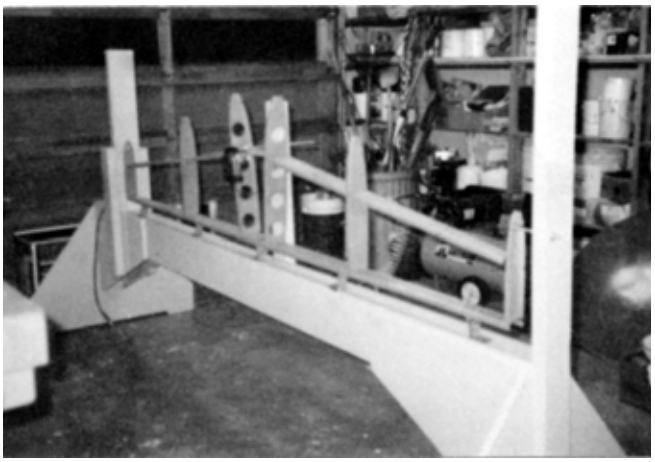
General Tips

Horizontal Stabilizer Jig [3/89]

Here is a photo of a free standing jig for the horizontal stabilizer. The important feature of a free standing jig is that it has to be sturdy and have wide feet.



Drain Holes [12/93]

by Van

All aircraft structures are subject to water entrapment. Sometimes it is due to rain intrusion, sometimes it is condensation. Thus all structures need to be fabricated with drain provisions. Those of you who have covered aircraft with fabric are familiar with drain grommets bonded into the low points of any wing, control surface, etc. Drain holes are also pre-flight inspection points.

You will notice that the RV plans make little mention of drain holes. This is because most components have natural drain paths incorporated into them. All control surfaces have end ribs which do not extend to their trailing edge. The wing itself has ribs which do not seal at the rear spar low point, thus permitting water to exit. However, several things have come to our attention which we need to pass on.

1. **Closed Ends on Control Surfaces**: Some builders have customized their RVs by filling in the end ribs of the control surfaces with foam/fiberglass or balsa wood to improve the appearances or perhaps the aerodynamics. This practice obviously closes the natural drain holes, necessitating that other openings be provided.
2. **The Rudder Bottom**: This is one exception to the natural drain of the control surfaces. While the trailing edge is open like other control surfaces, the fiberglass rudder bottom is a water trap. A hole, preferably about 1/4" diameter, must be drilled in the fiberglass bottom at its low point. When drain holes are drilled in fiberglass, they should be filed out smooth. Otherwise the stray fibers left by the rough drilling can attract lint, dust, and oil and eventually plug holes which otherwise seem more than adequate in size.
3. **Fuselage Low Points**: In the tailwheel RVs, the low point of the fuselage is at the rear bulkhead, so it would seem that a single drain hole at this point would suffice. Not necessarily so! Because of the tendency for oil, gum wrappers, AN960-1032 washers, etc. to collect in the tail cone of your airplane, natural dams can be formed at the otherwise vented fuselage bulkheads. It is suggested that a 1/4" or larger hole be provided in the base of each fuselage bulkhead, or that a 1/8" hole be drilled in the belly skin just uphill of each bulkhead.

Even if you keep your RV hangared, drains are important. You may go for years without a problem. Then when you are sufficiently complacent you will leave your RV tied down on the ramp during a cross country and it will get rained on real hard all night. Remember the ancient truism: *"water can find its way into an airplane but not out"*. While rare, it's possible for enough water to collect in control surfaces of upset their balance and cause flutter. If it rains and the entrapped water then freezes, and you fly before it thaws, you've got real problems. A couple of gallons of water, frozen or trapped in the aft end of the fuselage, could shift an already aft CG over the limits.

