MAKE A TEMPLATE

1. Draw half sail plan on 17x22 pad with 4x4 (1/4 inch) grid. Add ¼ inch extra on nose (for reinforcement) and plenty of extra where the sail will attach to the bow (which you trim to fit after the bow is in place.)

2. Cut out plan leaving an inch margin around the sail outline. Glue to poster board (spray mount works fine), then cut on sail outline to make template.

LAMINATE A BEND INTO THE SPINE (these directions assume you are using rectangular CF)

3. Square off and bevel one end with a sanding disc on a dremel tool, then split nose-end of spine. Be careful to split as evenly as possible – it helps to first make nicks on the top corners.   Apply CA glue (Zap-Flex or Gorilla extra-tough) then clamp onto form. Try for ¼" bend if you will also be putting on a tensioner.

2018 UPDATE: Sometimes I narrow the width of the top 6" or so of the spine to make it softer. Just use coarse sandpaper, outdoors, and turned so that the wind carries the dust away!
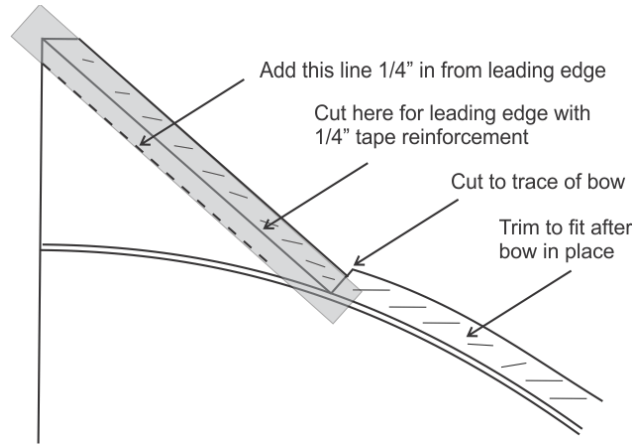
PREPARE THE SAIL

4. Draw centerline on sail material. Lay center edge of template on centerline and trace outline leading and trailing edges onto sail material. Mark where bow hits edge of sail and centerline. Before tracing other half of sail, extend both marks into sail (so that they won't be lost after cutting sail.) Flip template and trace other side of sail, marking bow positions. Extend bow marks into sail.

5. Cut the trailing edges of the sail. I use scissors, being very careful not to leave notches or jaggedy places between snips.

At this point you choose whether to a) reinforce the leading edge of the nose with a scotch tape or b) by folding the leading edge over and securing with double-side tape.

6. Either way, mark a line on the back of the sail that will become the leading edge of the nose (assuming you have not already cut to there --I draw my plans with an extra ¼ inch along the leading edge of the nose.)

7. (Option a) See sketch below. Draw a line 1/4" in from the leading edge line to guide the tape placement. Tear off a piece of ½ inch glossy scotch tape that will go from beyond the tip of the spine to about 1/8 inch past the point where the bow crosses the leading edge. Carefully lay the tape so that its edge is right along the line you drew ¼ in from the leading edge. Put a straightedge or similar object on the sail to make it lay flat,
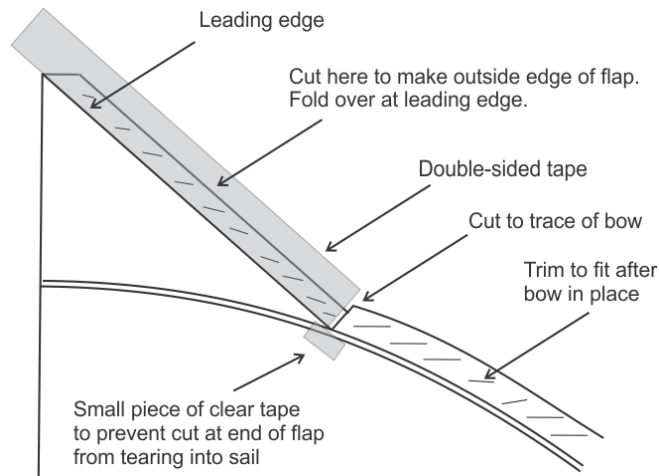
and make sure that the tape is not stretched when you drop it onto the sail (otherwise the sail will wrinkle when the tape unstretches.) Do the same for the leading edge of the nose on the other side of the nose. Burnish both strips of tape well, especially along the line that goes down the center of the tape (which will be the leading edge after cutting.)

