the canopy frame weldment. Drill through C-661 and the canopy frame and insert the bolt. See DWG 43, Detail J. Remove C-661 and de-burr holes.

Check the shape of the C-763 Slide Spacer against the full-scale template on DWG 41. The part supplied in your kit may vary slightly, so carefully adjust your C-763 to match the template. Complete the rear slider track assembly by positioning, drilling, and riveting the C-762 and C-763 parts together per DWG 43, Section H-H. Make sure that you are not changing the shape of C-763 as you are attaching C-762 to it. Lay the track assembly in place approximately centered on the rear fuselage top skin. Bend the tab in the F-7112 skin down to allow the track assembly to rest on the skin. See DWG 43, Detail J. Slide the C-661 block onto the track. For the time being, hold the track in place on the fuselage with duct tape.

Install the Wd-640 Canopy frame on the fuselage by inserting the rollers in the tracks through their open aft ends and inserting the bolt through the C-661. Slide the frame forward until it meets the roll bar. The flanges of the Wd-644 roller brackets will be the first part of the frame assembly to touch the roll bar.

Check the following points to insure the proper fit of the canopy frame to the fuselage:

The canopy frame side bows match the shape of the fuselage, but are inset 1/16". See DWG 43, Section F-F. The vertical distance from the canopy frame side bows to the F-721B canopy deck should vary by no more than 1/8" from front to back.

The rear bows of the canopy frame closely match the contour of the F-7112 skin but are inset about 1/16". (when the plexiglass is fitted, it will bring the level up above the contour of the skin.)

When viewed from the front, the roll bar should look centered on, and symmetrical to the canopy frame forward bow with the canopy frame top center bow centered on the latch pin on the roll bar. The canopy frame forward bow should be slightly higher at the center than the roll bar, see DWG 43, Detail B.

The canopy frame forward bow is slightly wider at the sides than the roll bar. The roll bar to canopy frame width difference is a fall-out of having the canopy frame side bows at the proper inset from the fuselage sides and is necessary because the fuselage widens going aft from the roll bar.

Make any adjustments to the frame shape that may be necessary to achieve these parameters. Use large, heavy objects of similar radius to add more curvature. Use your feet to push it against the floor on areas to reduce the curvature. Because the canopy bubble must be pulled down from its natural shape to conform to the canopy frame, the canopy frame will expand as much as ½" in width when the plexiglass canopy is attached. This will be compensated for during later stages of canopy fitting.

With the canopy frame moved fully forward, re-adjust and re-clamp the tracks so that the canopy frame side bows

are inset 1/16" from both fuselage sides when the rollers are centered laterally in the tracks. This should position the tracks approximately 40 13/16" apart when measuring between roller track inboard vertical surfaces. When you are happy with the track positions, drill #40 through the forward most screw hole in each track into the fuselage and cleco. Align the two tracks and measure to be sure that they are exactly parallel. Clamp the tracks firmly in place, drill the remaining holes #40, and cleco to the fuselage.

The C-762/C-763 Rear Track assembly is still free to move both side-to-side and fore-and-aft. Moving the rear track fore and aft raises and lowers the rear of the canopy frame. Use this feature to achieve the proper relationship between the canopy rear bows and the F-7112 skin. A straight edge placed on the F-7112 skin is used to extend the contour forward enough to check the measurement to the canopy frame rear bow. When you have adjusted the rear track position so that the rear canopy bow/skin relationship is correct, match-drill the rear track to the fuselage using a #40 drill at two locations, one aft and one forward. These holes must center on the upper flange of the F-787 channel as shown on DWG 43, Section H-H.

Install the C-664 threaded rod brace under the forward end of the rear track as shown on DWG 42, Detail H and DWG 43, Detail J. This brace is adjustable in length and serves to stabilize the overhanging end of the track. Leave the brace full length during fitting. It can be removed and shortened later, after the canopy has been positioned.

Do not worry at this point about the vertical relationship between the canopy frame forward bow and the roll bar. This will be adjusted when the canopy bubble is being fitted to the frame.

Now that you have all the canopy frame shape initial checks and adjustments complete, it is now time to start cutting the canopy.

CAUTION: You now have the canopy frame formed to the proper shape. Do not try to bend or reshape it after the Plexiglass is drilled to the frame, the frame will break at one of the attach holes.

TRIMMING THE PLEXIGLASS CANOPY

Lay the "as-delivered" canopy on a work table. The first step is to mark a fore/aft centerline on the outside of the canopy. This is done by measuring side-to-side along the outer surface of the canopy from bottom molding flange to bottom molding flange then dividing the distance by two (or simply running a string across and folding it in half.) Do this at two locations on the canopy, one forward and one aft. Finally, use a straight edge or snap line to connect the forward and aft center locations and draw the centerline.

Lay the canopy upside down on a padded work table.

Cut the bottom molding flange off of the canopy using a cutting disk in a die grinder. Use these early trim cuts to build your canopy cutting skills by marking straight lines on the canopy and cutting as close to the lines as possible. Whenever you trim plexiglass, take the time to sand and finish the edges to a rounded smooth surface.

Stick a couple of layers of tape over the top of the canopy frame latch handle tube to keep from scratching the inside of the canopy while the frame is being fitted to the bubble.

Lay the canopy frame inside the canopy bubble. Move the frame fore and aft to find the point of best fit between the shape of the canopy frame center tube and the shape of the canopy bubble.

Mark the fore and aft position of the canopy latch handle tube on the inside of the canopy at the previously marked centerline. Remove the frame from the canopy.

Use a unibit to drill a 5/8" diameter hole in the canopy bubble for the latch handle tube. Immediately de-burr the hole and sand the edges of the hole smooth initially with 220 grit, then 400 grit sandpaper.

Lay the canopy frame back into the canopy bubble. The latch handle hole in the canopy can be elongated fore and aft if necessary to fine-tune the frame to canopy fit. A cover strip will hide the elongated hole in the canopy.

Use the frame as a guide to mark the canopy for trimming. Initially, trim the canopy even with the bottom of the canopy frame side bows, so the plexi can be clamped to the frame. Trim conservatively as you might later want to shift the canopy around slightly to enhance the fit.

Place the canopy frame back into the canopy bubble and use spring clamps to tightly clamp the frame to the canopy along both sides and the rear. Clamp the frame into the canopy so its center is indeed on the centerline of the canopy and so the forward bow of the canopy frame fits the inside of the canopy with as few gaps as possible.

Mark the canopy split line dividing the bubble into the sliding canopy and the fixed windscreen. The ideal canopy split location is 1/16" to 3/32" forward of the most forward surface of the forward bow of the frame. See DWG 43, Detail B. Also mark the trim line just above the canopy frame side bows as shown on DWG 43, Section F-F.

Remove the frame from the canopy and make the cuts. The canopy is VERY floppy now and must be well supported when it is set down. One method of providing support is to run a strip of duct tape from side-to-side across the bottom of the canopy at two locations. Another, perhaps more dangerous method of keeping stress off the canopy to minimum is to carefully set the canopy down on its forward edge. The extra flexibility, however, will allow the canopy to fit the steel frame with little stress.

Clean the edges of the well supported plexi, sanding them smooth.

Place the canopy frame back onto the fuselage and slide it all the way closed.

Place the canopy bubble onto the canopy frame.

FITTING THE PLEXIGLASS CANOPY

FITTING THE SLIDING FRAME TO THE CANOPY

Secure the canopy to the canopy frame with duct tape and clamps. Initially drill #40 holes through the canopy into the sliding canopy frame at 2 inch intervals. (The holes will later be enlarged to 5/32" with a Unibit or special Plexi drill --remember, don't use a twist drill to enlarge holes in plexiglass!) Start at the top center and work aft and outward alternating from right to left. Be very careful when locating the holes so that they are directly centered on the canopy frame tubes. One good procedure for determining the center is to put a strip of masking tape on the bow. When the plexiglass is pushed against it, the contact line will show in the tape, indicating the exact center of the tube. After drilling a hole, cleco the plexiglass in place as drilling progresses.

When the canopy has been drilled and clecoed to the canopy frame, re-check the fit of the canopy and frame to the fuselage. The fitting of the canopy to the frame has probably pulled the frame so that it is a bit wider than is ideal. Note the amount of adjustment required and remove the canopy from the frame.

Take the opportunity to install C-653 Cover Strip while the canopy is off of the frame by placing the cover strip on the canopy and back-drilling from the canopy into the cover strip. See DWG 43, Section D-D.

Before you do anything else, determine and mark which holes will receive rivets directly, and which will contact dimpled aluminum…along the side skirts, for instance. Countersink these holes to the proper depth. Use a rivet or a dimpled scrap of .032 or .025 aluminum to test the depth of the countersink.

After countersinking and deburring the plexiglass, enlarge the holes to 5/32" using a plexiglass bit or small Unibit. By countersinking before enlarging the holes, you can use a countersinking bit with a standard pilot.

Moving back to the canopy frame, enlarge all of the #40 holes to #30. Adjust the frame, re-cleco the canopy to the frame, and re-fit the frame and canopy to the fuselage. Repeat the frame adjustments as necessary to achieve a perfect fit.

FITTING THE WINDSCREEN

Place the windscreen on the roll bar and fuselage. Use duct tape and/or clamps to hold it in place. Trim the front of the windscreen to fit the forward fuselage skin contours. Again, trim conservatively and carefully. The aft edge of the windscreen may also be trimmed slightly if/as required to allow the windscreen to better fit the forward fuselage and to allow the windscreen aft edge to mate nicely with the sliding canopy forward edge. The fit of the windscreen to the fuselage front deck has more leeway than any other part of the canopy, because the molding strip that will be installed here can bridge gaps up to 3/8".

With the canopy clecoed to the canopy frame and the windscreen taped/clamped to the fuselage and roll bar, it is time to make the final height adjustment of the canopy frame to the roll bar. While shims may be placed under the canopy on either the roll bar or the canopy frame, it is far preferable to place the shims on the roll bar. Shims on the canopy frame will be visible after the canopy installation is complete. Shims on the roll bar are hidden under the fiberglass trim strip and behind a fillet of epoxy paste laid between the aft side of the roll bar and the windscreen.

To ensure that no shims will be needed on the canopy frame, the height of the canopy frame is adjusted at the roller brackets so the windscreen portion of the canopy is even with, or slightly lower than the sliding portion of the canopy. Use a unibit to drill 11/16" holes in scraps of .063 aluminum to create temporary spacers that are inserted between the bottoms of the sliding canopy forward bow and the Wd-644 roller brackets. If it is necessary to lower the canopy frame, the bottoms of the sliding canopy forward bow may be shortened slightly.