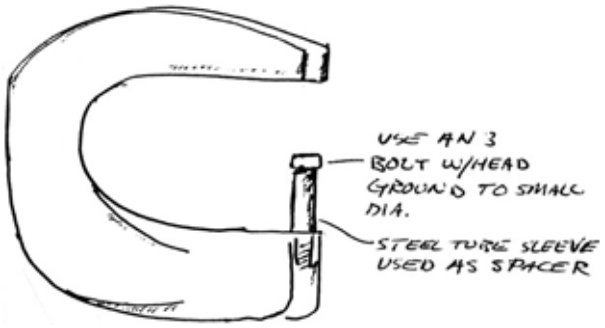
Tail Hints [12/96]

by Ken

Here are a few tidbits I learned while reteaching myself how to build:

- Think from the skin in, build from the inside out.
- Do all the drilling, dimpling, etc. you can before removing the vinyl.
- Dress all the edges on the Scotchbrite wheel after the vinyl is removed, otherwise the heat melts the edges of the plastic and it is tedious trying to get all the stringy bits off the metal before priming.
- Build the skeletons accurately and pay special attention to the small detail drawings. Andy has done a good job on these dimensions and they work, and with the holes already in the skins you can't afford to be off by much.
- Drill the rivet holes in HS-810/814 before you taper the ends. You can put a fence on the drill press and neatly

line up the holes. The outboard hole becomes the center of a neat radius at the end of the bar.



- You can make a simple dimple die for the #10 screws which attach the rudder counterweight. Use a small 3/4" thick block of oak (aluminum, hard plastic), countersunk to form the female side, and the screw itself as the male. No need to buy an expensive die set.
- It is difficult not to disturb the hinges in the trim tab and left elevator when you squeeze the rivets. You can make a small diameter set by grinding an AN3-10 bolt to fit behind the eyelets.
- Don't be afraid to use the hand seamer. I had to adjust the trim tab spar several degrees.
- Fitting the R-410 at the bottom of the rudder is a little tricky. It is easy to cut too much of the sides away and loose edge distance on the holes in the rib flange. If your part has the blue line on it, wipe it away and build a cardboard mock-up to get the exact dimensions. For some reason the R-410 is shown attached to the bottom of R-405PD. It attaches to the top on the RV-4, 6, and #6A. If you have difficulty getting edge distance on the top edge of R-410, where it attaches to the rib, you can install it on the top of R-405PD and gain a little.

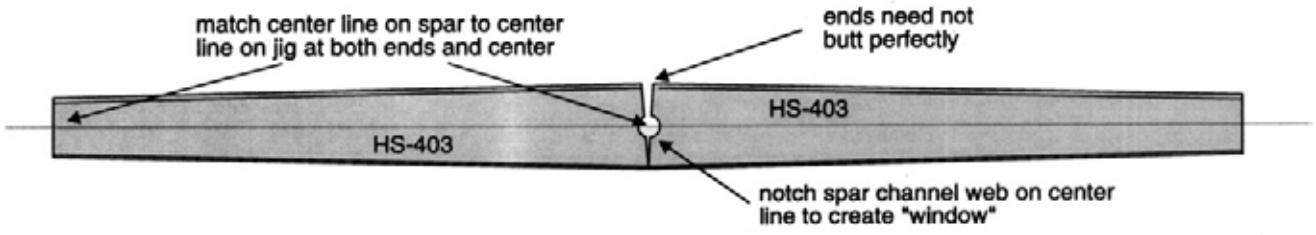
STABILIZERS

Stabilizer Spar Alignment [3/92]

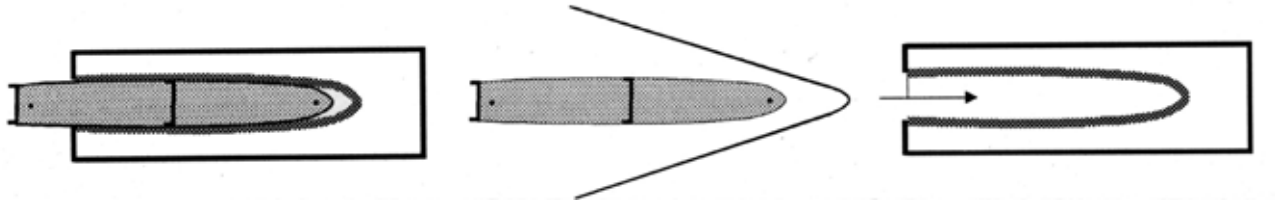
Several phone conversations have shown that some new builders have not grasped the importance of keeping the stabilizer spars, particularly the rear horizontal, straight. They having been simply butting the ends of the spar channels together and proceeding. This is not accurate enough and will cause alignment problems throughout construction. Here is the procedure.

