Raptor by Steve Childers

Raptor Series Fighter

This kite is somewhat difficult to build but well worth the effort. It's performance characteristics are, a good spin rate, excellent tracking, and wind window edge performance. This kite can be built from many different materials, mylar, gift wrap, and floral wrap films for the kite skin, all work extremely well. These materials are readily available at Micheal's craft stores for about $3 per roll. Clearphane, cellane, or other transparent films work well for the wing panels and a heavier mylar gift wrap for the center panel seems to give the best over all results. The instructions use two types of tape with a third optional type depending on your building preferences. Any standard building techniques will work with this kite. I suggest reading this entire instruction set before you begin, this will give you an overview of what is involved.

Material list:

Skin Panels

A 17" x 17" piece of clearphane, cut in half for the wing panels,
A 9" x 18" piece of a heavier mylar for the center panel.

If your material has a grain or pattern in it, you may need to use a 19" x 21" piece cut in half to use for the wing panels to properly orient the pattern.

Tape

ADouble stick tape 1/2" x 40" long (standard office supply)

Med. to Heavy reinforcement tape 1" x { various lengths as required }

[optional] Clear packing tape 2" x @ 36" long (standard office supply)

Spine

Bamboo 3/16" wide x 3/32-3/16" thick x 10" long

Carbon fiber Spine Pieces

10" long x { 0.040" Dia. 2-6 mph }
10" long x { 0.050" Dia. 5-12 mph }

Carbon fiber Bow

For light winds, (2 - 6 mph), use a piece of carbon fiber 24 7/8" x 0.050" Dia.
for Med. to Heavy winds, (5-12 mph), use a piece 0.060" Dia.
for high winds (12 mph +), 0.070" Dia.

{ These are open for interpretation, but should be one to two Diameters larger than the carbon fiber in the spine pieces }.

Glue

Contact cement {your favorite brand}

Super glue

Nail Polish {Maybe it's Maybelline}

Bridle line

Approximately 60" of 15-20# test Dacron line, or a small dia. waxed line.

Approximately 36" of a strong, small dia. cotton, linen or Spectra line for spine wrapping..

Tools

Here are the tools you will need:

3' x 24" work surface that will allow you to cut with a razor or X-acto knife.

A new blade or sharp break off utility knife.

Straight edge ruler

An extra fine point marker { Sharpie }

A metallic gel marker [optional]

Sharp scissors

A pencil point soldering iron or a sm. piece of metal & heat source for melting holes.

A Bow Setter { Two vinyl end caps joined by a length of line with a tensioning slider knot for adjustments }.

A 5" piece of rigid tubing { clear or opaque } for bridle knot tying.

Several barbell weights in the 2-1/2 to 5 lb. range to apply pressure to the kite while building.

Kite Specifications:

Wingspan 22", l.o.a. 19"

A line drawn between the wingtips bisects the spine 9" from the nose of the kite. The trailing edge should be cut on a smooth curve @ 1-1/8" deep from tail tip to tail tip.

The bridle uses 4 points:

The upper bridle attachments are 1-1/8" on either side of the spine on the bow.

The lower bridle attachment points are located @ 9/16" from the center line of the kite where the lower half of the spine crosses, approximately 9" below the bow.

The trailing edges from the wingtips to the tails can be straight of slightly curved. The leading edge can be straight of follow the natural curve of the bow...

The Spine

I normally begin construction of this kite with preparation of a spine. Several spines can be prepared ahead of time to speed building of more kites of this type. I typically use a piece of bamboo that I have split and shaped to about 3/16" wide, between 3/32" to 3/16" thick and half the length, plus one inch for a lap joint. The spine should be straight with no soft spots. Prebending of the spine is preferred, but not necessary.

Select carbon fiber round stock of 1 to 2 sizes smaller than the bow diameter.

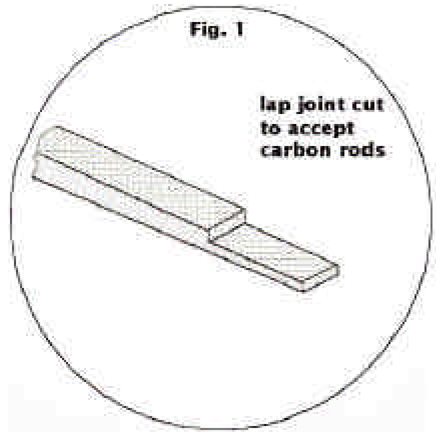
All carbon fiber round stock has a peculiar aspect of the manufacturing process, which allows it to have a side or bias which causes it to rotate around an axis when under tension or flexion. I refer to this in the following steps as the index of the rod..

