Kelly McComb's Spar System

Several of our past articles have dealt with flutter problems in swept wings and examined various means of inhibiting that destructive behavior. Kelly McCombs of Utah sent us a rather complete package of materials which details his method of building a very strong box spar using the vacuum bagging process. The package included a small cross-sectional piece of an actual wing built using his system.

A box spar is inherently strong in torsion, but Kelly's technique allows tailoring of the various parts so the assembled spar can withstand specific loads of high intensity. By using various types of fiberglass and carbon fabrics, for example, the spar can be made more rigid in the span-wise direction. The spar can also be made stronger at the wing root than at the tip by adjusting the types of materials and the number of layers used.

The real "secret" of Kelly's spar system is the use of 3M's "77" spray adhesive to hold the fiberglass and/or carbon fiber in place during application of epoxy and the vacuum bagging process. Kelly says it works great. An added benefit is the leading edge is close to being finished right out of the vacuum bag.

Kelly uses polycarbonate as the carrier, rather than Mylar™. He finds the polycarbonate material is available at a lower price than mylar — a 2' by 4' piece costs about $3.50 at any plastics shop. The polycarbonate is optically clear and gives an excellent finish. After coating with Armor-All™ or Rain-X™, this material can be painted so the finished wing is colored. As with mylar, the polycarbonate can be reused if you're careful with it. Kelly cut his carrier so it was just 1/16" short of the leading edge.

Kelly's process is a bit different than what is usually seen, as the box spar core is first cut out of the wing core, then replaced after fiberglass and/or carbon fiber is applied to it as deemed appropriate by the builder. Epoxy needs to flow into the spar area while the wing is under vacuum, but this is not a problem so long as Kelly's directions are followed.

Begin by cutting out the foam core. Note the length of the core will need to be about 1" more than the eventual length of the wing panel. Cut out the foam core as is your usual practice, then cut out the area which will form the box spar. Leave the last 1/2" of each end of the core untouched, as seen in

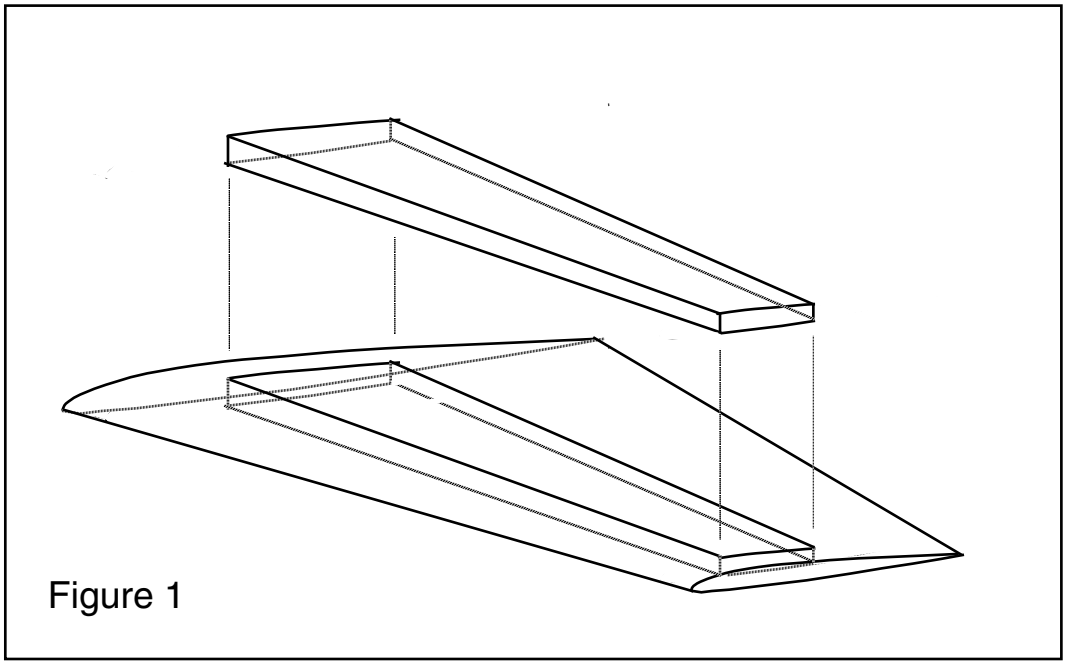

Figure 1. That last 1/2" at each end serves to hold the main part of the core in alignment.

Apply strips of fiberglass to both the front and rear face of the spar. Use 3M "77" spray adhesive in light coats to hold everything together. Don't forget you can make this webbing thicker at the root by putting on more layers. Once finished with this stage, spray the box spar with 3M "77" and wrap a layer of fiberglass around the assembly. Once satisfied with the box spar structure, push it back into the foam core.

Apply the fiberglass skin to the foam core, again using 3M "77." Spar caps of carbon fiber can be laid out on the upper and lower surfaces of the wing directly over the vertical spar webbing and between layers of the fiberglass wing skins. Brush epoxy over the wing surface using a 1½" brush. The polycarbonate, previously sprayed with a layer or two of paint, is then brushed with epoxy. Brushing another coat of epoxy on the core assures there is a sufficient supply of epoxy to the spar area.

Once the polycarbonate is laid out over the fiberglass and epoxy, the vacuum is applied and the entire wing assembly is left to cure.

The resulting structure is very strong, torsionally rigid, and relatively light. For additional information on this type of wing structure, look at the sketch and of the Vari-EZE wing in the September 1991 issue of *RCSD* or in "On the 'Wing... the book."

One additional trick... Kelly has found Kevlar™ thread laced vertically through the foam core before vacuum bagging really helps in preventing the fiberglass skin from peeling away at critical areas of the wing. The thread is not at all noticeable when the wing is completed, but it does become an integral part of the fiberglass skin.

The natural function of the wing is to soar upwards
and carry that which is heavy up to the place
where dwells the race of gods.
More than any other thing that pertains to the body
it partakes of the nature of the divine.

— Plato