Add this line 1/4" in from leading edge

Cut here for leading edge with
1/4" tape reinforcement

Cut to trace of bow

Trim to fit after
bow in place

.
Cut down the leading edge line. End with a 90 deg cut right out to the edge of the sail where the leading edge of the nose intersects the bow.

8. (Option b): See sketch below. Tear off a piece of ½ inch double-sided scotch tape that will go from beyond the tip of the spine to the point where the bow crosses the leading edge of the nose. Carefully lay the tape so that its edge is right along the leading edge line. Put a straightedge or similar object on the sail to make it lay flat, and make sure that the tape is not stretched when you drop it onto the sail (otherwise the sail will wrinkle when the tape unstretches.) Do the same for the leading edge of the nose on the other side of the nose. Lightly tap the tap with the tip of your burnishing tool to get it stick to the sail, especially along the center of the tape which is where you will be cutting.

The center line of the tape should be right along the template tracing (which is ¼" out from the leading edge.) Cut right down this line to form a ¼" flap backed with the double-sided tape. Place a small piece of scotch tape right where the cut you made ends at the bow. This will help prevent the cut from tearing into the sail. Do a 90 deg cut right out to the edge of the sail where the leading edge of the nose intersects the bow. Very carefully fold the flap over – the crease will be right along the inner edge of the tape which is also the leading edge. Burnish to make sure the flap is well-adhered.

Leading edge

Cut here to make outside edge of flap.
Fold over at leading edge.

Double-sided tape

Cut to trace of bow

Trim to fit after
bow in place

Small piece of clear tape
to prevent cut at end of flap
from tearing into sail

9. Finish cutting the sail along the bow shoulders. It's okay to cut a bit beyond the line traced from the template because this part of the sail will undergo a final trimming later.

PREPARE THE BOW

10. Prepare the bow. I use a little spreadsheet to guess how long a bow I will need given the sail dimensions (length, width, where the bow crosses the spine.) Cut the bow to length (maybe a few mm extra) using a little diamond cutting wheel on a Dremel tool or wire-strippers modified ala Bruce Lambert. After cutting, check which way the bow bends naturally and mark the top of the CF rod with a silver sharpie. If you will be using a "bow-setter" (which I do), use a dremel cutting wheel to bevel the ends of bow on the side exactly opposite the silver sharpie marks. Check the bow on the bow-setter to see that it just comes to the marks at the wingtips, to the notch where the nose ends and bow shoulder starts, and crosses the spine at the mark. Trim length and re-bevel end if necessary.

11. Before removing bow from bow-setter after the final trim, use a silver sharpie to mark the ends of the sections where contact cement will be applied (the bow shoulders). Then, use a fine-tip sharpie to trace the bow outline for ¼" or so on either side of the spine where the bridle yoke lines will come through the sail to the bow. I usually position these bridle attachment points between 1" and 1.5" away from the spine (usually 1.25"). If you like, trace a line along the inside of the bow under the bow shoulders as a guide for applying contact cement later on.

MAKE BRIDLE ATTACHMENT HOLES

12. Cut two small patches of scotch or other tape to reinforce the sail around the bridle holes. Apply these over the spots you just marked, centered on your tracing of the bow.

13. Using a metal erasing shield and soldering iron, cut a neat hole or slot through the tape and sail material centered on the bow line. I am not sure that battery powered soldering irons are any good for soldering, but they work just fine for this!
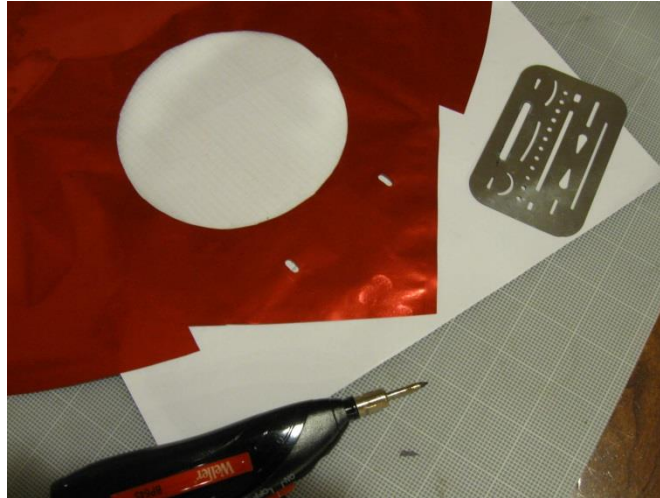
INSTALL SPINE