Cut two tail pieces of equal length then pickup a tail piece and rotate it in your fingers while under slight tension end to end. You will notice one side of the rod which seems to roll over in your fingers, some times two sides will have an index.

Hold the first tail piece in your fingers. Apply downward pressure to your work surface with the primary index facing up. Mark near each end and a few witness marks along the length with your marker. This will indicate a side or index.

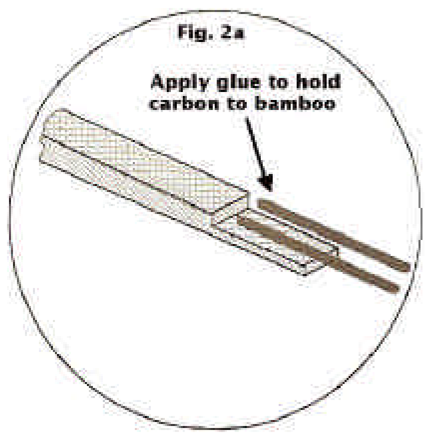
Repeat with the other tail piece and set them aside.

Cut the bamboo as in Fig.1 with a sharp blade to form a lap joint on the trailing edge to accept the carbon fiber tail pieces. If the bamboo is cut too deeply or seems weakened, do not use it! Start with a new piece of bamboo, as this joint receives extreme stress in all axis and will break if not strong..



a Tip: If your favorite marker will not mark carbon fiber well, try a gel marker silver or gold.

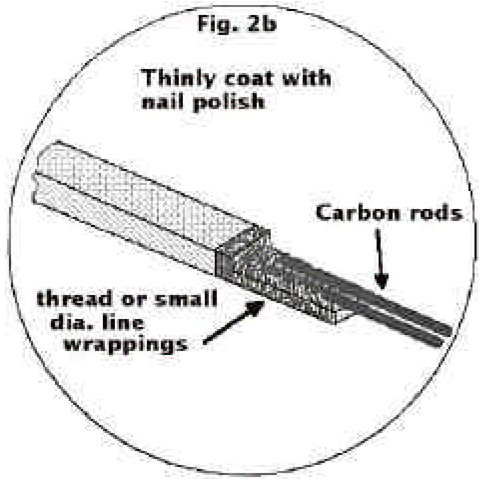
Glue the carbon to the bamboo with a few drops of super glue; the index marks made earlier should face up, see Fig. #2 Allow to dry before proceeding.



Using small diameter line or thread begin to wrap the joint tightly; overlapping it in it's entirety with a little above and below the junction.

Apply a few drops of super glue to the top , center, and bottom of the wrappings, allow to dry.

Cut off any excess wrapping and apply a thin, but through coat of nail polish to the wrappings. Allow to dry completely and repeat.



The Skin / Design criteria

The skin of this kite requires a template or 1/2 pattern for the wing panels, a template can be made for the center panel, but it is not necessary as the center panel can be sized up or down to your particular design. The design of this kite is open to several changes with positioning of the wingtips an important design consideration. I have found that most successful fighters have wingtips that cross the spine between 44% - 60% of the kites l.o.a. {length over all}, with 45% - 56% being the optimum per centages [ie. a line is drawn from wing tip to wing tip bisecting the spine; This measurement is divided by the length over all]. If you have looked at the construction diagrams ahead of time you will have noticed that this kite has a large area missing from the tail section, the percentages I have stated include the missing tail which would change the numbers. The standard design practice is to use an existing kite pattern and adjust the inside edges of the wing panels to raise or lower the wingtips by in creasing the base width of the center panel. If after building this kite you feel that the spin rate is too low or the tracking ability is compromised you may wish t move the wing tips up or down. You can change the wing tip positions or the baseline length of the center panel as previously mentioned.

If unsure of your design leave the wing tips in the same location and adjust the center panel to fit between the wing panels.

A beginner I flew with for a while asked me a pointed question about the relationship between wing tip positioning and flight characteristics. After several strained moments of thought I said, " I just don't know, but it seems to me that kites with lower wing tips act like a Japanese Hata or a Thai Pakpao using wing tip induced drag to increase straight tracking ".

That's my story and I m sticking to it...

Using your template cut two wing panels and one center panel to your design criteria. The leading edge can be straight of slightly curved to follow the natural curve of the bow.

Assembly

1) Spray water on your flat work surface, lay the center panel down and use a squeegee to remove all air bubbles, dry the exposed center panel thoroughly. Mark the center line and 1/2 edges down each side of the panel.

2) Start with a 20" piece of double stick tape down both edges of the center panel.

