

## Vacuum-Bagging

For our airplane, Erik wanted to use the vacuum-bagging method. Vacuum-bagging is a process by which the wing is placed in a plastic sleeve and sealed, allowing the air to be pulled out with a vacuum pump creating completely uniform pressure around the entire wing assembly. The wing and skins are inside the plastic sleeve while the shucks are lightly weighted on the outside to hold everything in place.

For vacuum-bagging there is a fair amount of special equipment and supplies you need to have on hand. Many suppliers have kits available that have all the stuff you need to complete the procedure. A couple of those companies are: The Composite Store and Aerospace Composites. (See the Equipment list for contact information for these companies.)

Here's a list of the items we used:

Pump and regulator

Vacuum line

3 yards 36-inch-wide nylon tube (bag for wings)

3 yards 18-inch-wide nylon tube (bag for stabs)

1 roll of tacky seal

4 yards 2-inch breather strip



When the foam cores and sheets are prepared and ready for assembly, label the sheets according to where you want them to go. Determine placement by weight and the quality of the finish.

Obviously, the top outside of each wing panel should get the best-finished pieces. Try to match the sheets so that each pair is as close to the same weight as possible. The care you took in the initial groupings should make them close. We trim each sheet so there is only about  $\frac{1}{4}$ -inch overhang all the way around the panel.

Seal the wood with hair spray or Balsa Right and lightly sand with 300-grit paper as discussed before. Then, using thin epoxy (we used *Aerospace Composites* laminating epoxy), spread the mixture evenly on the panel. Leave no excess on the wood by scraping the sheets clean, leaving only a fine sheen perceptible when held up to the light. Make sure there are no dry spots. (Note: only go this fine with the glue if you are vacuum-bagging; more is required with other methods)

This epoxy takes about 10 hours to set so you have plenty of time to set up and align the cores and set up the equipment.



Once the glue is on the sheets, align them onto the cores and set them aside in the shucks. Cut a length of the vacuum bag material about 18 inches longer than you need. Erik likes to pull vacuum from both sides for a more uniform pull so he put a “T” in the hose and ran two long lines, one to each end of the bag.

Place the top side shuck down onto the flat work surface with the bag on top of it. Slide the wing panel and sheets top side down into the bag, being careful to retain alignment of the sheets. Slide in the cloth breather-strips alongside the panels on each side, make sure to keep the strip away from the work.

Here’s the tricky part. Peel one side of the backing off the tacky seal material and place it into the seam of the bag on each end. Fold a short length of breather strip around the end of the vacuum tube to keep the bag from sealing the tube, and place it so that it connects to the strip inside the bag. Wrap some tacky seal around the vacuum tube where it will exit the bag. When everything is lined up pull the backing off the tacky seal and mold it around the vacuum line so there are no leaks. Then seal the end of the bag along the entire seam.



Once the bag is sealed and everything is aligned, we like to clamp the vacuum lines in place before the pump is turned on. The idea is to get a smooth even pull around the entire panel so that there is consistent pressure on all sides at once. Any fold or wrinkle left to set will mark the work permanently. As the bag starts to shrink in, work quickly around the piece to pull out any wrinkles and keep the bag even on all sides.

When the pressure is about 4 psi and the bag is tight around the work, lightly rub out all of the wrinkles and folds working them out to the edges.



When the bag is smooth and even, turn up the regulator to reach about 8 inches Hg. Place the bottom shuck on the top of the wing panel and lightly weight it to ensure that the panel stays flat and true and let the piece set overnight. When the glue is dry you can simply cut the ends of the bag off just inside the seal and re-use the bag for the second wing panel.

Erik sheeted all of the foam parts for our Extra by vacuum bagging. The results are very strong and light parts that are permanently bonded.