14. Cut the spine to final length. I like to have the spine extend about ¼ beyond the sail at the tail end and so allow for that before cutting.

15. Using the spine as a guide, make 4 or 5 marks along the length of the centerline to help center the spine when gluing it on.

16. Using a q-tip to apply a thin stripe of contact cement down the centerline and to coat the sail-side of the spine.

17. While the contact cement is drying, use removable scotch tape (2 pieces near the nose and 2 near the tail) to gently stretch the sail in the direction of the spine and fix it to the work surface. The idea to balance the stretching at 90 deg to the spine that the bow will create, so stretch a bit tighter for stiff bow than for a light one. To check that the sail is stretched evenly with no twisting or shearing, look for two "ridges" in the stretched sail that will wrinkle up on either side of the spine. Make sure that they are even.

18.. Starting at the nose end, lay the spine onto the centerline exactly between the guide marks you drew earlier. Once the spine is down, remove tape from the sail, flip it over, and use your finger to burnish the sail onto the spine.

INSTALL BOW

19. Apply contact cement to the sail along both bow shoulders. The cemented area should extend just to the inner edge of the bow (i.e., to the line you traced in step 11.) It doesn't need to extend all the way to the sail edge because you will trim that off later.

2018 UPDATE: With my lovely Elmer's "blue goo" contact cement all gone, it's back to the stinky Weldwood contact cement. I now wait until the bow is secured at the corners before applying the Weldwood to the leading edge of the sail.

20. Apply contact cement to the bow from the silver sharpie marks you made earlier out to the tips.

21. While the cement is drying, use removable tape right below the wingtips to secure the sail to the work surface. Stretch the sail away from the spine about as much as you think the bow will (so tighter for an 0.06 bow than for an 0.05 bow) before applying the tape to the work surface.

22. Make a cut about ½ inch from the wing tips from the edge of the template into where the outer edge of the bow will be. This will be the flap that secures the sail to the bow while still in the bow-setter.

2018 UPDATE: This is the only place on the sail where I put Weldwood before securing it at the corners.

23. Get the bow-setter into position on the sail and secure it the work surface using masking tape.

24. Put strips of wax paper over the contact-cemented areas on the sail except at the flaps near the wingtips.

25. Insert the bow into the bow-setter. Make sure the bevels are oriented so that they fit into the notches on the bow-setter securely.

26. Fold the wing-tip flaps over the ends of the bow. Secure to the sail as completely as possible with the bow still in the bow-setter.
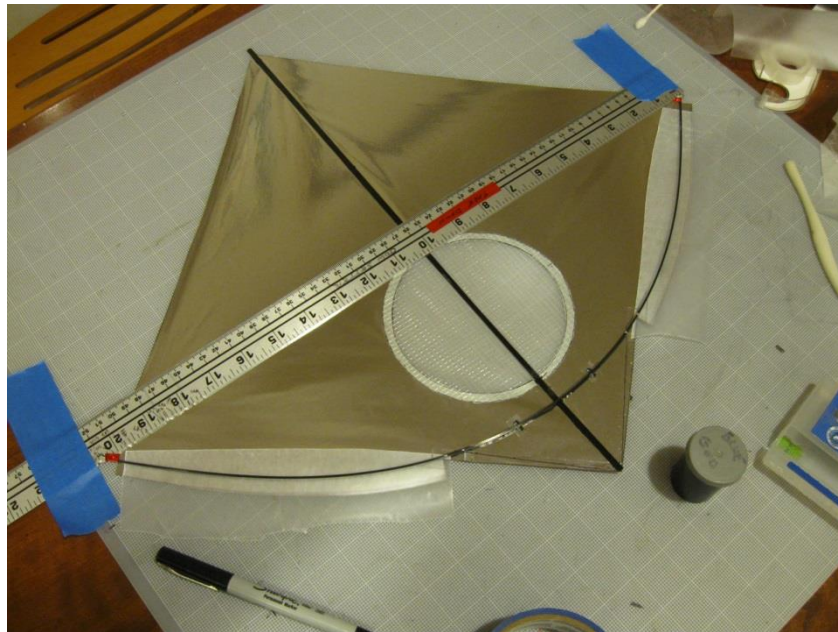
27. Remove the bow setter. Put a sharpie under the central part of the bow to keep it above the sail.