After all height adjustments have been made, match-drill the canopy frame and canopy roller brackets for the AN525 screws. See DWG 41, Detail A. The proper alignment of the Wd-644 roller brackets to the C-657 roller tracks is critical. Verify proper alignment before match-drilling by clamping a straight edge to the inboard flat surface of Wd-644 and aligning the straight edge with the roller track.

Drill the windscreen to the roll bar beginning at the top/center and progress down each side. If it is necessary to place shims between the roll bar and windscreen, be sure to install the shims at each hole location before moving down the roll bar and drilling the next hole. The shims can be neatly cut pieces of aluminum or a stack of AN960-6 washers. It helps to have a worker inside the cabin to fit the shims while the driller works from the outside. An absolutely perfect transition from windscreen to sliding canopy is not essential, any mismatch less than 1/32" is not worth fussing over. A fiberglass trim strip (similar to the windshield base molding) will be laid up over the top of the windscreen. The trim strip will conform to and hide any remaining minor mismatch.

Remove the windscreen, countersink for 6-32 flush head screws, then enlarge the holes in windscreen to 5/32" using a plexi bit or Unibit. Enlarge the holes in the roll bar to #35 and tap 6-32. See DWG 43, Section K-K.

Set the windscreen aside for now.

CANOPY LATCH AND ANCHOR BLOCKS

FITTING THE LATCH

Assemble Wd-642 Canopy Handle, C-667 Bushing, and C-654 Canopy Latch Arm. See DWG 43, Canopy Latch Isometric View

and Section C-C. The AN310 nut should be tightened on the AN23 screw lightly so that the latch is free to pivot. The latch arm should fit easily around the C-667 bushing. If not, carefully enlarge the notch in the arm so that it fits freely.

Install the Wd-642 canopy handle sub-assembly through the bushing on the upper front of the Wd-640 canopy frame. Slide the canopy all the way forward to the closed position. While holding the canopy handle sub-assembly up against the bushing, rotate it so that the C-654 latch arm contacts the latch pin on the Wd-641 roll bar. First, check that the elevation of the latch mechanism aligns the latch hook so it contacts the latch pin. See DWG 43, Detail B. Adjust as necessary by shortening the bottom of the latch bushing on the canopy frame or by adding spacers.

When you have determined the correct level for the hook, fit the C-671 washer and the C-656 outside handle and note the amount which the Wd-642 handle shaft needs to be trimmed to bring the C-656 handle down close to the canopy. Trim the shaft and re-install the outside handle. Drill and tap for a machine screw as shown on DWG 43.

The C-654 latch arm has been made with excess material so that the exact location of the hook can be varied to accommodate each different canopy installation. See DWG 43, Section C-C. After all other aspects of the canopy installation are complete, the latch arm should be filed and/or trimmed so that it holds the canopy firmly in the closed position, but does not pull so hard that it distorts or mis-positions the canopy and frame assembly.

Remove the canopy and frame from the fuselage.

FITTING THE REAR ANCHOR BLOCKS

Lay-out the hole pattern in the C-677 Rear Pin Mounts as shown on DWG 41. Initially drill holes at #40. Initially drill the holes through the side of the pin mounts only on the outboard side. Make one left pin mount and one right pin mount. Match-drill and mount the C-677 Rear Pin Mounts to the top of the F-718 longerons per DWG 42, Detail B. Also see DWG 41, Detail B.

Place the C-665 Anchor Blocks in position in the C-677 mounts. Slide the canopy almost all the way closed so that the pins on the canopy frame are just touching the anchor blocks. Mark the points of contact and use a #30 or #40 drill bit to make a 1/16" deep mark in each of the blocks. Place the anchor blocks back in position in the mounts and again slide the canopy forward so that the pins are just touching the blocks. Verify the points of pin contact and adjust if/as necessary. Line-up a straight edge with the axis of the pins and project this angle to the sides of the blocks. Slide the canopy fully aft. Line-up a straight edge with the canopy tracks and project this angle to the tops of the blocks. See DWG 41, Detail B, and C-665 detail views. Also see DWG 42, Detail B. Remove the blocks and using a drill press and drill press vise, drill ¼" diameter holes in the blocks for the pins to engage. Check the fit of the blocks to the pins on the canopy frame. The pin holes may need to be enlarged slightly by wiggling the drill bit while drilling. Chamfer the edges of the pin holes as shown on DWG 41, C-665 detail views.

Place the blocks in the rear pin mounts. Slide the canopy all the way closed with the pins engaged in the blocks. Drill through the blocks using the pre-drilled holes in C-677 as drill guides.

Finish-up the mounting of the C-762/C-763 rear slide track by final drilling all holes and installing screws/washers/nuts.

FITTING THE SIDE SKINS

Study Section F-F on DWG 43 and the Exploded View on DWG 41 to understand how all the parts fit together. If the distance from canopy deck to canopy frame side bow varies considerably from front to back, you may want to skew the mounting of the skirt to the frame so that the top edge of the skirt remains parallel to the canopy deck.

Pre-drill the hole patterns in the C-660 Canopy Skirts. See DWG 41.

Fit the canopy skirts to the canopy frame. Start at the front, drilling #40 and clecoing to the frame as you progress aft. Remove the skirts from the canopy frame.

Modify the C-759 Inside Canopy Skirts as shown on DWG 41.

Lay the C-759 against the inside surface of C-660, lining up the top edges of the two parts. Use C-660 as a drill guide and match-drill the four forward most holes in C-759 using a #40 drill. See DWG 43, Detail E & Section F-F.

Cleco C-759 and C-660 to the canopy frame. Hold C-759 and C-660 tightly against the canopy frame as you drill #40 and cleco, working from front to rear.

Drill #30 holes through the canopy lower edges and into the upper flange of C-759 using the pre-drilled holes in C-660 as a drill guide. Use a piece of wood to bridge vertically from the fuselage side to the canopy frame side bow to the canopy holding everything in alignment while drilling. Begin in the middle of C-660 and work forward and aft from there.

Cut lightening holes and notch the lower flange of C-791 as shown on DWG 41. Pre-drill the holes in the upper flange of C-791 using a #40 drill.

While holding the upper flange of C-791 against the inside surface of the canopy frame side bow, match-drill #40 to the canopy frame. See DWG 43, Section F-F. Drill and cleco working from front to rear.

With one person on the inside of the cabin using a wood block to hold the lower flange of C-791 tightly against the inside surface of C-660 and a second person on the outside, match-drill #40 into C-791 using the pre-drilled holes in C-660 as guides. The person on the outside must hold the canopy skirt in the desired final position relative to the fuselage while drilling and clecoing. After these holes are drilled, the canopy side skirt final shape is essentially locked-in.

Remove all the pieces of the side skirts. Enlarge the holes in C-759 and C-660 for the #6 canopy attach screws and the holes for the MK-319-BS blind rivets. De-burr and dimple all holes as appropriate. Countersink the holes in the canopy, then enlarge them to 5/32" a plexi bit or a Unibit. De-burr the insides of the holes in the canopy.

Re-cleco all the side skirt pieces in place and install #6 screws through the canopy before beginning the aft canopy skirt installation.

FITTING THE REAR SKIRTS

Installing the C-666 aft canopy skirts is perhaps the most demanding detail of the canopy installation. These skirts, right and left, are riveted along with the canopy, to the rear bows of the canopy frame. The trick is in attaching the skirt so that its unsupported rear edge contacts the rear top fuselage skin when the canopy is closed. Accomplishing this will depend both upon the fit of the canopy frame to the fuselage, and how well the builder is able to fit and attach these aft skirts.

Fit the skirts in place with tape and progressively trim them to the best shape and fit possible. In some places the skirts will lie down nice and flat. In other places the trailing edge will probably tend to pull away from the fuselage. Cut the aft skirts generously oversize to start with and begin drilling them to the canopy at the top of the fuselage. Use a strap duplicator (also known as a "hole-finder") to align the holes with the holes that have already been drilled. Use one that lifts the skirt away from the plexi as little as possible.

Have an assistant pull the lower forward corner of the skirt forward, as hard as possible without buckling the front edge, as you drill. This will pull the aft edge of the skirt in toward the fuselage and the ratio of forward movement to inward movement may startle you. The skin can be held here while it is drilled to the frame. If the canopy is blocked open slightly while the aft skirts are fitted, they will more snugly when the latch is reinstalled and the canopy pulled forward.

The aft skirts can exert enough pull on the canopy frame aft bows to slightly expand the canopy frame out of shape, so hand form the aft skirts to fit the shape of the canopy and fuselage so they exert as little pre-load as possible.

Install C-792 as shown on DWG 42, Section G-G. Also see DWG 42, C-792 detail view.

Builders who have mastered the black art of fiberglass molding may wish to mold the canopy rear skins of this material rather than using the aluminum skins. In so doing, a better initial fit can be achieved because of the ability to make compound curves with fiberglass. The disadvantages include the longer construction time because of the molding and sanding process, the thicker lap joints caused by the fiberglass, and the tendency of fiberglass to warp over a period of time.

INSTALLING CANOPY BASE MOLDING STRIP

Now that the canopy has been riveted and screwed to the frame, a fairing joining the windshield portion to the front skin can be fabricated and installed. This may be made of aluminum, or fiberglass, molded in place. Because an aluminum fairing requires some relatively advanced metal working skills, most builders choose one of the fiberglass options. If you choose fiberglass, be certain to use only epoxy resins. Do *not* use the more common polyester or vinyl ester resins. They are not compatible with plexiglass and cause crazing that might (probably will) ruin the canopy. We have had excellent luck with West Systems epoxy, available from boat yards and mail order houses.

The following directions were written by an expert RV builder, known for the beautiful finish around his canopies: They were written during the installation of a sliding canopy, but the techniques work equally well for the strip around the front of the tip-up.

If you choose to mold your own fairing, begin by cleaning the aluminum skin. Several builders have reported markedly better adhesion after they etched the skin with a mild phosphoric acid, but don't get any of this on the windshield! The molding should continue around the base of the windscreen back to the point where the windscreen is under the aluminum skin. At this point the fiberglass molding is to be faired smoothly into the skin line.

Imagine (or draw on a sheet of paper) a cross section view of the fwd base of the windshield to the top deck of the fuselage. It will be an inside radius. Cut out about a 4" diameter circle in poster board or similar and hold on edge at the base of the windshield. Where the circle touches the windshield and the skin is about where the fiberglass will end on each. Also notice that the space formed by the circle that you want to fill with fiberglass is not the same thickness across the whole section. This is why you can't use cloth all one width (unless you want to do more sanding than any metal airplane builder should have to do).

A couple of general tips -

The closer you get to your finished shape, and the more accurately you lay up the glass/resin, the less finish work (read: sanding) will be involved.

