

Kelly McCombs' Kevlar Hinge

A few months ago we presented a spar system developed by Kelly McCombs of Fruit Heights Utah. In this month's column we'll describe a Kevlar fabric hinge system which Kelly uses in composite structures.

Many builders use Kevlar as a hinge material, but most have found hinge failure after several hundred cycles. This is because the epoxy penetrates the fabric during the vacuum bagging process, producing a brittle matrix which rapidly fatigues. What is needed is commonly called a resist — a material which will prevent the epoxy from penetrating the Kevlar, leaving the fabric in its original state, free to flex. Surprisingly, the resist which Kelly uses is a common grease pencil, as used for marking china and glass! A detailed description of the entire process is outlined below:

- Mark the hinge line with a pen or pencil. Be sure to mark the top, bottom, and both ends.
- Apply one layer of Kevlar fabric to the hinge line using 3M “77” spray.
- Using the grease pencil, mark a 1/4 inch wide area directly over the hinge line. Choose the color of the grease pencil carefully, as you will want to have good contrast between the grease pencil marking, the yellow Kevlar fabric, and the carbon fiber which will be added in the next step. Kelly suggests red or blue rather than yellow, black or green.
- Apply a single 12K tow of carbon fiber over the hinge line using 3M “77” spray. A portion of this material will be removed in a later step, but what remains will reinforce the hinge line.
- Apply fiberglass cloth to the entire structure, including the control surface. Use 3M “77” spray, or follow your normal construction practice.
- Vacuum bag as usual.
- Once removed from the vacuum bag, cut a V groove into the structure on the side opposite the hinge. This groove provides the clearance necessary for proper hinge movement, so it should go all the way through to the Kevlar hinge material.

- Flex the control surface so the V closes completely. Using a razor blade held vertical to the hinge line, scrape away the fiberglass and carbon fiber until the grease pencil line is just visible.
- The control surface hinge is now complete.

This process, with appropriate modifications, can also be used by builders who prefer to construct the leading edge of the control surface and the trailing edge of the main surface prior to 'glassing.

An added tip... If a length of music wire is imbedded in the leading edge of the control surface, the CG of the control surface will be shifted forward, inhibiting flutter.

Kelly included a small sample of a completed Kevlar hinge produced using the above described techniques. The resulting hinge is extremely strong and very flexible. As is usual with any new construction method, this technique should be tried out on scrap materials at least once before being applied to a model structure.