28. Finish securing the wing-tip flaps over the bow ends (now that it is out of the bow-setter.)

29. On one side of the sail, remove the wax paper, pull sail flat (laying a straightedge or other flat object on the sail is helpful). Pull the sail tight enough that there are no

wrinkles but not so tight that the bow is distorted. When everything is just exactly perfect, drop the bow onto the sail. Get it right the first time – the contact cement adheres immediately!

30. Repeat on the other side of the sail. Tap down on the bow (both sides) to make sure it is well stuck to the sail.

31. Make a final trim to the bow-shoulder flap part of the sail. I like to trim it so that the flap just wraps around the bow with no excess. For an 0.06" bow, I cut the flap so that is about 1/8 inch (or 3 mm) wide.

2018 UPDATE: With Weldwood, the cement on the bow is sticky enough that you can tack the bow down before trimming and adding contact cement. And you really just need the contact cement on the part of the sail outside the bow if you have it trimmed so that it just curls around the bow.

32. Carefully wrap the flap over the bow, making it as smooth as possible. Using your fingers, make sure that the sail is well adhered to the bow. Clean off any excess contact cement on the sail.


ADD REINFORCEMENT TAPE TO CRITICAL AREAS

33. Cut a 1' length of 3/4 inch wide Scotch 465 Adhesive Transfer Tape. Peel off the backing and apply the tape to the back side of a scrap of the sail material. Trim around the tape so that you have a 1' long, ¾ inch wide strip of peel-and-stick tape that matches
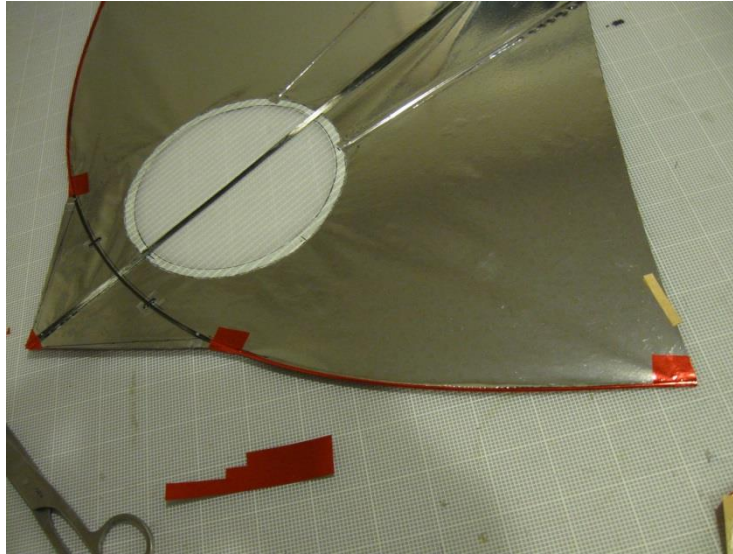
the color of your sail. In the pic below, I am making reinforcement tape for both the front and back of the sail, which are different colors.
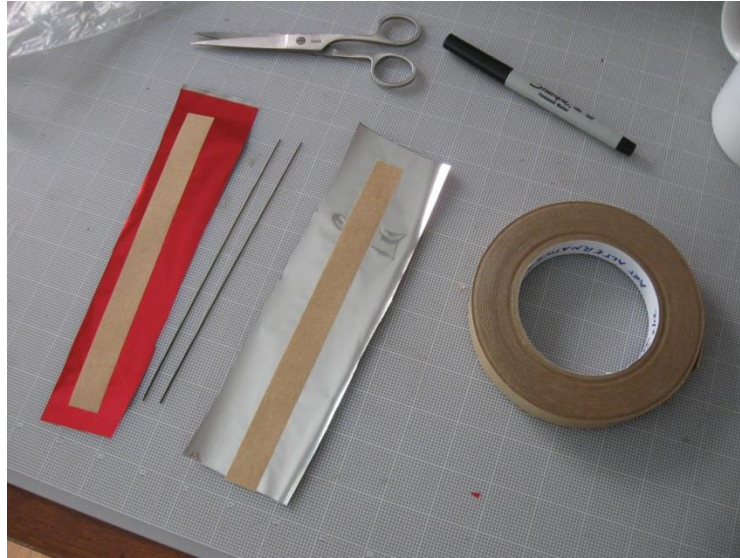
34. Cut off two pieces of the tape, each ¾ to 1 inch long. Use these to reinforce the wingtips.