Draw a spanwise centerline on the rear face of each HS-603 (403) spar channel. File a 1/8" (approximately) notch in the inboard ends of each spar web. Lay the HS-603 channels, flanges up, on the crosspiece of the empennage jig. Butt the inboard ends together and use the "window" created by the notches to locate the centerline on the jig. Align the spar channels with the line on the jig and clamp them in place. (A couple of #40 holes may be drilled on the spar channel centerline and the channels clamped to the jig without compromising spar strength.)

Now the HS-409 flange strips may be prepared, laid out and drilled to the spar channels. The spar will be straight, and all subsequent operations, installing the hinge brackets, etc., will be easier and more accurate.



Stabilizer Clamps [pre 1987]

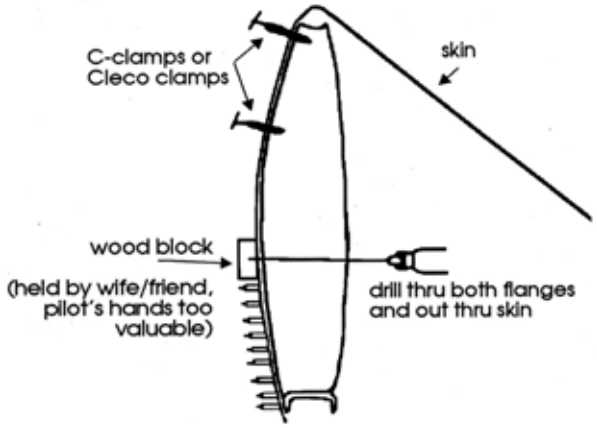


RV-4 builder Jim Franich came up with a very handy tool to aid in the construction of his stabilizers. It is a very simple form of a "C" clamp which is made of a piece of plywood 1/2–3/4" thick sawed out as shown and slipped over the skins to hold them in place on the jigged up ribs and spar assembly. As most of you are aware, the pre-bent skins supplied with the kits do require additional bending pressure to hold them in shape for drilling and riveting. A couple of these clamps of varying sizes, padded to protect the aluminum, work very nicely.

Back Drilling Stabilizer Skins [1988]

by Dan Moffett

Instead of locating the underlying spar or rib flange by marking lines on the skin and drilling blind through the skin, you can (after clamping the skin in the proper position) lift the skin on one side and using a 12" drill bit, drill through the hole centered in the flange completely through the flange on the other side and out through the skin. Of course, all the hole locations should first be marked. Drilling should begin along the rear spar since creating the proper overhang positions the skin correctly. Clecoes are placed in the holes as they are drilled. It helps to have someone to hold a piece of wood over where you're drilling to keep chips from forming between the skin and flange. They can also place the clecos since they are on the other side of the skin. After one side is done, the skin is clamped down on the other side. The clecoes are removed and drilling is done from the previously clamped side.



The drill bit is placed through the existing holes, and holes are drilled through only the skin on the other side. Cleco as you go. This works great except for the holes near the leading edge where the flanges are not parallel. But, since a line of holes is already established, it's easy then to figure out where the flange center is.

Van Adds: We might add that this idea does have merit. However we would caution anyone using it about the need to regularly check for vertical alignment. With one side of the skin peeled back, the opportunity for misalignment is greater than when the entire skin is held down during drilling.

Horizontal Stabilizer Tips [1999 6th]

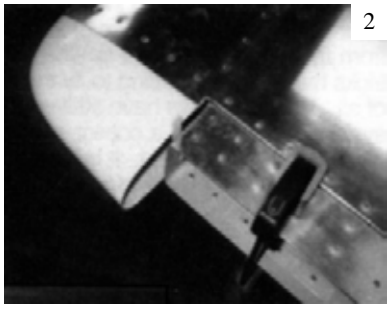
by Leo Benetti-Longhini

Here is another option for closing off the open end of the fiberglass stabilizer tips. Begin by placing the tip in position and making sure that the joggle in the fiberglass matches the edge of the horizontal stabilizer skin. File the joggle if necessary until the tip fits snugly. Verify there is sufficient clearance between the front face of the elevator counterweight skin and the step in the HS skin. File the HS skin if necessary (mine needed about 1/8" trimmed)

See Photo 1. Mark a line on the tips upper and lower edges perpendicular to the HS skin edge. The line should be about 1/32" upstream of the step in the HS skin (this will be taken up by the tip's new fiberglass cap). On a flat surface, sand the open end of the tip down to the line.