Make sanding tools in the exact shape/radius for the areas you wish to sand. For example: All around the forward base of the windshield, you will be sanding a varying inside radius. Find some type of round tube (thick wall PVC pipe works very well) that you can glue different grits of sandpaper to that has the radius you want the finished shape to be. I use about a 3-4" inch radius and glue sandpaper with spray contract adhesive.

Before doing any glass layups you need to do some prep work.

First, figure out where the edges of your finished glass work will be on the plexi. Use your round circle radius gage to find the contact points around the front of the windshield, and bring it around the sides to match up with the top of the canopy side skirts. I usually match the portion that goes over the top, to the front edge of the roll bar. Mark these edges with a layer of good quality (3M) electrical tape to protect the plexi.

Now carefully sand all of the plexi and aluminum that you intend to bond to with 60 to 80 grit sandpaper. Sand until there is no gloss of the plexi remaining. Do not worry about removing the alclad because it will be sealed in epoxy.

Mix up some resin with microballons to make a small fillet to fill the recess where the windshield mates to the fuselage. Mix it very dry (lots of micro balloons / not much resin) so it will not run. This fillet will prevent the cloth from dropping down into this space.

Cut the cloth strips. On the portion around the front I start with about a 1/2 " wide strip and then make each successive strip about 1/4" wider (1/8" to each side) which will give you about 7 or 8 layers if you go up to 2 inches. The last layer you put down should be the width of the finished fairing. These strips do not need to be cut 45 degrees to the weave. If fact, in this case it is easier to cut the strips parallel with the weave. I use at least 2 pieces of fabric for each layer to go around the entire front of the windshield. Because the strip is being pulled on a compound curve the end will not be square as you lay it down. You can just cut it square before laying it down and then butt the next strip up to it. On each successive layer vary the lengths slightly so that the butt joints don't fall on top of each other.

A rotary cloth cutter (available from cloth stores, or get in touch with your friendly local composite airplane builder) and a long straight edge works great for cutting long skinny strips. The more accurate you are cutting (and installing) the strips, the less finish work that will be needed.

Now add another layer of electrical tape to the first one already applied and start laying up the layers.

Center the first ½" strip around the base of the windshield at what will be the center of the fairing. Put on each successive layer centered on the previous ones with the final layer butted up next to the electrical tape but not over lapping onto it. These strips can be laid up all at once – there is no need to let each layer cure before applying the next layer.

Let this begin to set up slightly and then do the portion over the top for the canopy to windshield intersection using a similar procedure. Apply release solution or mylar packaging tape to the top of the sliding canopy so the resin will not bond…gluing your canopy halves together is embarrassing and makes the airplane difficult to enter. The strip over the top of the windshield has an outside radius, and typically needs fewer layers with the layers differing in width by about 1/2" instead of 1/4").

Once everything hardens for a day or so it is time to start sanding…very carefully. Use the shaped tools mentioned previously and start with about 40 to 50 grit paper. This will get you quickly to the general shape --but be careful to not get into the electrical tape. When you get down near the tape switch to about 80 to 100 grit paper and work very carefully until you are just contacting the tape and the skin metal on the edges of the layup. If you sand through the first layer of tape the second one should protect the plexi if you are watching carefully.

Now remove the second layer of tape (leaving just one layer) and sand very, very, very carefully using about 150 grit until you just start to see sanding marks in the tape.

Brush on a heavy coat of epoxy (after getting rid of all sanding dust) overlapping the epoxy onto the tape and the metal at the edges, and let harden.

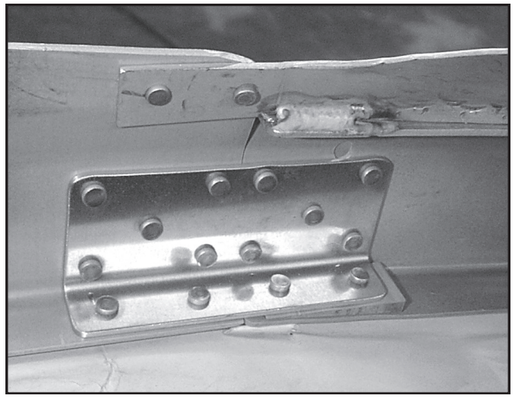
More sanding with 100 and then 150 grit paper.

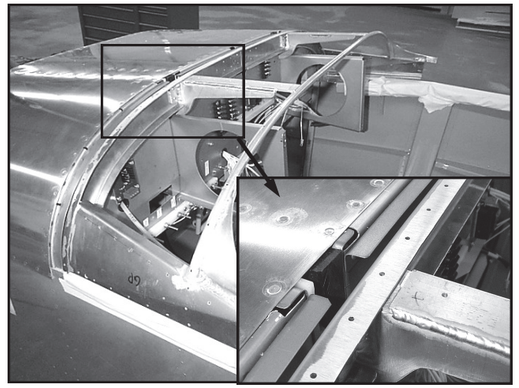
If you have areas that need filling you can fill them now by scuffing with 40 or 50 grit paper and filling with a dry mix of epoxy and microballoons.

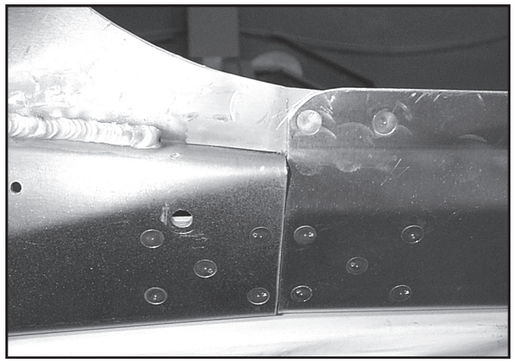
The goal is to have a layup with the outer surface being a buildup of 2 or 3 coats of epoxy that has been finish sanded to final shape with the epoxy blending onto the plexi being the thickness of the electrical tape or less, and the epoxy on the metal skin blending out to nothing.

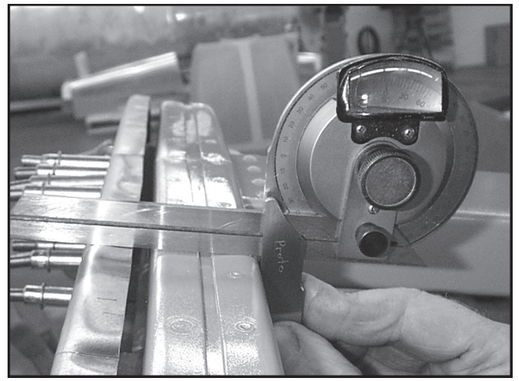
The final blending into the metal may require a couple of wet sanded applications of a filler primer to blend it out entirely.

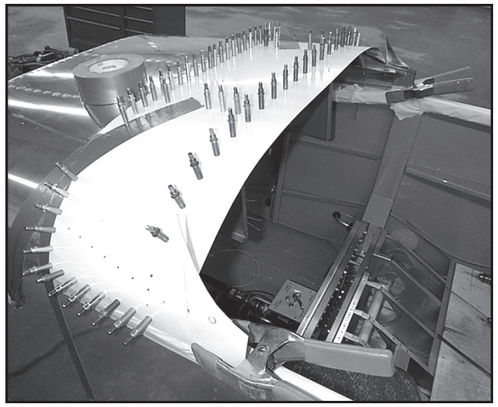
If you do it properly it will give you a very nice looking low drag intersection and it will make all the "Fast Glass" builders wonder how a rivet pounder could get a windshield/canopy finish that looks so good.

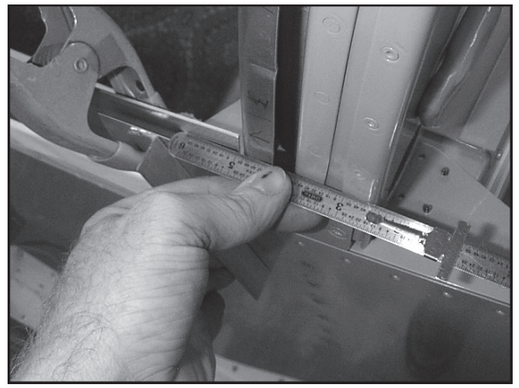




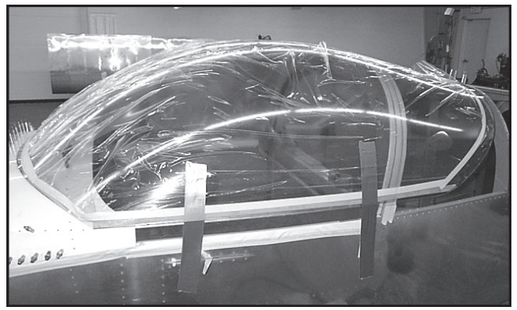


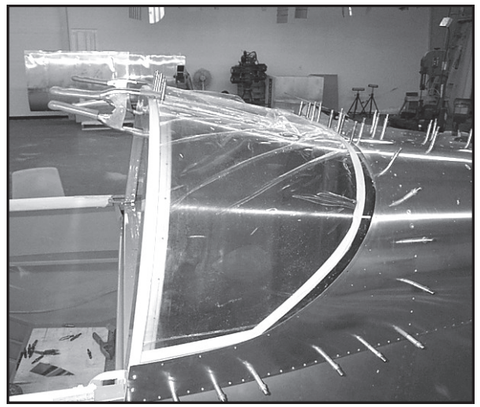


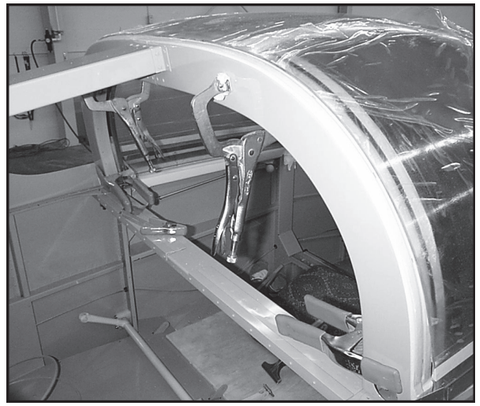


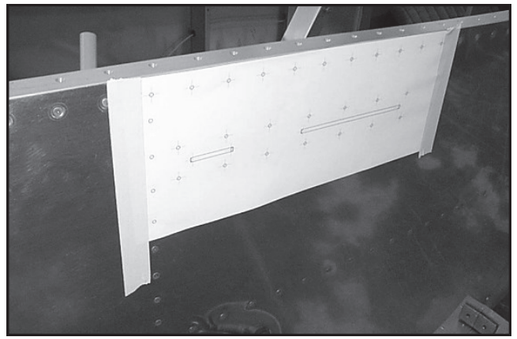


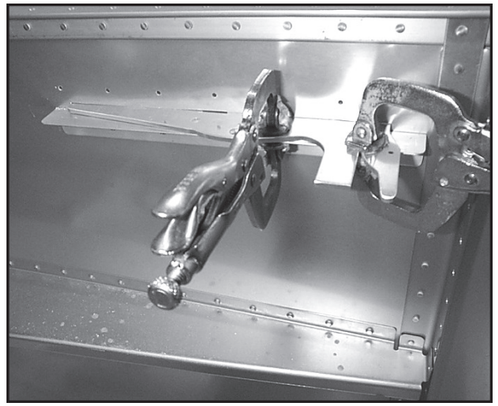
Aligning the tip up canopy frame to the fuselage and cabin frame.