35. Cut off two more pieces (same size) and use them to reinforce the point where the leading edge of the nose and the bow shoulder meet.

36. Cut a 1 inch long piece and place it on the nose end of the sail so that about ½ is on the front side of the sail and ½ sticks out beyond the end of the nose. Flip the kite over so the back side is up – the sticky part of the tape is facing you now. Make a notch in the tape by making 2 cuts, each parallel to a leading edge, that meet right at the end of the spine. [FIGURE] Fold these over the spine.

37. Cut a 1inch long strip of the tape that is about as wide as the spine. Use this to secure the tail of the sail to the spine.

INSTALL BATTENS

38. Draw lines on back of sail marking position of battens.

39. Cut 0.03" rods to length. Smooth off ends with fine sandpaper.

40. Make tape using 1/2" transfer tape with sail material. Put the transfer tape down on the front side of the sail material (so that backside will show when applying tape to backside of kite). Cut the tape in half (so ¼" wide) and about 1" longer than batten.

41. Using the tapes as a guide, make a few ticks (ends, center) along the batten lines to make it easier to center tape over battens when installing.

42. Apply thin line of contact cement along the line on the sail and on battens.

43. Carefully position the battens on the lines. Start at trailing edge and make sure that batten does not extend beyond sail.

44. Apply tape over the battens. Start it about 1/4" above the upper end of the batten.
Being careful not to stretch the tape, lay down over the batten using the ticks to keep it
centered over the batten. Press down lightly, trim end to be flush with trailing edge, then
burnish.
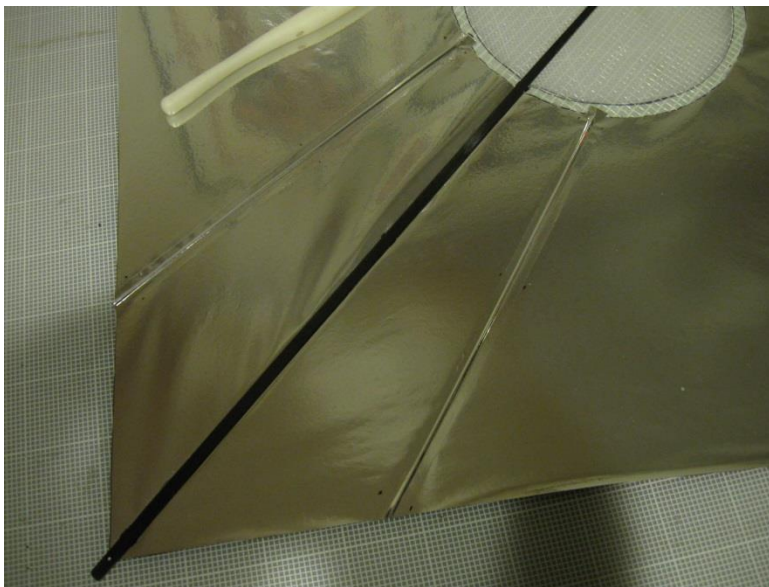
TENSIONER AND BRIDLE

45. Use a silver sharpie to make small dots right on the spine where holes for the bridle and tensioner will be drilled. I usually make a 4-point bridle, with attachment points 1/3 and 2/3 of way from the bow crossing to the tail. For the tensioner, mark points about 1 cm from the nose and halfway between the two lower bridle attachment points.

