Making (well, Faking) a Tapered Bow With Carbon Fiber Rods

"Master, what is the difference between a fine kite and one with less desirable attributes?"
His mentor's reply: "Very little."

A fighter kite made with a bamboo bow has a slightly different look than one that made with a carbon fiber (CF) bow. It's because the bamboo bow is tapered – thicker in the mid-section and thinner out near the tips. The result is the "high-shouldered" look (the paper Indian on the right) the kite gets from the way the bow bends sharply at its ends. In contrast, the bend of a constant-thickness CF rod (like in the Steve Bateman kite on the right) is more even and the leading edge is straighter.

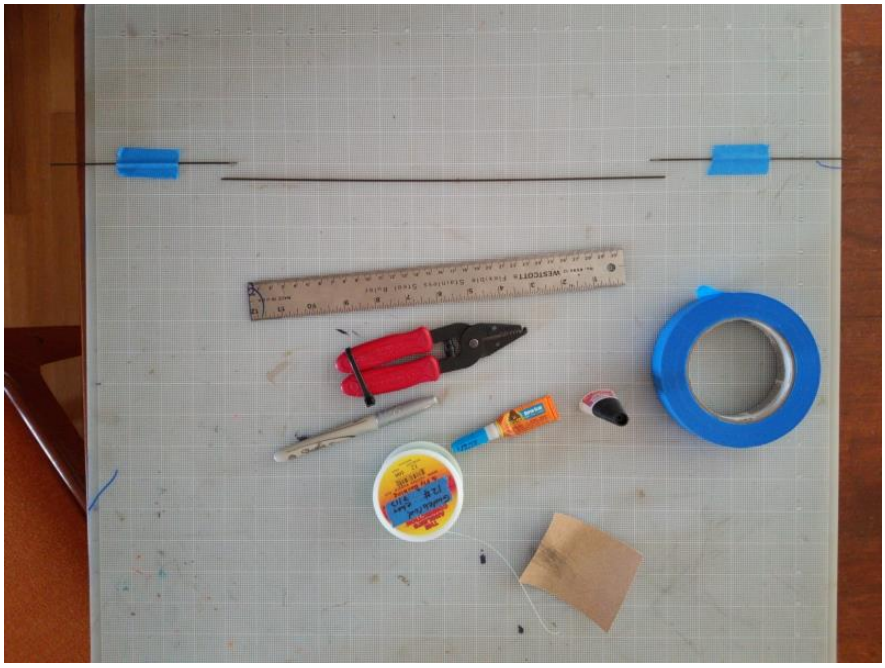
One way to simulate the bend of a tapered bamboo bow with CF is to join rods of different diameters together – thin rods at the tips and a thicker rod in the middle. Here is a way to do it with superglue and braided dacron line:

1. The kite I am building here is a "1952", which takes a 24" bow of 0.06 CF. I decided to try it with a bow made of 0.05" CF at the tips and 0.06" CF in the middle. Since the tip sections will bend more, I figured the bow would end up being a little bit longer than 24". So, I laid out a 25" bow that I could trim to length. I cut a 12" piece of 0.6" rod and two 7" pieces of 0.5" rod. Allowing for a ½" overlap at the two joins, the finished length was 25", looking sort of like this:

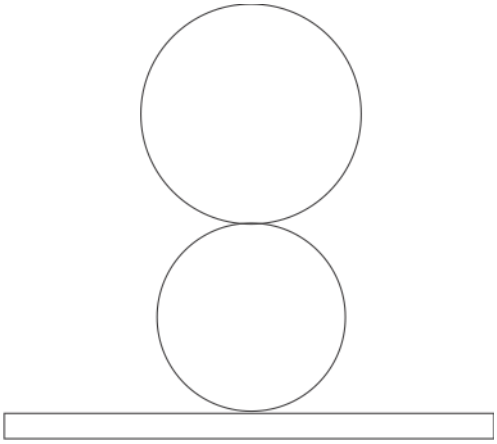
2. Next, I spent some time figuring out which way the rods want to bend. CF rods are NOT perfectly round, and so have an easy bending direction and hard bending direction. It is crucial

that the rods are joined so they can all bend in their easy direction. I use a silver Sharpie to mark the rod so can align its bend with the other rods.

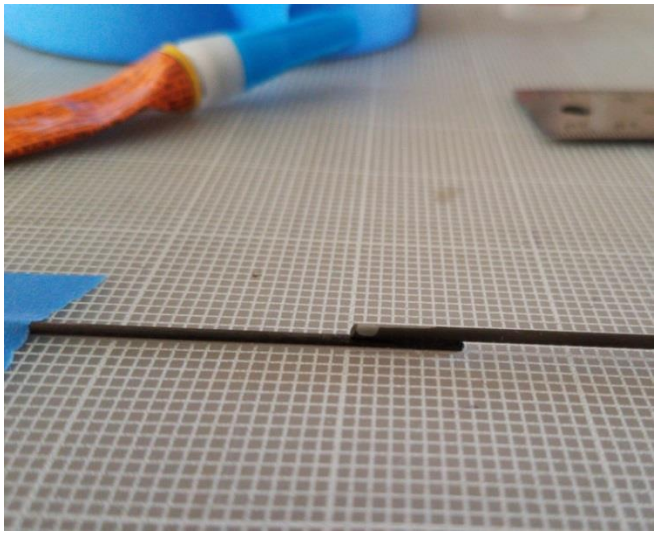
3. In the pic below, the 0.05" rods are taped on to my cutting mat. I have lined them up with a grid line on the mat and spaced them for ½:overlap with the 0.06" center rod. The 0.05"rods are aligned so their easy bending direction is vertical.