1

Once the tip fits and the clearance between the counterbalance skin is verified, the tip shape must be fixed. Bond a small support (piece of a wooden mixing stick between the inside surfaces of the tip near the opening. It should hold the tip snugly against the HS skin without deforming the tip. See Photo 2. Use a small dab of automotive body filler at each end of the support stick. It sets up fast and can be easily removed later.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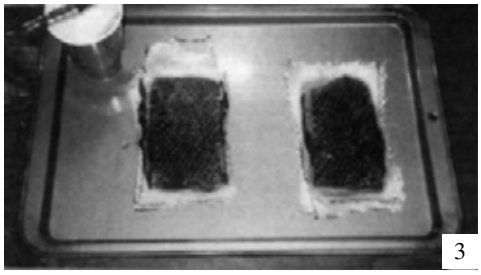
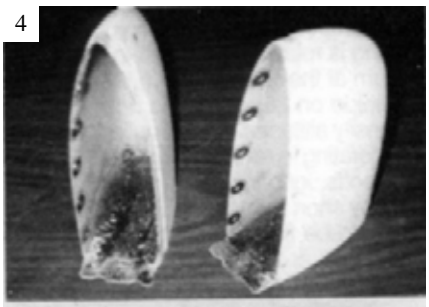

3

While the body filler is curing prepare the fiberglass that will cap the tips. On a non-stick surface, layup 3 – 4 layers of 3x6" pieces of fiberglass. See photo 3. West systems epoxy was used even though the tips are polyester resin.

Place the tips onto the fiberglass layups with the open end down. Leave an extra 1 1/2" of fiberglass on the inboard side of the tip. This will fill the space inside the HS rib. See photo 4. Use some weights to force the tips into the uncured fiberglass. I taped the counter balance weights to the tips. Note the additional support sticks bonded to the inside of the tips. The tips had settled and needed to be opened a little to match the counterbalance skins.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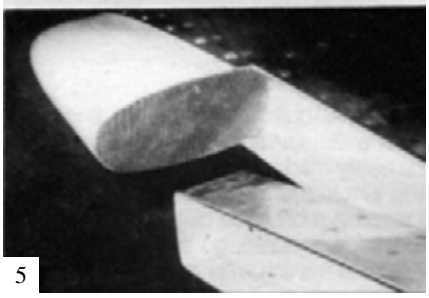
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Once the fiberglass has cured, trim and sand the new fiberglass flush with the molded tip. Sand parallel to the surface of the molded tip until the white gel coat just begins to be scuffed. File and sand the fiberglass extension to fit inside the HS skin and rib. Remove the support sticks and grind away the body filler with a die grinder or Dremel tool. I had to notch the extension to clear 2 rivet heads. See Photo 5. Position the tips on the stabilizer and match drill the skin with the tips. Lay up some strips of fiberglass tape along the inside comer of the tips to reinforce the bond between the tip and new cap. Additionally, bond some #6 washers at each hole with 5-minute epoxy. While the corner layup is curing, de-burr and dimple the holes in the HS skin.

Finish the tips by countersinking the holes along the fiberglass joggle. Pop rivet the tips to the stabilizer. I applied epoxy between the skin and the tip to fill in any voids and provide some permanency to the installation. Fill the pop rivet heads with a low-density filler before sanding and priming.

RV-10 Service Bulletin SB 06-2-3

[2006 1st]

During our winter maintenance program, we found cracks at the top of the vertical stabilizer spar on N410RV, our RV-10 demonstrator. At the time, the airplane had flow 700+ hours and had been stalled hundreds (maybe thousands) of times.

In response, Van's issued Service Bulletin SB 06-2-3 on February 3, 2006. This details the addition of a doubler to the vertical stabilizer rear spar. All RV-10 builders in Van's records have been mailed the Service Bulletin directly and necessary parts to comply are provided free of charge. The Service Bulletin has also been posted on Van's website. On the chance that there is an RV-10 builder not in our database, or somehow didn't get the word, here is the Service Bulletin

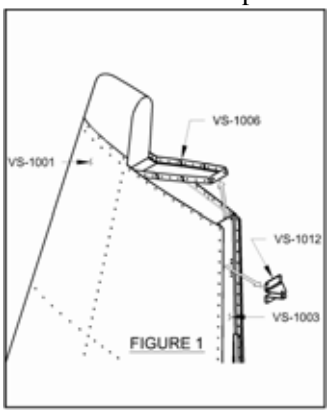
Required Action

To satisfy this Service Bulletin, install a hinge doubler as detailed below. The hinge doubler will be provided free of charge.