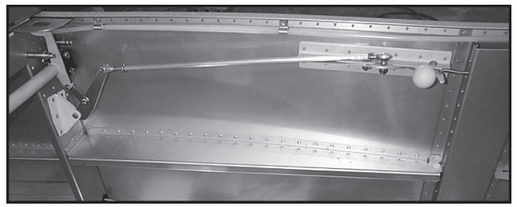




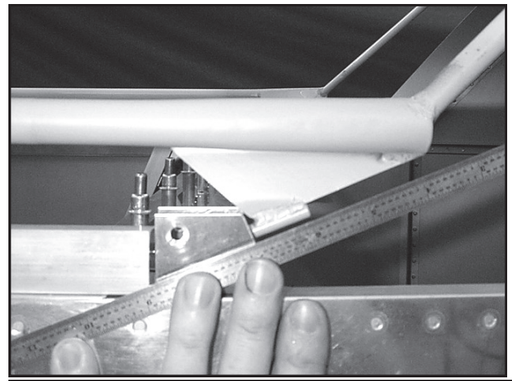


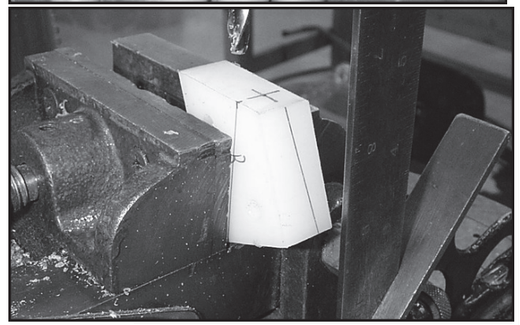


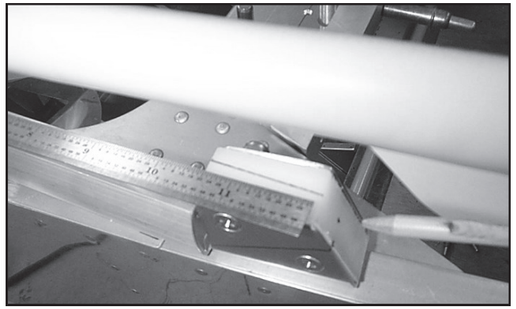




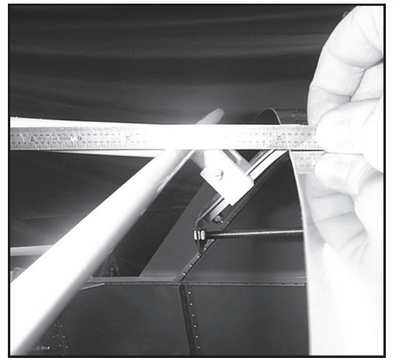
Fitting the plexiglass canopy bubble and tip canopy latch.

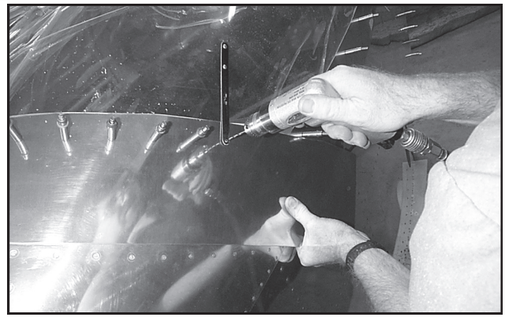


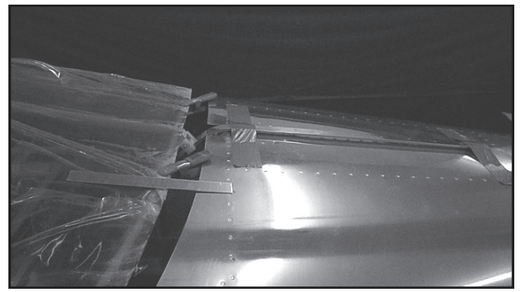


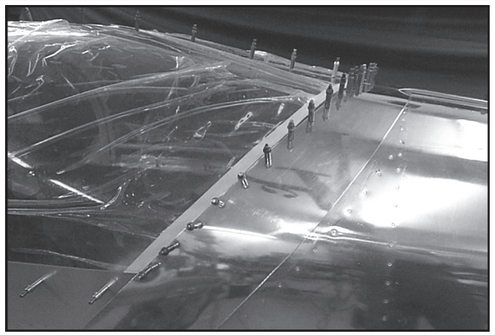


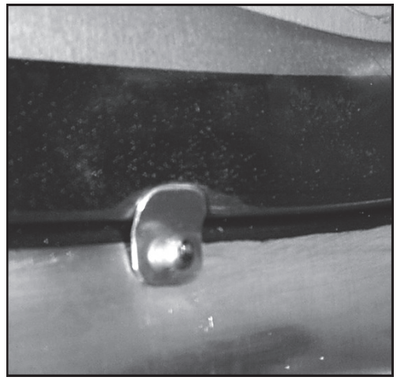
Various views of aligning the canopy frame and fitting the skirts as described in the text.

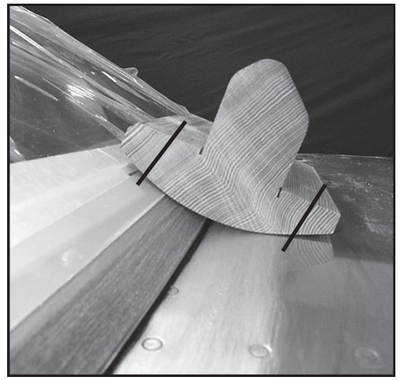






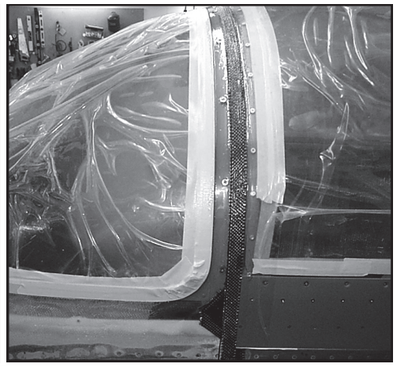


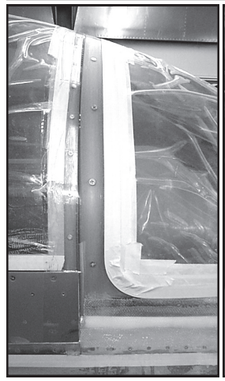


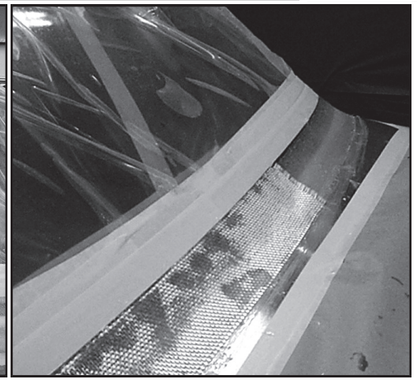


Left: Small clips of .040 aluminum can be used to hold the windshield in place. These are blind riveted to the forward deck and simply buried in the fiberglass fairing.

Right: A homemade sanding block contoured to the desired raduis. It was later narrowed to the width shown by the black lines.







Above: Laying up the fiberglass fairing around the front of the windshield and over the top of the sliding canopy. Note how well the plexi is protected .

Left: Nearing completion. The cleaner the lay-ups, the less sanding and finishing.

NOTES

SECTION 10: ENGINE MOUNT, LANDING GEAR AND LANDING GEAR FAIRINGS

The RV-7/7A uses a well-proven tapered rod landing gear. Developed by race pilot and aviation pioneer Steve Wittman, this gear arrangement has been widely used on both production and experimental aircraft. It is rugged, simple, relatively light, and inexpensive. By using simple landing gear leg fairings, drag is minimized.

The RV-7/7A uses an engine mount fabricated from aircraft grade steel tubing. The mount incorporates a mounting provision for the RV-7 main gear legs or RV-7A nose gear leg.

Since the gear legs are round, they permit the wheels to move in all directions and do a good job of smoothing out runway bumps. But, because they are spring steel, they are not as well damped as are the air-oil ‘‘Oleo’’ struts on some aircraft landing gear installations. Spring steel gear legs do not absorb much energy, but rather tend to rebound to release the energy taken in by smoothing a bump. This is the same as a leaf spring gear (Cessna), but the leaf spring gear can only flex inward and outward from the aircraft centerline, not fore and aft as the round rod gear can. When flexing inward and outward, the tire ‘‘scrubs’’ on the runway and damps the rebound action.

THE ENGINE MOUNT

The engine/landing gear mount is shown on DWG 46 (RV-7) or DWG 46A (RV-7A.)

DWG 46 (RV-7): The mount is fitted by squaring it with the firewall of the fuselage and aligning it with the pre-drilled holes in the corners of the firewall. Variations in the dimensions of the mount should be small enough that they can be compensated for by the differences between the undersize holes in the firewall and the 3/8" full size holes in the mount. The two center holes are also drilled at this time. Spacers can be used between these two attachment points and the firewall if necessary.

Drill the holes in the firewall to full size using the engine mount as a guide.

DWG 46A (RV-7A): The mount is initially secured to the firewall using the top two mounting points and 3/16” bolts. The holes in the remaining four bottom attachment points are then drilled into the firewall using the mount as a guide and then secured with 3/16” bolts. Ensure the drill is perpendicular to the firewall while drilling, and install a bolt into each hole before drilling the next. One at a time, the attachment points are gradually up-drilled to full size and secured with a 3/8” bolts.

INSTALLING THE MAIN LANDING GEAR LEGS

The main landing gear legs are made of alloy steel with poor corrosion resistance. They are supplied powder coated except for the axle and surfaces which contact the landing gear mount. These cannot be painted because the thickness of the paint would prevent installation. A film of wheel bearing grease applied during installation will keep unpainted areas from corroding.

Installation could scarcely be easier: a round rod is inserted into a round tube and secured with one bolt.

