

## **WING-ADECTOMY (or How to open your wing)**

**Note:** This procedure explains how to open the wing for inspection, cleaning or replacement of various internal parts. It is very time consuming and requires the advice and guidance of a certified A&P (AME) mechanic that knows about riveting and structural aircraft components. Do not undertake this without their help!

After an unfortunate incident, I realized that a “new” right-hand wing was in the cards for replacement on my Seabee. As luck would have it I had access to a set of wings that were very low time and in reasonable shape. Once home the wings were scrutinized and it was determined that opening the wing would be required to clean out years of bird nests, squirrel nests and other wildlife that called these wings their home. But how do you go about gaining access to the innards of the Seabee wing? I wasn't quite sure but with the help of an expert mechanic a plan was developing that proved to work pretty well.

First, a flat, 16-foot table was to be made. Two four by eight OSB (particle board) sheets on top of a 2 x 4 frame did the trick. It stands about 34 inches high and is completely flat. Two holes were drilled into the top of the table to allow the float strut fitting and the wing strut fitting to sit down into. This allowed the wing to sit flat on the table. Cost? About \$75 USD.



Wing table – Notice 2 x 4's for holding the leading edge in place and holes for fittings.

Once the wing was on the table a detailed plan was finalized. We would drill out the wing tip rib rivets, root rib rivets and the rivets along all three spars along with the rivets on the center rib (remember, there are only three ribs in the wing), and the rivets supporting the wing float strut socket. There are approximately 100 rivets in each spar and 50-75 rivets in each wing tip. Only the rivets on the top of the wing were removed. The rib rivets were removed all the way from the trailing edge around to the flat underside of the wing. Removing these rivets allowed the wing skin to be lifted up enough to gain access to the entire inside of the wing without disturbing the skin rivets and putting very little stress on the wing skins.

**Note:** The use of numerous and various sizes of Clekos was used as the drilling progressed to prevent any unwanted strain on the wing frame. Once all the rivets were removed the Clekos were also removed. The rivets along the spar lengths are AN442AD flat head rivets. These were the original rivets Republic used. However, the three rib rivets and the float strut socket rivets are AN470AD universal head rivets that are the standard today. All the rivets are still available from rivet supply houses.

**Caution:** There is no need to remove any rivets that hold the wing skins together. The skins are all attached to each other and there is no need to remove them. All the wing skins are attached together as an "envelope". I'm sure this is how republic made the wings.



Wing opened up on the wing table. This allows full access to everything.



Once all the rivets were removed a 24-inch wood support was made to hold up the wing skin so that cleaning and painting could begin (see photo above). When I first opened it I was shocked at the amount of wildlife remains that were in there. There was a slight amount of surface corrosion on some sections of the lower wing skin but very little on the upper wing skin, which was a relief. The cleaning process soon began.

I initially removed all the grass and hay that the birds used for their nests and vacuumed the wing completely. Stubborn "stains" were removed with a hot water mix of soap (Dawn Liquid) and a green Scotchbrite pad (the red ones are too coarse). Each "bay" of the wing was cleaned and scrubbed to remove the surface corrosion and then cleaned with lacquer thinner and treated with Alodine in the spots that were bare aluminum.

The aileron bellcrank and flap hydraulic systems were removed for cleaning, painting and replacement. With the wing totally exposed like this, it made it much easier to inspect and replace inner components that would have been a nightmare otherwise. All steel hardware was replaced as the years of exposure caused much rusting of those parts. The navigation light wire was also replaced as the original wire was frayed and seemed to be a fabric covered wire not suitable by today's standards. The float strut socket hardware was removed and painted and the bolt holding the float strut "key" was replaced. This bolt is an AN6-30A bolt and could never be replaced any other way. Two large AN970-6 washers are used on the outside of the socket to hold the "key" in place.



Wing Float Socket with bolt and the "key" below the bolt.

After drying, the inside of the wing was then sprayed completely with a self-etching primer which worked exceptionally well. Use the self-etching primers available at your automotive paint supply, as these are much better quality than the "Home Depot" brands. I used the **SEM** brand.

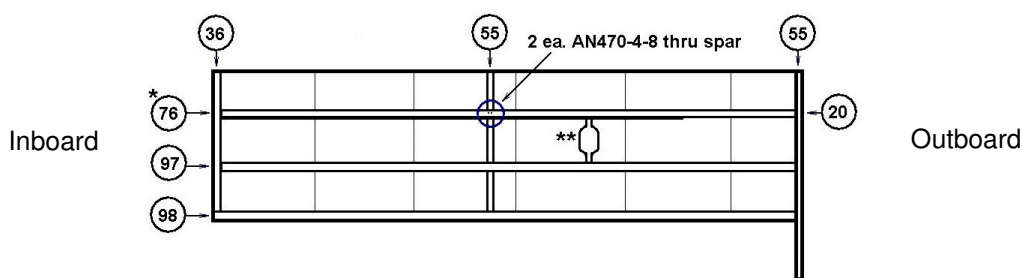
Once the primer was dry the inner components were reinstalled (except for the hydraulic lines explained below) and the top skin was repositioned for new rivets. The top skin was Clekoed in place completely and a new strategy was emerging; the aft spar had to be removed. This allowed much better access to the forward spar rivets and minimized the use of CherryMax rivets. This also allowed for the installation of the hydraulic lines after the center spar was riveted in place.