4. The next step is to tack the 0.06" rod on top of the 0.05" rods with superglue. The hard part is making sure that three things are just exactly perfect: 1) the easy bending direction of the 0.06" rod is vertical (like it is for the 0.05" rods); 2) there is the ½" overlap at both ends of the 0.06" rod; and 3) the 0.06" rod is centered over the 0.05" rods, as in the sketch below:



I put just a little bit of gel superglue on the ends of the 0.05” rods, set the 0.06” rod down on top, and then make sure that the alignment is just exactly perfect. In the close-up below, you may be able to see a silver Sharpie mark on the 0.06” rod marking its easy bending direction:

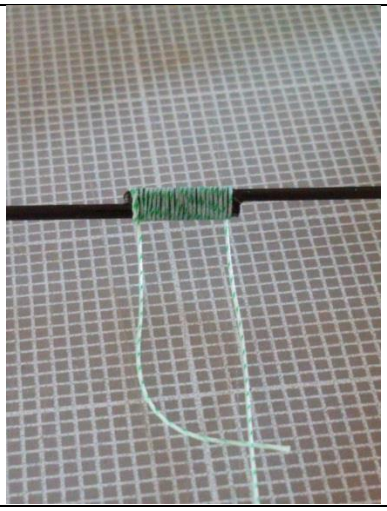


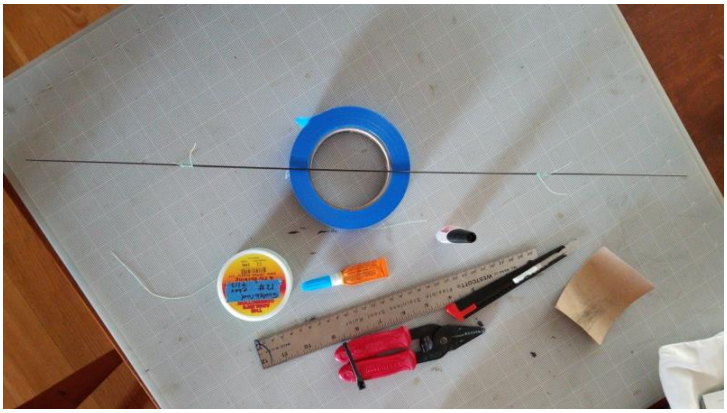
5. Once the superglue had set, I very gently removed the tape holding down the 0.05” rods and let the rod assembly lay flat on the mat. I ran some liquid superglue into the seam where the rods overlap, on both sides:

6. Next, I tightly wrapped both joins with bridle line (12# braided dacron) and then soaked the wraps with liquid super glue. Once the glue dried I trimmed off the excess wrapping line. I have

some much thinner thread (also by Gudebrod – intended for fly-tying??) that I meant to use, but forget. Next time.

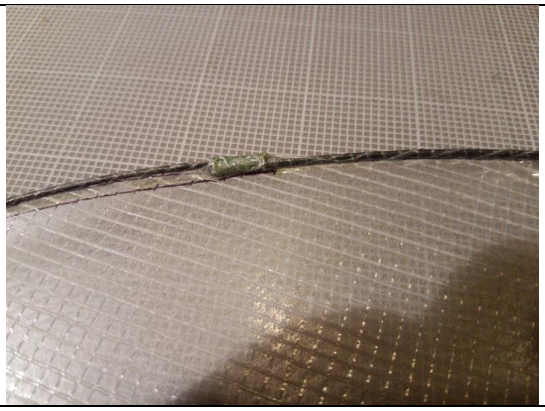
This bow came out perfect: when bent, the joins stay in the plane of the bend. That means that the bending directions of the three rods were well aligned. (Confession: I screwed up on my first try with this bow. Everything looked great, but when I bent the bow, BOTH joins rotated out of the plane of the bend (by a lot – like 45 degrees!) Since both joins were bad, it probably means I did not have the center rod lined up correctly when I tacked it down onto the tops of the 0.05" rods.)





7. The sail pattern dictates the positions of bow tips and where the top of the bow crosses the spine. I trimmed in both ends of the composite bow until it matched the pattern. As expected, it turned to out to be just a little bit (~5mm) longer than a uniform 0.06" bow. The leading edges of the sail will also have a different shape, but I trim those to shape anyway after having installed both the spine and bow onto the sail, so not a problem.

8. The pics below show how the composite bow looks after it is installed. Notice that the join is in the same plane as the bend – nice!



The pics below show the difference between the bend of an 0.06” bow (in the black kite) and the bend of the composite bow and (on the right) the finished kite with its “high-shouldered” look from the composite bow.

The composite bow gives a kite a soft but responsive feel. I presume that mostly comes from the wingtips being more flexible rather than the subtle change in the shape of the sail.