The following instructions for installing the landing gear, wheels, brake lines, fairings and stiffeners are much the same for both RV-7 and RV-7A installations, but actual dimensions may vary. Be sure you are working with the correct drawings. Details of the RV-7 main gear are shown on DWG 46. RV-7A main gear are shown on DWG 34A.

INSTALLING THE NOSE LANDING GEAR LEG

Attach the U-00019 Nose Gear Leg to the engine mount using the bushings and hardware called-out in DWG 46A. The nuts and bolts attaching the gear leg need to apply enough clamping force on the bushings that they rotate with the gear leg inside of the engine mount brackets. So, when applying grease to the cylindrical surfaces of the bushings, be careful not to get any grease on the flats of the bushings; this could significantly reduce the friction between the bushings and gear leg.

Next, install the U-01407 Elastomer Pad, the U-00020 Nose Gear Link, elastomers, spring, and U-01420-1 Cap. Slide on the washer and thread on the nut enough to compress the spring and remove any gap between the elastomers and pad. The final amount of spring compression is determined only after the nosewheel is installed as noted in the drawing.

Finally, attach the bottom end of the link to the gear leg.

INSTALLING THE MAIN WHEELS AND BRAKES

Details showing the installation of the wheels and brakes are shown on DWG C2. The axle and U-403 Brake Mounting Flange on RV gear legs have been designed to use the Cleveland 5:00x5 wheel and brake assemblies. The brake mounting flange has been honed and drilled to fit the axle at the factory. The hole through one side of the U-403 is still undersize, so, before final installation, pass a 5/16” drill through the assembly. Now install the Allen head screw that secures the brake flange to the axle. It is possible that the heat treating process used to strengthen the gear leg has expanded the axle slightly, and the flange will not slip on smoothly. A strip of fine crocus cloth briskly worked around the axle will remove enough material to allow the flange to be installed.

Cleveland brakes are included in the kit. Swap the fittings on one brake assembly to make a left and right brake. Each brake has a mounting plate supplied, which bolts to the U-403. Three of these bolts, running through U-408 spacers, also attach the U-810 Wheel Fairing Mount. The exact length of these spacers may be altered slightly to achieve the correct gap between U-810 and the brake disc.

Mount the U-810, U-408 spacers and Cleveland mounting flange to the U-403 Brake Mounting Flange. Install the AN822 brake line elbow in the Cleveland brake assembly. Remove the inboard brake shoe from the brake caliper, and bolt the caliper to the mounting flange. Brakes are mounted with the caliper aft of the axle, and the bleed nipple down.

Fit the 5:00x5 Cleveland wheels and U-405 Axle Spacers (one on each side of the wheel) on the axle. Install the VA-106 wheel nut. Tighten this nut carefully, until there is no side play in the wheel, but it still rotates smoothly. Then, through the cotter pin hole in the nut, center punch mark the position of the cotter pin hole in the axle. Remove the nut and wheel, and drill a 1/8’’ hole in the axle for the cotter pin.

MAIN WHEELS and TIRES

Split the wheels by removing the bolts holding the wheel halves together.

Remove and inspect the wheel bearings. This requires removing the circlip retainer and popping the tapered bearing assemblies out. Be sure they are fully greased with Aeroshell #5 or equivalent.

Re-install the bearings and mount the tubes and tires on the wheels. Dust the inside of the tire with talcum powder before installing the tube. Discard the nuts and washer on the valve stem. The red dot on the tire should be installed next to the valve stem of the tube.

Bolt the wheel halves together. Carefully observe the manufacturer's bolt torque specifications, shown on the document in the wheel/brake package.

SLOWLY inflate the tire to 25 psi. Deflate it fully and re-inflate it SLOWLY a couple more times to work out any wrinkles in the tube. Inspect for a good seat around the wheel rim.

Install the wheel and re-install the inside brake shoe with bolts and safety wire.

BRAKE LINES

DWG 36 (RV-7) and DWG 36A (RV-7A) show details of the brake system, including both single and dual brake installations. The brake lines have been designed so the same master cylinders, brake fluid reservoirs, and flexible brake line segments can be used for either the single or dual brake system.

As the exact length and route of the tubing is being determined, the rudder pedals should be moved throughout their range of travel to observe the action of the tubes. In routing the brake lines, care should be taken to protect them from chafing where they pass through bulkheads or around corners. Such protection can be in the form of plastic fairlead bushings as shown, wrapping the brake lines with protective tape, or slipping a piece of polyethylene tubing over the brake line at the wear point.

Note the brake line routing at the lower end of the gear leg as shown in DWG C2. This routing permits the brake line to come straight out of the fitting for a distance before making a bend. The brake caliper moves inward and outward along the line of the axle as the brakes are used. The ‘‘spiral wound’’ routing shown accommodates this movement very well with little stress on the brake line or the fitting.

Once the brake lines are fitted, the brake fluid may be added.

NOTE: *Use ONLY the aircraft brake fluid recommended by the manufacturer. DO NOT use automotive brake fluid, especially silicone based fluid. The seals in aircraft systems are not compatible with automotive fluids. Serious damage may result if they are used.*

Brake lines must be “bled” to force air from the lines. Use a clean squeeze-pump handle oil can with the appropriate fluid. Connect it to the bleed nipple on the wheel cylinder with a clear plastic tube that seals tightly to the nipple, loosen the nipple about 1/4 turn, and pump the system full. Work carefully and watch the plastic lines that connect the master cylinders to the fluid reservoir until no more bubbles appear.

WOOD GEAR LEG STIFFENERS (OPTIONAL)

With a rod gear leg, the wheels can move fore and aft, so, with no scrubbing action on the tire, there is no damping, and a fore-and-aft shimmy can result. This is most prevalent at low speeds (10-15 mph) and on paved surfaces. Turf surfaces have sufficient rolling resistance to provide a damping action. Out of balance wheels and higher than necessary tire pressures also promote wheel shimmy (lower pressure in the tires increases rolling resistance, and thus provides damping). Generally such shimmy occurs on landing roll out or while taxiing, and can be stopped with light brake application. Un-checked shimmy can transmit vibrations into the landing gear mount and eventually cause cracking. However, wheel shimmy is a rather nebulous thing; it occurs on some airplanes and not others, and with varying degrees of severity. The cause, or combination of causes, is very difficult to detect and define. Fly the plane first to determine if you need the stiffeners.

Wheel shimmy tendencies can be minimized by using the lowest practical tire pressures, having well balanced wheels and tires, and brake discs which run true and don't drag at one point of rotation.

Bonding a wooden block to the spring steel rod gear leg will alter its vibration characteristics and decrease the tendency to shimmy. This is shown on DWG C3. The wood used in this illustration is a standard window molding available from most building supply stores. The shape of this molding provides a good place to start. Sawing two pieces of this molding lengthwise and bonding them together as shown will provide a tapered piece, which attaches easily to either the front or rear of the gear leg. The resulting assembly is attached with putty of epoxy and thickening agent or even a "Bondo" type body filler.

Once this has cured, sand or file the excess bonding agent smooth, and wrap the whole assembly with 2 or 3 layers of 9 oz. fiberglass cloth. Fiberglass tape, 2-3" wide wrapped around the gear leg works well because it is easier to keep taut than a large sheet of fiberglass cloth. These wrappings of fiberglass tape are saturated with polyester resin (or epoxy if you prefer) as they are applied.

The wood stiffener blocks may also be attached temporarily by spiral wrapping them with fiberglass filament re-inforced packaging tape. This should be viewed as a short term installation, because the filament tape will deteriorate and may not last for more than one or two years; much less if directly exposed to sunlight for long periods of time.

INSTALLING THE FIBERGLASS MAIN GEAR LEG FAIRINGS

Gear leg fairings are very important for drag reduction. While one might feel that a fairing on the large wheel and tire would add more speed than a fairing on the small, round gear legs, just the opposite is true. Wheel fairings add about 3-4 mph but the gear leg fairings add at least 8 mph. The combined wheel and gear leg fairings add around 12 mph to the top speed. Looking at it another way – it would take an additional 27 horsepower from the engine to achieve the 12 mph contributed by the fairings. Obviously, a good fairing installation is necessary if high speeds are to be obtained from your RV.

Proper alignment of the gear leg fairings is also important for several reasons. Since the gear legs are located forward of the aerodynamic center of the aircraft, they have a de-stabilizing effect on directional trim. Any mis-alignment will have the same effect as a rudder input, but in the opposite direction and of much greater magnitude. For instance, it was found that just a 1/4 inch mis-alignment of the lower trailing edge of one gear leg fairing produced a half-range deflection of the skid ball. A very noticeable opposite rudder input was required to re-center the ball.

Main gear leg fairing installation is shown on DWG C3. Place the fairing, leading edge down, on a table or other flat surface and use a square at one end to position the trailing edge exactly above the leading edge. Make sure that the other end of the fairing also has the trailing edge exactly above the leading edge. This will verify that the fairing was molded without twist. With the fairing in the "no-twist" position, place two or three spring clamps on the trailing edge. Wrap a piece of tape around the trailing edge and then use a razor blade to split it at the trailing edge or make a thin pen mark across the trailing edge. If the fairing becomes twisted, the tape edges or pen mark will not line up.

Cut out the paper trim template (for YOUR airplane) found on DWG C3. Position the trim template over the fairing using the molded-in scribe lines and the leading edge parting line as reference points. Smooth the template over the outside of the fairing and use spring clamps to hold it in place. Trace the root end, trailing edge, and tip end trim lines onto the fairing. Make small "tick-marks" on the tip and root at the gear leg centerline. Extend the gear leg centerline marks approximately ¼" to the center of the part after removing the template. The marks will be helpful later when positioning the fairings to the gear legs. Trim the root and tip ends of the fairing, but not trim the trailing edge. After trimming, file or saw notches approximately 1/16" deep in the edges of the fairing at the gear leg centerline marks.

Trim the hinge material to 2 inches longer than the length on the drawing. Do not trim the hinge pins yet. The hinge material is left 2 inches long so there will be a 1" excess on each end to help clamp the hinge to the fairing. Mark (but do not drill) fastener locations and final trim locations on each of the hinge segments. When drilling the hinge to the fairing, the fastener location marks will be visible through the translucent fairing. If the fairing is opaque, refer to Section 5.18 MATCH-DRILLING OPAQUE FIBERGLASS PARTS.

Place the trimmed gear leg fairing on the gear leg and clamp the trailing edge closed with two or three spring clamps. Use the tape or pen marks to be sure that the fairing is not twisted. Adjust the position of the fairing to align the gear leg centerline marks with the gear leg centerline. The trim as defined by the pattern was conservative, and the fairing may be slightly oversize. Trim the lower end of the fairing as required for proper fit.