STEP 1

Drill off the two rivets attaching the VS-1006 Top Rib to the VS-1003 Rear Spar. Drill off enough of the rivets along both sides of the top rib that will allow the top rib to be lifted as shown in Figure 1.

Drill off the eight rivets attaching the VS-1012 Top Rudder Hinge Brackets to the rear spar.



STEP 2

Final-Drill #30 the holes in the VS-1017 Hinge Doubler, shown in Figure 2, which are common to the VS-1012 Top Rudder Hinge Brackets.

Cleco the hinge doubler to the aft face of the VS-1003 Rear Spar web using the holes that were used to attach the top rudder hinge brackets.

If necessary, rivets along one side of the rear spar that attach it to the VS-1001 Vertical Stab Skin can be drilled off for easier access.

Match-Drill #30 all of the remaining holes of the hinge doubler into the rear spar.

Uncleco the hinge doubler, deburr all holes, and prime if/as required.

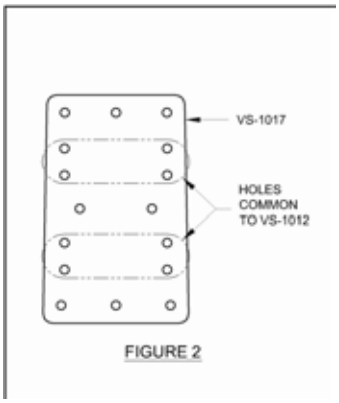


FIGURE 2

STEP 3

Cleco and rivet the VS-1017 Hinge Doubler to the forward side of the VS-1003 Rear Spar using the rivets called-out in Figure 3.

Cleco and rivet the VS-1012 Top Rudder Hinge Brackets to the rear spar and the hinge doubler using the rivets called-out in Figure 3.

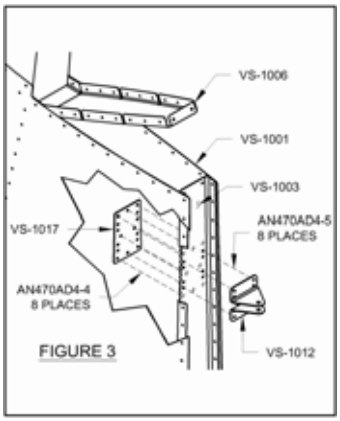


FIGURE 3

STEP 4

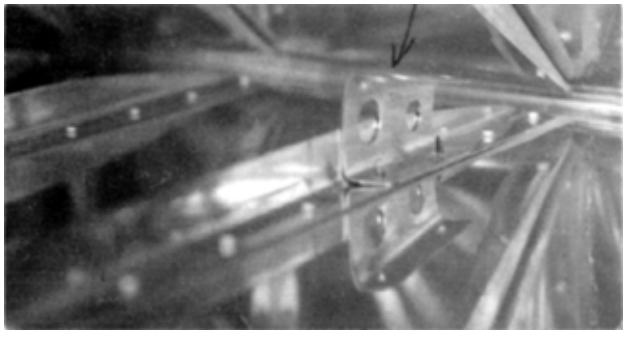
Rivet the VS-1006 Top Rib to the VS-1003 Rear Spar using AN470AD4-4 rivets. Rivet the VS-1001 Vertical Stab Skin to the top rib (and if necessary the rear spar) using AN426AD3-3.5 rivets.

ELEVATOR & RUDDER

Elevator & Rudder Stiffener Supplement [12/89]

by Jack Hakes

Here is a technique used to stiffen the elevator and rudder trailing edges. It consists of a short full depth rib segment of .025 aluminum which is bent to fit between the stiffener angles on the top and bottom skins. The snub rib is attached to the angles with the 3rd and 4th rivets from the trailing edge. They are attached to the top skin with 426AD3 rivets before the trailing edge radius is bent closed, and then to the bottom skin with 3/32" MK-319-BS pop rivets. I used the stub ribs at every other stiffener angle and found this to be enough to add significantly to the firmness of the skins.



We have not yet tried this technique, but see nothing wrong with the principle. We feel that it might be a bit difficult to form the snub rib to the correct shape and depth for each station and difficult to buck AN rivets in the shallow rib segment.