It will overhang the skin by about 1" on either end.

Note: When taping, do not stretch the tape or the skin will buckle /curl..

Burnish the tape down and press out any bub bles under it, a moistened finger works well.

3) Carefully apply the wing panels to the edges of the center panel and burnish down the material. Spray water under the wing panels, squeegee out the excess water, air bubbles, and dry thoroughly.

Note: An alternate method is to apply uncut material for the wing panels, then using your wing panel template, cut out the wing panels after they are applied to the center panel.

4) Now is a good time to reinforce the leading edge. Packing tape can be used alone or a glue fold over with .01-.02" dia. carbon fiber laid along the edge. I prefer a thin (a.b.s.) plastic flat stock.

The reason I bother with stiffening the leading edge is that I believe it reduces leading edge flutter and decreases the angle of attack the kite can fly at. Example: far edges of the wind window or the top of the power band.

5) Following the manufacturers' instructions of your contact cement, apply it to the wing tip tabs or wing tip fold overs according to your selected wing panels. Allow it to tack before setting a bow in place.

Put your bow into your bowsetter and adjust the tension so that the bow can fit across both wing tips, without any of the natural curve falling outside the leading edge of the kite. This should allow about 1/2" of the bow to extend beyond the wing tips.

6) Make a cut approximately 5" from the tip of the kite to form a 1/2" wide fold over or make 1/2" wide tabs down the wing edge to enclose the bow in a natural curve to the wing tips.

While folding over your tab(s) alternate from side to side as you fold over the bow. This will allow for bow adjustments. I usually place a 2-1/2 lb. barbell weight on top of the bow / spine cross point to hold it in place during this operation. WAIT 30 MIN.before continuing..

The Spine

7) Remove the weight. Measure from the kite nose down to 50% the length of the kite. Mark this location. Apply contact cement down the kite along the centerline to the mark made earlier. A small 3-5 ml. syringe works well. Allow this to tack. Place the prepared spine under to bow & bow setter and on top of the glue line running down the center of the kite. Press firmly for one minute. I usually apply additional pressure for 30 minutes with (2) 5 lb. weights...

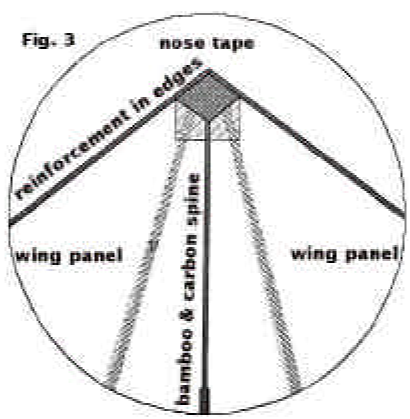
DO NOT REMOVE these weights till AFTER the tail pieces have both been taped in place.

8) Slowly spread a tail piece away from the center line until it is in the desired location on the tail of the kite. Tape down to the kite with 1/4" wide x 1" strip of heavy tape. Burnish well. Repeat with the other tail piece.

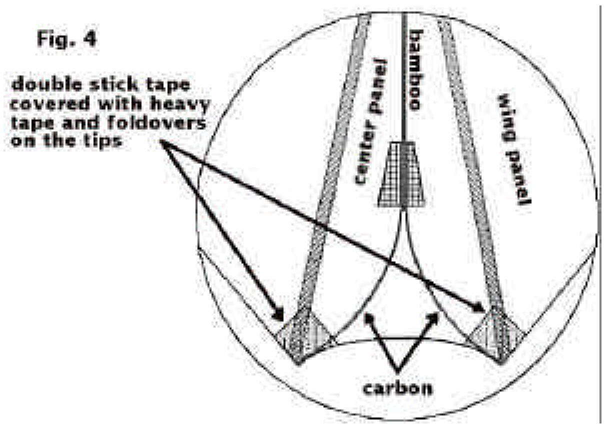
9) Measure a line 11/8" long bisecting the center line, where the lower halves of the spine cross. Those points will be your lower bridle points. Apply small tape squares to these locations and burnish well.

10) Remove the weights, apply a small triangle of tape (1/2" wide x 1" long) to the spine over the wrappings on the spine center. Burnish the tape well. Measure 1-1/8" on both side of the spine where the bow crosses. Mark them. These will be your upper bridle points. Carefully apply loose-leaf binder reinforcements over these marks. The reinforcements will limit any tearing from bridle legs.