Note: Each hinge half must be drilled, clecoed, de-burred, countersunk, and riveted before moving to the next hinge half because the fairing section is too thin at the tip to allow installation of clecos in both sides without interference.

Position the marked hinge inside the trailing edge of the fairing and clamp the ends of one hinge half in place. With the hinge ends clamped in position, begin at one end and drill #40 through the fairing and hinge using the fastener locations marked on the hinge to position the holes. Use light pressure and high drill speed, and allow the bit to cut through without distorting the hinge. Work from one end of the fairing to the other, clecoing each hole before drilling the next.

Un-cleco the hinge from the fairing and clean out any metal chips. De-burr holes and trim the 1" excess hinge from each end. Remove and countersink the fairing for AN426AD3 rivets. Because the fairing is quite thin, it is recommended to that you keep the hinge clecoed to the fairing while countersinking. The holes in the hinge will guide the countersink cutter and keep it from elongating the holes in the fairing. Rivet the hinge to the fairing, using a hand squeezer. Don't fully set the rivets as you would in a metal structure. This would cause the thin composite fairing to crack around the holes.

Remove the fairing from the aircraft and insert the hinge pin to join the trailing edge. Use a long sanding block to remove any excess "tail" on the fairing and even the sides of the trailing edge.

Remove the pin and bend the lower 1" to 90º. Grind the upper end to a chisel tip. This shape helps guide the pin through the eyes of the hinge. Drill a #40 hole in the upper surface of the lower end of the fairing. A piece of safety wire can be looped to hold the hinge pin in place.

Wrap the gear leg with wear resistant plastic adhesive tape at two or three locations to prevent chafing and hold the brake line in place. Slip the fairings over the gear legs and insert the hinge pin from the bottom. The hinge pin is thin enough to curve as it is inserted without taking excessive permanent bend.

Roughly align the fairing to the airflow, and align the gear leg centerline marks with the gear leg centerline. At the top end of the fairing, install a hose clamp around the gear leg capturing the ¾ inch wide fingers of the fairing to help hold it in place. When installing the hose clamp for the first time, use a heat gun to soften the fingers so they conform to the surface of the gear leg as the hose clamp is slowly tightened. When the hose clamp is fully tightened, leave the fairing in place and allow it to cool.

You can also, as an option, add one or two layers of fiberglass cloth under the fingers. The purpose is twofold: to strengthen the finger and to contour the inner surface of the finger to the landing gear leg. Cut one or two laminations of 9 oz. fiberglass cloth so they fan out and anchor to a larger surface area of the gear leg fairing. See the dashed lines on the full scale trim templates.

Before laying up the fiberglass, prepare the surface of the gear leg by locally coating it with wax, mold release agent, or thin cellophane packaging tape. Cut out the glass cloth doubler patches and attach them to the inside surface of the fairing with a liberal application of epoxy resin. Before the resin cures, install the fairing to the gear leg using the hinge pin to close the trailing edge. Lightly clamp the lower end of the fairing if necessary to hold the fairing in place. After cure, remove the fairing and trim any rough edges around the doubler patches. The exterior surface of the finger can be filed or sanded to provide a smoother contact surface for the hose clamp.

The alignment of the fairings is important and can substantially affect the way the airplane flies. While a very careful "eyeball" alignment job might come close, this is difficult because of visual illusions created by the sweepback of the gear legs.

The gear leg fairing must be aligned with no load on the wheels, simulating the in-flight condition of the gear legs. Jack and support the fuselage far enough off the ground that the wheels no longer touch. Set the tail up so the airplane is level at the cockpit longerons (datum line). Use caution while the airplane is on jacks. Don't let it tip or it will fall off the jacks!

Align the fairings as shown. Pick a point on the landing gear fairing and measure the distance to the center of the fuselage. Pull a string from a point on the landing gear to a similar point the same distance from the center of the fuselage near the tail of the airplane. This string is a displaced centerline of the airplane. A stick is clamped between the stabilizer and the floor at this point. The string is then wrapped around the leading edge of the fairing and both ends pulled tight to the stick under the stab. Be sure the string is held level and parallel to the longerons… usually measuring from the floor is accurate enough. The leading edge and trailing edge of the fairing should be centered between the strings.

The string is then relocated up and down the gear leg (and of course, the stick at the tail will have to be move inboard/outboard the same distance, so the displaced centerline remains parallel to the aircraft centerline). This will align the fairing and eliminate any twist. Slightly loosen the hose clamps so the fairings can be accurately aligned. When the alignment is correct, tighten the clamps.

The installation is completed by fabricating intersection fairings between the upper end of the gear leg fairing and fuselage/wing and between the lower end of the gear leg fairing and the wheel fairing. The process for creating the intersection fairings is outlined later in this Section.

On the completed wheel fairing/gear leg fairing/intersection fairing installation, the custom molded intersection fairings will define proper alignment of the gear leg fairing, so the hose clamp is used primarily to keep the fairing from sliding down the length of the gear leg. This also means that the gear leg fairing alignment procedure need not be repeated each time the fairings are removed.

INSTALLING THE MAIN WHEEL FAIRINGS

Main wheel fairing installation is shown on DWG C2.

The VA-157 wheel fairing consists of two pieces, the VA-157A forward half and the VA-157B aft half. They should mate as accurately as possible. Because of the variations possible in fiberglass moldings, the first step must be to make the halves fit. Use coarse sandpaper glued to a straight stick as a disposable file to remove any material that prevents the halves from matching smoothly. Typical areas that might need some extra work are shown on Details D and E; the inside radius of the flange on the rear half, the inside of the front half where glass cloth layers overlap, etc. Take the time to custom fit the halves of your fairings as exactly as possible.

Drill and cleco the VA-157 fairing halves together. Begin at the tops of the fairings and work down the sides to help minimize bulging and mismatch between the fairing halves. Space fasteners per Section A-A. Do not install the second fastener up from the bottom on the inboard side of the fairings as this part of the fairing will be cut away to clear the axle. The fairings as supplied are symmetrical (no right or left hand fairing) but the asymmetrical installation of the fasteners will establish which fairing will be installed on the right side of the aircraft and which will be installed on the left.

Attach front and rear halves of wheel fairings to each other as shown. Mark a lengthwise centerline across the top of the assembled fairing.

The airplane will need to be supported on jacks to get the wheels on and off the axles. Unfortunately, you may need to remove and re-install the wheels a few times while getting the bracket-to-disc gap just right. Use caution while the airplane is on jacks. Don't let it tip or it will fall off the jacks!

Install U-810-L and –R Brackets to the U-403 Brake Mount Flanges using 3 each: U-408 Spacers, AN4-11A Bolts, AN365-428A Nuts, and AN960-416 Washers. There should be 0.032" to 0.094" gap between U-810 and the brake disc when the wheel/brake assembly is installed.

Raise the airplane on jacks so the tires are just off the ground (zero to 1/16" gap). Level the airplane (longitudinally and laterally) at the upper longeron. Once again, use caution while the airplane is on jacks!

Attach U-808 Outboard Brackets to the VA-106 Axle Nuts using AN4-5A Bolts and AN960-416 Washers. There is not a right hand or left hand U-808, but the brackets do have a top and bottom to them. The longer leg of U-808 goes to the top. Using a carpenters square or drafting triangle on the floor, rotate U-808 so the forward and aft edges are perpendicular to the floor. Tighten the bolts.

Install a 1 inch thick wood/metal/plastic spacer between the top of the tire and the inside of the wheel fairing. This spacer will be placed on the top of the tire to establish the correct vertical position of the fairing relative to the wheel/tire. (The 1" dimension assumes a 14" diameter tire is being used. The spacer thickness should be varied to account for tire wear or inflation pressure.

Tape the spacer to the top of the tire.

The inboard forward edge of the aft fairing must be locally trimmed to clear the axle. The wheel fairing is positioned correctly in the fore/aft direction when the forward edge of U-808 lines-up with the molded in "step" located approximately 1" aft of the forward edge of the aft fairing (see Detail C).

Center the rear half of the fairing over the tire while using the spacer to hold it in the correct vertical position. Locate and use some blocks of wood/metal/plastic to place under the aft end of the fairing to position the center of the aft edge of the fairing roughly 8 5/8" off the floor (see Wheel Fairing Side View). Mark the area of interference with the axle, remove the fairing, locally trim a small amount of the fairing, re-position the fairing over the wheel, re-mark and trim as required to achieve the correct final position. Trim the minimum required to clear the axle as this will make the shaping of the clay mold for the wheel fairing to gear leg fairing intersection easier.

When the weight of the airplane is off the gear, the wheels naturally camber inward. The vertical axis of the fairing is intended to be aligned with vertical axis of the wheel and tire.... not perpendicular to the ground. The tire tread provides a good alignment guide. The centerline on the top of the fairing and center of the opening on the bottom should align with the center of the tire.

When the aft fairing is located vertically (by the spacer on top of the tire), fore/aft (by alignment of the "step" with the forward edge of U-808), approximately leveled (by the blocks under the aft end), and aligned with the tire, (look and see) drill and cleco it to the U-808 bracket using the pre-punched 0.125" diameter holes in U-808.

U-808 mates to the wheel fairing in a region where the part thickness is changing. This will cause mis-alignment of the bracket, so a few plies of fiberglass cloth must be bonded to the inner surface of the aft fairing to make the thickness constant in the two areas where U-808 touches the fairing. Use coarse sandpaper to roughen the surface of the fairing --really roughen it, don't be shy --before bonding patches of fiberglass cloth in place with epoxy resin.

Locate an approximately 1" wide shim thick enough (0.032" to 0.094") to fit tightly between the U-810 bracket and the brake disc. This shim will keep the bracket from deflecting excessively when drilling through from the outside of the fairing. Scrap pieces of aluminum with strips of duct tape added to achieve a snug fit work well.

Attach the forward half of the fairing to the aft half. Now carefully adjust the fairing position until it is aligned with the aircraft centerline both in a horizontal plane and in a vertical plane (see wheel fairing side view). Drop plumb bobs from the center of the fuselage, fore and aft, and mark the position on the floor. Snap a chalk line through these

marks, transferring the centerline to the floor.

With the fairing held in its final position, drill and cleco the fairing to U-810 in four places (two front and two rear). It is easier and safer to initially drill the holes #40 and then work up to the final #20 size. Use your "sharpie" pen to make four ink "dots" on U-810 where each of the four fasteners will ideally be located. The ink dots can be seen through the translucent fiberglass and the holes are then drilled and clecoed. If required, refer to Section 5.18 MATCH-DRILLING OPAQUE FIBERGLASS PARTS.