46. Use a carbide micro drill (0.0292" or 0.75 mm, Dremel #69, blue collar) in a Dremel tool to drill the holes. Use a pointy carbide grinder tip to chamfer the holes, especially the tensioner holes on the back side of the spine and the bridle holes on the front side of the spine.

47. First, the tensioner. I like to laminate a little bit of bend into the spine, and than add a tensioner so that I can increase the bend if the wind gets strong. I make two kinds of tensioners, one that uses one or two small glass beads (the Manny Alves tensioner) and also one that uses no beads. *2018 Update: I have found the no-bead tensioner to work better- it never gets stuck like the ones using beads do. So prefer the no-bead tensioner when making new kites or retro-fitting old ones.*

2-Bead tensioner (Manny Alves) instructions:

to spine

could use a glass
bead here too

glass bead

to spine
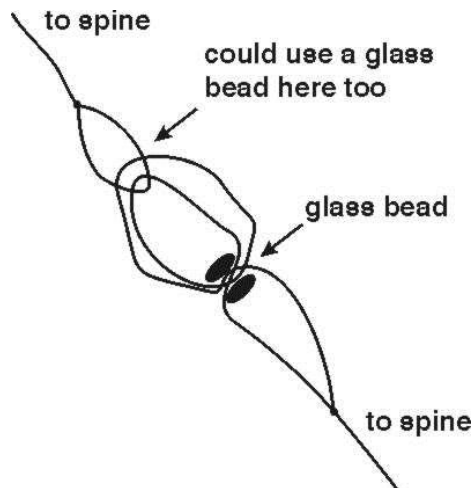
a) Take an 8" long piece of 10# or 12# braided Dacron and make the smallest loop you can at one end. Or, secure a small glass bead to the end of the line. If you don't use this bead, then it will be a 1-bead tensioner.

b) Select a small glass bead that has looks even (no thin parts) and has no sharp edges. Take a second 8" length of braided Dacron and loop it through the bead, through the loop at the end of the first piece of line, back through the bead and then the loop in the same direction as before, and then back through the bead in the same direction one last time. There should now be single strands on one side of the bead and a double-strand loop connecting the bead and loop on the other line.

c) Slide the bead so that the double-loop gets as small as possible. Now, make a loop about 2" by tying the two single strands of line on the other side of the bead with an overhand knot. Trim the loose strands coming out of the overhand knot. One can be very short; the other should be about 1.5" long.

d) With the back of the kite facing you, thread the 1.5" long single strand of Dacron through the lower tensioner hole. Flip the kite over, pull the strand as far as it will go, then tie a stopper knot as close to the hole as you can.

e) Flip the kite over again so that the back is facing you. Slide the bead so that the double-strand loop is about ½" long. Take the unlooped end of the first Dacron line and thread it through the upper tensioner hole. Pull tight, the tie a stopper knot as close the hole as you can. If all this has gone correctly, then you should get about the right bend in the spine with the bead pulled ½ to 2/3 of the way toward the tail. (I like to get the weight of the tensioner as low on the kite as possible.)

No-bead tensioner instructions:

NOSE

To increase bend:
Pull loop toward
nose while sliding
Tautline hitch
toward tail.