11) Remove the kite from the work surface and apply the nose tape. Fold over the points/tabs of the reinforcement to cover the nose of the kite. Make sure to cover the tip of the spine. Burnish well. See Fig. #3



12) Cut two 1/2" x 1" pieces of heavy tape for the tail pieces. Apply to the tail pieces and burnish well. Cut two pieces of /8" x 1" { light to med. } tape for the wingtips. Apply to the wingtip tape and burnish well. See Fig. #4



13) Using a small tipped soldering iron or a heat source to heat a piece of metal, Melt holes for the bridle points. The upper bridle points are the center holes of the loose leaf binder reinforcements [See step #10]. The lower bridle points are centered on the tape applied to the carbon fiber tail pieces.

Note: instead of tying the bow to the upper spine you can use small 1/16" x 1" pieces of tape on either side of the upper bridle points to secure the bow and stop the upper bridle legs from wandering.

The Bridle

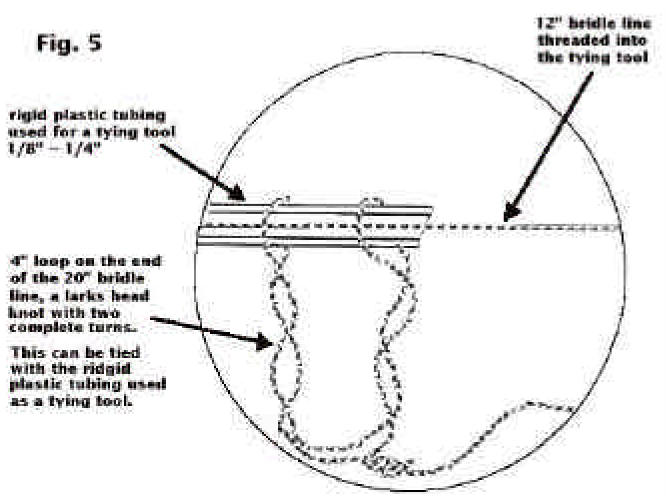
14) For the bridle cut four pieces of bridle line two 12" - 13" long, another approx. 20" long and a fourth 6" long.

Take the 6" piece, fold it in half tie an overhand knot. Trim the ends and set it aside. This is your tow connection.

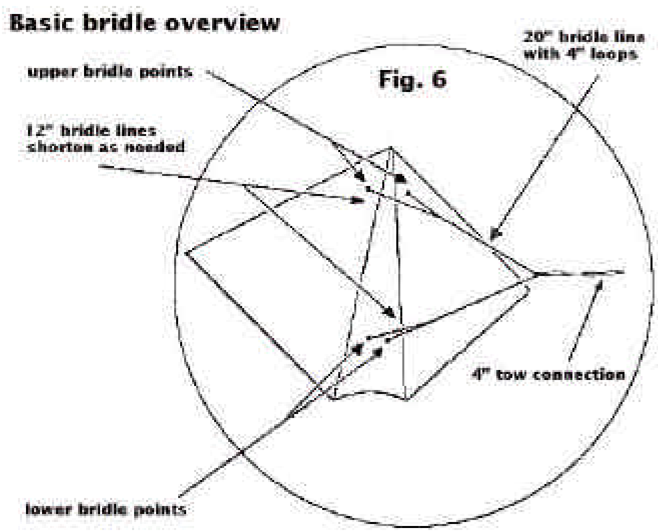
15) Tie one end of a 12" piece to the lower bridle points through the face of the kite skin. Use any knot that will hold well. Using a 20" piece form a 4" loop. Attach the looped end to the bottom bridle line using a larks head knot. Center it. Tie the loose end of the bridle line to the other bottom bridle point. Adjust the legs to a length of 2". Tighten the knot and trim the ends of the line { If your tying abilities are in doubt try the technique in step 17 }.

16) Tie the other 12" piece of bridle line to one of the upper bridle points through the face of the kite using a knot you like and can tie well. On the loose end of the 20" bridle line form another 4" loop using an overhand knot.

17) Using a 5" piece of rigid tubing stick it through the 4" loop on the 20" bridle line and twist each of the loops' legs two complete turns (See Fig. # 5). Thread the loose 12" bridle leg into the



end of the rigid tubing. Slide the the twisted loop onto the bridle leg and slide the tubing back off. Pass the loose end of the bridle line through the skin around the last upper bridle point and pull out the slack till the bridle line will no longer reach the wingtips. Secure the knot and use super glue on all none adjustable knots. (See Fig. # 6)



18) Apply small amounts of nail polish to the nose, tail pieces, and wing tips of the kite. This will increase the durability of the kite by quite a lot.

LET DRY.

Dust the back of the kite with corn starch and cover any exposed double stick tape or conntact cement that may be visible on the skin. If the wing panels are off you may wish to dust the front also.

Fig. 7

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" Raptor "