When the holes are located, reinforce the area about three inches around them by laying up 2 or 3 layers of fiberglass on the inside of the wheelpants. Re-check alignment and adjust as necessary while enlarging the holes. Enlarge all holes to final size and remove the wheel fairing. Install K1000-08 Nutplates to U-810 using AN426AD3-5 Rivets. Attach U-808 to the aft half of the fairing using AN426AD4-6 Rivets. Remove all blocks, spacers, shims, etc., and install the wheel fairing to the airplane.

FINISHING THE WHEEL FAIRINGS

After the wheel fairings are fitted it is necessary to remove them for sanding, filling, and paint preparation.

This can take longer than most people realize, but it is necessary to achieve a good finish when you paint. It will also cure you of any lingering desire to build a whole airplane from fiberglass!

When you put everything back together, remember to install and safety wire the inside brake pads and install the permanent cotter pin in the wheel nut before re-installing the wheel pants.

INTERSECTION FAIRINGS

To fully fair the landing gear, small intersection fairings cover the intersection of the gear leg or gear leg fairing and wheel fairing, and the gear leg/fairing and fuselage. Because of the variation between individual airplanes, these are best made in place.

A mold is made of oil based modeling clay. This can be the common modeling clay found in toy stores, or more professional variety used by commercial designers. The clay is applied between the gear leg and wheel fairing or fuselage and formed to a pleasing shape by hand or with any plastic or metal tool. A wet spoon works well.

The clay is oil based and is a natural parting agent. However, since the intersection fairing must part from one or more of the adjoining metal or fiberglass parts, it will be necessary to use automotive wax, PVA (a special liquid parting agent) or brown mylar packaging tape on these parts to prevent adhesion.

Because the wheel fairings are made using epoxy resin, epoxy must be used when creating the intersection fairings between wheel fairing and gear leg fairing. At the gear leg fairing to fuselage intersection, polyester resin may be used instead of epoxy if desired. A lay up of three thickness of 9 oz. fiberglass cloth is about right for intersection fairings. After the initial lay up has cured, several more brush coats of resin are applied to fill the cloth weave. The final coat of resin should be "finishing" resin which cures to harder finish, making sanding easier.

The upper intersection fairings are not permanently joined aft of the gear leg. The natural flexibility of the fiberglass allows them to be opened and removed if necessary.

The intersection fairings for the gear leg/wheel fairings are intended to become an integral part of the wheel fairing, so sand the surface of the wheel fairing with 60 grit sandpaper until all the gel coat is removed and fiberglass strands start to show. Clean with acetone to improve adhesion.

Lay up the fairing as one piece and when it is cured, split it top and bottom at the wheel pant joint, using a die grinder and cutting disc. The split can be made by carefully using a small cutting wheel in a Dremel tool. To protect the gear leg fairing, a 3/8 inch wide piece of scrap 0.016 or 0.020 aluminum which has had one end sanded to an edge can be slipped under the edge of the uncut intersection and the gear leg fairing at the split line. If the cut is started at the top of the intersection, the aluminum can be pushed in as the cut progresses down the intersection.

Be very careful not to damage the gear legs or brake lines.

INSTALLING THE NOSE WHEEL

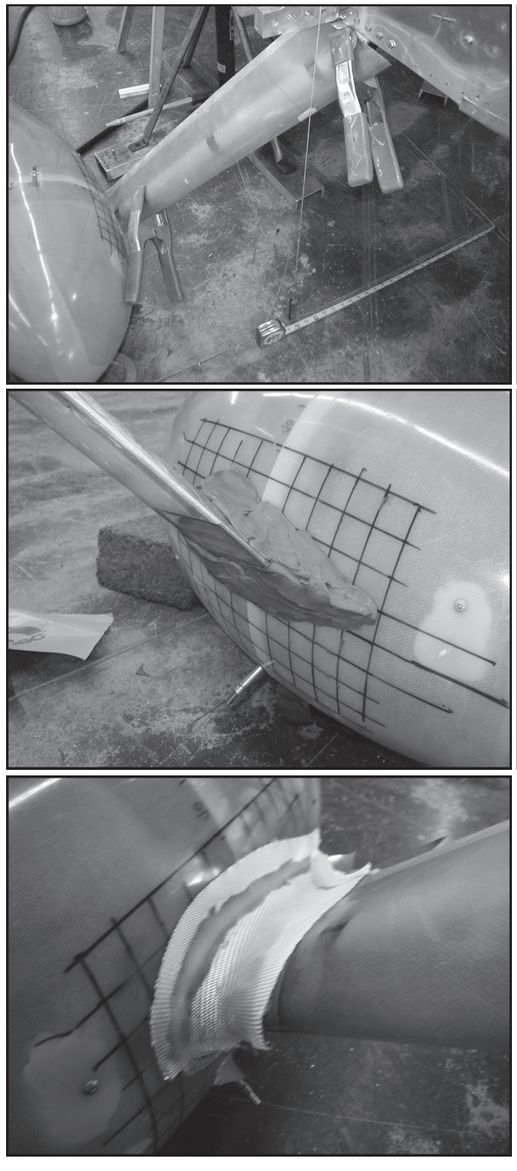
Coat the interior and bead of the tire with talcum powder. Also coat the inner tube so it will easily slide into the tire.

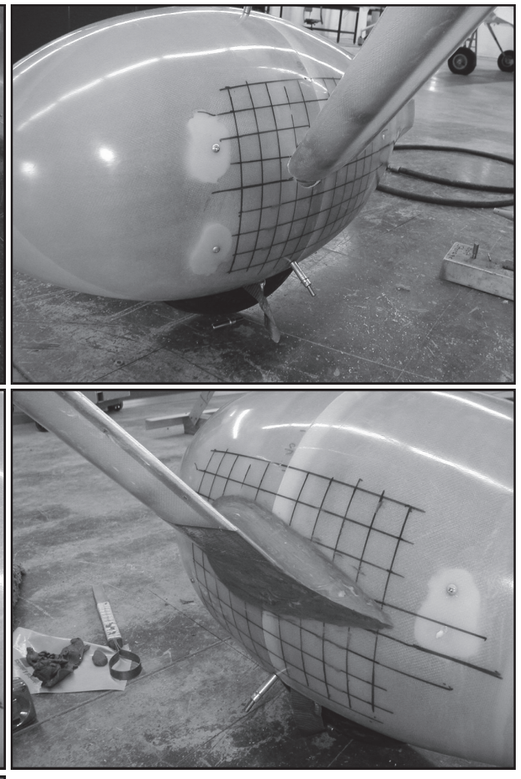
Van's uses Matco brand wheels for the RV-7A nose wheel. See DWG C1. The bead of the tire fits very tightly on the rim of the wheel. Insert the wheel halves into the tire and align them as carefully as possible... then, with two people, compress the halves together enough to get the three bolts started. BE SURE that the tube is NOT caught between the two wheel halves. Use the bolts then to draw the halves together. It is often helpful to inflate the tube slightly during this process to keep the tube away from the wheel parting line.

Once the wheel halves are together, torque bolts to the AN specification of 50-70 in-lbs, inflate the tube slowly to at least 60 psi and then remove the valve stem to allow it to relax completely. Doing this a couple of times will insure that the tube and tire are both in their correct positions. Final tire pressure should be around 30-35 psi.

Now, prepare the wheel bearings for installation. Clean the interior of the wheel, including the installed bearing races. Then grease the wheel bearings with the appropriate lubricant (Aeroshell #5 or equivalent). The bearings

The following photos and text illustrate how we fabricated the gear leg to wheel fairing intersection fairings on our RV-10 prototype. Use a similar method to make the upper fairings.





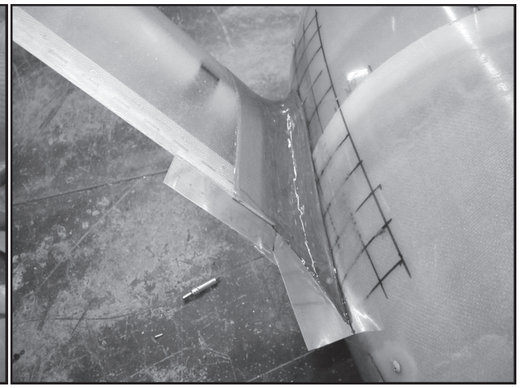
Top left: The wheel pant and gear leg are installed and aligned to their flying position, as explained in the builder's manual.

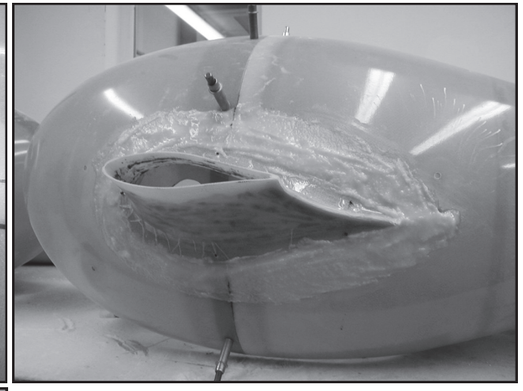
Top right: Before installation, a simple grid was drawn on the inboard side of the wheel pant. Without this reference, the swoopy intersection fairing would be almost impossible to make symmetrical.

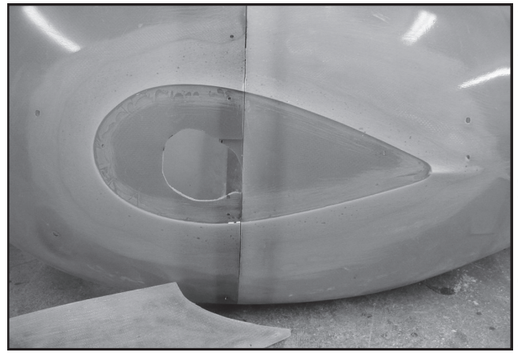
Middle left:: Oil-based modeling clay is applied to the intersection.

Middle right: Careful work with trimming tools like the one on the floor (simply a loop of crate banding strap attached to a wood handle. It works better if it isn't sharp), a damp spoon and a scraper made from a section of plastic milk jug streamlines the clay shape.

Bottom left: The intersection fairing will be a separate piece. It is not bonded to the wheel pant, so the pant is covered with a release solution or mylar tape. Strips of fiberglass cloth are laid up with resin. Be sure to cut all the cloth strips you will need before you start the lay-up.







Top left: Wider layers of glass cloth are applied. A total of four or five layers of 9 ounce cloth works well.

Top right: Scraps of taped aluminum sheet are inserted into the rear of the gear leg fairing to prevent the aft edge of the intersection fairing from bonding to itself. The finished intersection fairing will be flexible enough to open to remove from around the gear leg.

Middle left: The cured, sanded intersection in place, held by clecos. In the finished installation, nutplates will be installed on small fiberglass pads laid up inside the wheel pant and the fairing will attach with # 6 screws and recessed washers.