**Note:** There are some rivets on the forward, center nose rib and wing float socket that simply cannot be bucked even with the aft spar removed. In these cases CherryMax rivets were used. Make sure you use certified CherryMax rivets! Do not use just any pop rivet! CherryMax rivets are more expensive but there isn't that many that are required. The use of a CherryMax rivet gauge is indispensable to determine the rivet grip required. (A good investment at about \$10)

### Wing Rivet Count

#### Grip Conversions:

.062" = 1/16" Grip  
 .090" = 3/32" Grip  
 .125" = 1/8" Grip  
 .250" = 1/4" Grip



Forward Spar	- .065" - AN442-4-8 - 76 ea. (1 ea. - AN442-4-8 at root)
Forward Outboard Spar	- .065" - AN442-4-5 - 20 ea.
Middle Spar	- .035" - AN442-4-4 - 97 ea.
Aft Spar	- .050" - AN442-4-5 - 98 ea.
Wing Tip	- .040" - AN470-4-4 - 98 ea.
Root Rib	- .055" - AN470-4-5 - 36 ea.
Float Socket	- .050" - AN470-4-4 - 36 ea.
Center Rib	- .055" - AN470-4-5 aft of forward spar - 70 ea. CR3213-4-2 on forward center rib - 17 ea.
Root Rib Nut Plates	- .156" - AN470-3-4 - 16 ea.
Float Strut Fitting	- .055" - CR3213-4-2 - 16 ea.

#### Notes

- (76) = Rivet Count per Spar/Rib  
 Center Nose Rib must be CherryMax Rivets  
 \* = From root to end of spar doubler  
 \*\* = Float Strut Socket  
 Root Rib has 8 Anchor Nuts (16 AN470-3-4 rivets)  
 Cherry Max CR3213 = Nominal. CR3243 = 1/64" oversize.

It was now time to reset the wing skin onto the ribs and spars. Clekoed in place, a rivet count was done and the rivet gauge was used to determine the rivet "grip" (your rivet count may be different). See rivet count drawing above.

The riveting began at the main, forward spar working from the middle out toward the ends of the wing (This was the hardest part). Putting most of your upper body inside the wing and holding the bucking bar in place provides the best access to the "shop" end of the rivet. A Cleko was removed, an AN442AD rivet was installed and so on until all the rivets were installed in the spar. There is 1/8" angle reinforcement along the upper part of the forward spar that requires longer rivets than the remaining forward spar (see drawing above).

**Warning:** It is very important to inspect each rivet after it is driven to check for the correct shop head. The machine head should also be inspected for "smiles" and proper seating. If you can get your fingernail under the rivet or there are "smiles" on it drill it out and drive another rivet.

The ribs were then riveted using AN470AD universal head rivets just to the main spar until the center spar was riveted to the skins. A rivet squeezer can be used on the end ribs. The center spar is very easy to get to with the aft spar removed and bucking was considerably easier however, the flap hydraulic lines cannot be in place while riveting the center spar for there is no room to get a bucking bar in place with them installed. You have to install the hydraulic lines after the center spar is riveted in place. Remember that all spar rivets are the AN442AD flat head rivets. I'm sure you could use universal head rivets but flat head rivets keep the original design intact. As you move closer to the wing float socket, these rivets are AN470AD rivets. You may not be able to access all the rivets in the float socket so CherryMax rivets are acceptable but must be a tight fit.

After the forward and center spars were riveted the aft spar had to be installed. A 2" x 8" wing support was made to assist in access to the lower part of the aft spar (see photo below).







End view of wing support for aft spar installation.  
(2 ea. 2 x 8 and 2 ea. 2 x 4)

The wing support is simply two 2 x 4's screwed to the bottom of two 2 x 8's. The smaller length lumber is much easier to handle as it is much lighter. This provided excellent wing support for installing the aft spar. Remember to put the small, 8-inch 2 x 4's on the wing table edge to prevent the wing leading edge from sliding and screw in the 2 x 4 support to the table. The aft spar can then be riveted using a rivet squeezer. If you don't have a rivet squeezer, get one! They are indispensable if you do any riveting at all. The rivets on the end of the aft spar that attach to the end ribs are AN442AD-5 rivets, which are larger than the wing spar rivets. These must be driven as a squeezer will not work.



Completed wing!!

After all that, you're done! All that's left is to strip the paint if you have to or touch up the rivets. Make sure you're A&P (AME) signs the logbook if he or she is happy with your work. I hope this helps in some way if for no other reason than to give you an inside look at the wonder of the Seabee wing.



Completed painted wing

### **Suppliers:**

AN442AD rivets	Hanson Rivet Company
AN470AD rivets	Aircraft Spruce or any Aircraft Supply house
CR3213 CherryMax rivets	Aircraft Spruce
CR3243 CherryMax rivets	Aircraft Spruce
Rivet squeezer	Aircraft Spruce
Lumber	Ed Smith Lumber, Gilbert, SC
SEM Self-Etching Primer	Enlow's Auto Supply, Lexington, SC

**Note:** CR3213 CherryMax rivets are "standard" size rivets. CR3243 are 1/64" oversize if you need them.