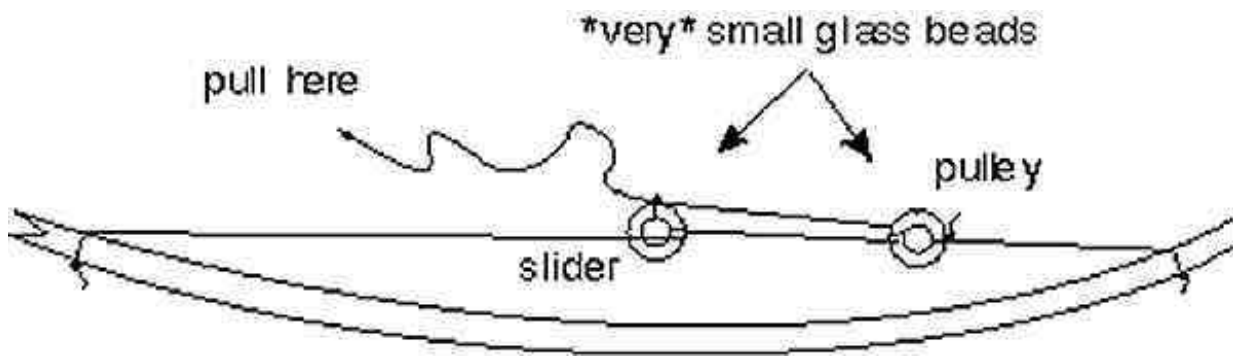


## ADJUSTABLE SPINE TENSIONING

When using carbon fiber for the spine of a fighter kite, figuring out how to put the rocker shaped bend in the spine can be a challenge. Not only how to get the bend in the spine, but also to be able to adjust the amount of bend easily is important.

Another important element is where along the spine the bend will be. This can be controlled by where the attachment points are located on the spine, since the only portion of the spine that will be tensioned and bent is that portion between the attachment points of the tensioning mechanism.

Most of the builders use Spectra or Spectra-like non-stretch line for the tension line. Some use Dacron line. When using Spectra, you need to be aware of the highly slippery surface it has and make certain you provide enough friction in the 'adjuster', whatever type you use to prevent slippage during flight.



As you can see in the photos, there are only a few methods that are used. The most popular and probably the easiest to make is the tensioning line with beads that Scott Bogue developed, shown above. The beads are used both as pulley's and by wrapping the line around the 'slider' bead it provides enough friction to minimize the tension line from slipping.



Ralph Resnik used his version of Scott's tensioning method on this kite.

**bow tensioner slip knot**



Many builders use only a line connected at the two points on the spine and use an adjustable knot, such as a tautline hitch, a prussik, or the knot Dennis Ische sent me in shown to the left to adjust the amount of bend.

Adjustable knots are the lightest way to accomplish the bend in a carbon spine, but they can be a little tricky to

adjust when making very small amounts adjustment. And depending on the line you use for the tension line, they may not hold securely because of the slipperiness of the line.



Chuck Lund thought of the 'brilliant' idea of using a nylon nut and bolt as a spine adjuster mechanism. Drilling small holes in the head of the bolt and the nut to thread the tension line through is all that is needed. It works very well. As you can see Chuck drilled through the center of the bolt and nut to attach the lines.



This is a simplified version of Chuck's nylon nut and bolt idea; I just drilled holes in the head of the bolt and into a nylon washer for the line. I have also drilled holes into the bolt like Chuck did. Both work.



I experimented with modifying Chuck's nylon nut and bolt arrangement. I drilled a hole through the flat carbon spine into the edge face of one of the nut facets, then inserted a short piece of 0.03" diameter carbon rod and glued it. The short rod acts like a post to help hold the nut onto the spine. Glue alone would probably not be sufficient because the tension needed to create the bend in a spine can be substantial.

Bruce Lambert 9 2005

Another method that is used to put a bend in carbon fiber spines is non-adjustable. By splitting the spine and gluing it back together clamped to a form that duplicates the bend you want in the spine, when the glue sets, your spine will be permanently bent. This is a great way to make curved carbon fiber spines. It is easy and relatively quick. I split the carbon fiber with a utility knife....carbon fiber splits very easily, similar to bamboo. I use a CA based glue designed for carbon fiber.

These photos and descriptions show a few of the methods fighter kite builders successfully use for putting a bend in a carbon fiber spine. I hope they give you some assistance in figuring out how you want to create bends in carbon fiber spines in your kites. Or if you're like me and prefer bamboo for spine material, you don't need any of the tensioning mechanisms ;o)

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