Middle right: For a smooth transition, the surface of the wheel pant is built up around the edge of the intersection fairing. The intersection fairing, covered in release solution, is screwed on, and a slurry of resin and cotton fibers (brand name Cabosil) is applied to the sanded surface of the wheel pant.

Bottom left: the hardened slurry is sanded to a smooth surface. After the usual filling and sanding, the landing gear fairings are painted and begin a hard, hard life.

have a seal of black rubber. This seal MUST have a coat of grease on its perimeter where it contacts the aluminum wheel. Insert the greased bearing sections into the wheel being sure that the rubber seals also fully insert. Then install the U-00710 Axle and U-00711 Spacer.

Next, thread on the axle nut. The rubber seals on the bearings produce considerable drag on the wheel and tend to cause the bearings to spin with the wheel rather than remain stationary with the axle. The nut will need to be tightened to provide just enough frictional force on the bearings to prevent them from spinning, but not overly tightened which would place undue load on the bearings. To accomplish this, tighten the nut while rotating the wheel back and forth. When the bearings are fully seated and the bearings seals no longer rotate with the wheel, tighten the nut to align the next available slot /hole combination in the nut and axle. Install the U-00712 Axle Nut Pin by inserting the bent end of the pin into the hole in the axle and then pulling the remainder of the pin over the circular, non-hexed portion of the nut. At this point there may be considerable rotational wheel drag; this is normal. Taxiing will break in the rubber seals and, within a short time, the wheel will rotate more freely.

The final step is to insert the wheel and axle assembly into the WD-630-1 Nose Fork. Once centered on the axle bolt hole, insert the axle bolt and any washers, brackets, etc., and install the nut on the axle bolt.

SETTING THE BREAKOUT FORCE OF THE NOSE WHEEL

When installing the nose wheel/fork assembly for use, tighten the nut down so it requires 14 ft/lbs of torque to swivel the fork on the axle. Measure this by rigging a small tension scale (like a fish scale) to pull in-line with the axis of the axle. DWG C1 shows this arrangement. Progressively tighten the axle nut while swiveling the fork and taking readings with the scale as the “break out” force increases. When the scales measure 22 pounds, temporarily safety the axle nut. Swivel the fork several times from stop to stop. Measure the pull both to the right and to the left. Be sure the scale is perpendicular to the wheel when pulling. If the scale reading varies significantly from one direction to the other, re-adjust the axle nut as required to achieve a scale reading of 22 pounds for the direction that produces the highest load.

If the cotter pin hole in the axle is more that half way between two adjacent notches in the nut, tighten the nut to align the notch with the hole; if less than half way, loosen the nut to align. Install the cotter pin.

INSTALLING THE WHEEL FAIRING and U-00713C-L/R-1 FAIRING BRACKETS

Install the WD-630-1 Nose Fork and the nose wheel, with tire mounted, onto the nose gear leg as shown in DWG C1. The airplane must be properly set up to use the dimensions on the plans for fitting the wheel fairings. See Note 1, DWG C1.

Finish the U-00713C-L/R-1 Nose Wheel Fairing Brackets by removing the material shown in the U-00713C-L/R-1 Trim Detail on DWG C1 and deburring all the edges. The screw holes in the tabs of the fairing brackets that attach to the U-813A Rear Nose Wheel Fairing will not be visible through the wheel fairing. To locate these holes on the wheel fairing, incorporate the method in Section 5.18 MATCH-DRILLING OPAQUE FIBERGLASS PARTS into this section.

Tape a 1/2” thick spacer – almost any solid material will work – to the top of the nose wheel tire. Slide the U-00713C-L/R-1 brackets onto the nose fork, fitting the slot of the brackets around the smaller NAS washers of the axle bolt. The brackets will be “sandwiched” between the larger washers and the nose fork. Use the socket head cap screws to secure the brackets to the fork.

In order for the U-813A Rear Nose Wheel Fairing to slide into position, it will be necessary to trim the bottom of the fairing to clear the tire, and the top of the wheel fairing to clear the gear leg. During this iterative process, keep all trimming to the minimum required. When this is accomplished, slide the fairing into position and support it with blocks on the floor.

All the tabs of the U-00713C-L/R-1 Brackets should rest on the inside surface of the wheel fairing. Note any adjustments necessary on the tabs, remove the wheel fairing and bend the tabs to fit. While the wheel fairing is off, make measurements and marks on the floor (or a temporary template) to the position of the socket head cap screws. Replace the rear wheel fairing, allowing friction to hold it on the brackets.

Fit the U-813B Front Nose Wheel Fairing. Cut a slot in the top of the fairing that will clear the nose gear leg and allow the front and rear halves of the fairing to join. The fairing will ultimately require additional trimming to clear the gear leg as the nose wheel is rotated to its stops, but, even at this point, keep the clearance gaps to a minimum. Drill, then cleco the wheel fairing together (3” between the nutplate screw holes on both sides of the gear leg slot should provide sufficient edge distance after the final trimming of the slot is completed). Trim the bottom of the fairing for a at least a 5/8” clearance with the tire in all directions.

Adjust and block the wheel fairing into position. Drill and cleco the rear wheel fairing to the tabs of the brackets.

Now, rotate the nose wheel back and forth while noting and marking locations of fairing interference with the gear leg. Trim to clear. Repeat the process until the nose wheel can be rotated to both stops without interference. Although the clearance gaps will be covered by the bottom of the U-00019 Nose Gear Leg Fairing, excessively large gaps will be visible; so, keep the gaps to a minimum.

Remove the front wheel fairing and determine the position of the socket head cap screw on the outside of the rear wheel fairing. Drill this hole undersize, file any adjustment necessary to keep the hole centered on the bolt, and

finish the hole to the called-out dimension for the socket head cap screw or to sufficient size for tow bar access to the bolt.

Remove the wheel fairing and brackets and install the nutplates in both the bracket and rear wheel fairing. Complete the necessary countersinking, etc. on the fairings.

Permanently install the brackets on the nose fork and re-install the nose wheel fairing.

COWL/NOSE GEAR LEG INTERFACE

It will be necessary to inter-relate the following instructions with those for cowl installation in Section 12. Refer to DWG 45 which shows the relationship of the bottom cowl and the nose gear leg.

A slot must be cut in the fiberglass cowl to allow it to slide on and off around the nose gear leg; DWG 45, SECTION T-T provides information for making the slot. The slot leaves an opening in the cowl forward and aft of the leg. To strengthen the cowl, and to improve cooling air outflow and aesthetics, removable close-outs are installed. Details for the close-outs are also shown on DWG 45.

As shown in DETAIL K, cleco the FF-00097A Close-Out and FF-00097B Doubler together, locate the parts on the bottom cowl, then drill the screw holes into the cowl using the holes in FF-00097A as a guide. Similarly, locate the FF-00096 Close-Out and drill the screw holes.

Machine countersink the required rivet holes in FF-00096 and FF-00097A & B, then rivet the parts and install the nutplates.

FIBERGLASS NOSE GEAR LEG FAIRING

The U-00021 Nose Gear Leg Fairing is a fiberglass wrap-around fairing with one end molded to match the curve of the bottom of the nose gear leg. Details are shown on DWG C1.

Remove any twist from the gear leg fairing in the same way as the main gear leg fairings. The nose gear leg fairing has an obvious flange along the trailing edge. With twist removed, tape the flanges together in several places, then drill three #40 holes through the flanges and cleco to hold them together. Remove the tape.

Trim the nose gear leg fairing to within 1/4” of the factory marked trim lines on both ends of the fairing.

The nose gear leg fairing is attached using a through bolt at the top of the fairing and two screws at the bottom. The holes for the attachment hardware will need to be located from the gear leg by sighting through the fairing. In order to make the fairing transparent enough to see the underlying holes (the magnetic ball locating method will not work here), the gelcoat in the area of the holes will need to be removed with sand paper. The sanding locations are indicated by two factory marked dots on both sides of the fairing. A final sanding with 400 grit sand paper should achieve the required degree of transparency (when actually sighting the holes, using water to wet the area will improve transparency).

The gear leg fairing is fitted using an iterative process. The fairing is slipped onto the gear leg, locations that require trimming are marked, the leg fairing is removed and the lower and upper ends are trimmed, then the faring is slipped back on the leg and checked for fit. Repeat this process until:

1. The fairing can close around the attach bracket at the bottom of the gear leg with the trailing edge clecoed together. (This will require trimming the lower end of the leg fairing until the fairing can drop enough, relative to the gear leg, to place the bracket in a deeper portion of the fairing cross-section.)

2. The lower end of the gear leg fairing covers the clearance gap in the wheel fairing forward of the gear leg.

3. The gear leg fairing clears the wheel fairing and the structure at the upper end of the gear leg. (Minimum clearance with the wheel fairing is sufficient for now, more clearance trimming comes later.)

Now the attachment holes are located and drilled. With the fairing in place on the gear leg and the trailing edge clecoed together, make sure the fairing plane of symmetry is aligned with the plane of symmetry of the airplane. Sight through the sanded areas of the fairing and mark the locations of the underlying attachment holes. Remove the fairing and drill the holes in the leg fairing as dimensioned in DWG C1.

Next, the hinge is located and drilled. Sand any resin build-up on the inside surface of the nose gear fairing where the hinge will lay. It must be smooth so that the hinge will lay flat against the surface as shown on DWG C1, SECTION A-A. The length of hinge shown in the drawing is the final, installed length; at this point, the hinge will need to be long enough to extend beyond both ends of the fairing by about and inch. Draw the rivet line on the outside of both hinge halves. Cleco the trialing edge. Place the hinge inside the fairing so that it extends beyond both ends of the fairing and rests flush against the inside without forcing the trailing edge open, then clamp in place. Mark the ends of the rivet line on the fairing from the rivet line drawn on the hinge, then complete the rivet lines on the fairing by connecting the marks. Mark the rivet spacing on the fairing (note that the location of the first rivet hole at the bottom of the fairing is dimensioned from the hole in the attach bracket; the lower hinge trim is based on this hole) and drill and cleco the fairing and hinge. Mark the upper end of the hinge to be trimmed flush with the end of the fairing. Remove the hinge, remove the hinge pin from the hinge, then trim the hinge to length. Machine countersink the fairing and rivet the hinge halves in place. Cut the hinge pin roughly one inch longer than the hinge. The extra length is bent and secured to the upper end of the fairing with safety wire. Trim off the trailing edge flanges.

Install the nutplates on the attach bracket at the bottom of the gear leg, then install the leg fairing. Trim the leg fair-

ing as necessary to clear the nose wheel fairing as it sweeps through its range from stop to stop.