TAIL
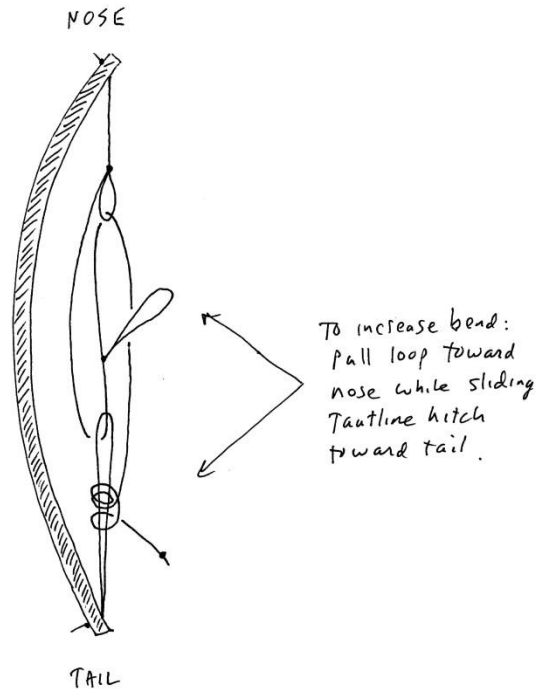
a) Cut 10" of line. Form a loop that is about 3.5" long. Thread the longest of the two ends through the lower tensioner hole in the spine. Pull the loop all the way to the spine and tie a stopper knot to keep it there.

b) Cut a 24" long length of line. Thread it through the upper tensioner hole in the spine and tie a stopper knot.

b) Tie a small loop in the line. You want the bottom of this loop (when pulled tight) to about 2" from the top of the lower loop (also pulled tight).

c) Thread the line through the lower loop.

d) Tie a 1" long loop on the line as close as you can to the point where the upper line emerges from the lower loop.

e) Now thread the end of the line through the upper loop (it's on the same line).

f) Pull the line towards the tail and tie a tautline hitch around both strands of the lower loop. The tautline hitch should be tied up toward the top of the loop.

g) Tie a big stopper knot about 1" from the tautline hitch and then trim the line just past the stopper knot. You now have a 1" long line you can pull on to tighten the tautline hitch.

52. Now, the bridle yoke. Cut a 12" length of 10# to 12# Dacron line and rub it with beeswax. Thread it from the front side of the sail through one bridle attachment hole, twice around the bow, and then back out through the bridle attachment hole. Secure it to the bow with your favorite knot.

53. Do the same with the other end of the line, going through the other bridle attachment hole. Before securing to the bow with a knot, make sure that the bridle is as long as it can be without reaching past the nose of the kite.

54. Select another small glass bead. Pinch the end of the bridle as small as you can make it and thread the loop through the glass bead. Now, open the loop and pass it back over the bead, so that the bridle is "larksheaded" to the glass bead. The glass bead should be in about the center of the bridle.

55. Cut a length of braided Dacron that reaches from the glass bead to the wingtip and then back to the spine. Select another strong-looking glass bead and tie it to one end of this piece of Dacron line. (I like the Uni knot for this purpose.) Finally, rub the line with beeswax.

56. Take the end of the Dacron line on the spool and, from the front side of the kite, thread it through the lower bridle attachment hole on the spine. Tie a stopper knot on the end of this line.

57. Cut this piece of line so that it is long enough to reach from the lower bridle attachment hole to the tail and then up to the upper bridle attachment hole, and then 2" more.

58. Thread the end of this piece of line through the glass bead on the loose piece of line and through the upper bridle attachment hole. Tie a stopper knot, making sure this lower bridle line is as long as possible without reaching past the tail of the kite.

59. Finally, take the remaining free end of bridle line and thread it through the glass bead on the bridle yoke. This step can be a bit tricky if the glass bead is small because there is already a loop of bridle line (so, two strands) going through this bead. Once you get it through, adjust its length so that the bridle is as long as possible without reaching past the wingtip and then secure to the bridle yoke bead with a knot (I use a taut-line hitch here.)

60. Take a 6"long piece of Dacron line and rub it with beeswax. Make a loop out of it with about ½" of line sticking out from the knotted end. This is the tow-line attachment loop – attach it to the upper bridle leg with a larkshead knot.

61. Make sure the bridle yoke knots are tight, and the adjust their positions on the bow that they are *exactly* symmetrical about the spine. Once you have them just exactly perfect, apply a drop of superglue to each knot to keep them from sliding on the bow.

62. Trim any loose ends of line coming out of knots on the bridle and tensioner.

63. Dust some cornstarch on places on the back of the sail where contact cement is showing. This step will prevent sand grains or dirt from sticking to the cement.

64. Sign and label your kite. I use a silver sharpie to paint the lower part of the spine on the backside of the kite, and then a fine-point sharpie to add my name, date, and other info about the kite.

Done!