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METHODS OF INSTALLING A CARBON FIBER BOW IN A FIGHTER KITE

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This article is about installing a bow into any no-sew fighter kite where the bow is a carbon fiber or fiberglass rod and you want to tape or glue the bow to the fighter kite's skin. Gluing and taping can be very lightweight bonding methods that provide a very secure bond between the skin and the bow.

In talking with many fighter kite makers, gluing is by far the most popular method of bonding the bow to the kite skin. The most common type of glue used by kite makers is contact cement. There are several different kinds of contact cement and they all seem to work well. Whatever glue you use, be sure to test it on the skin material to assure yourself it will bond well and/or not damage the skin material.

When making a fighter kite that has a carbon fiber or fiberglass bow; installing or 'setting' the bow is an aspect that can be a little tricky. The reason it can be tricky is that you need three or four hands to complete the task; the bow must be under tension so it is the shape that's correct for the kite plan, then while the bow is bent in this particular shape, you must glue, tape or otherwise secure the kite skin to the bow. Enter a 'bow setter'.

A bow setter is a device that holds the bow under tension, bent in the desired shape. This frees both your hands so you can easily manage to the details of bonding the kite's skin to the bow. It's a jig, helper, third hand, or whatever other label you want to attach to it. I call it a bow setter. This device makes installing a carbon fiber or fiberglass bow predictable, quick and easy. Plus, it can also provide precise repeatability if you plan to make several of a particular kite plan.

For this article I have included bow installation descriptions and photos supplied by other kite makers as well as descriptions and photos of my methods. The intent is to show as many PROVEN ways to install a bow as possible. My premise is that if in this article you find an easy method for installing the bow, a method that 'clicks' with you, it's more likely you'll make more fighter kites.

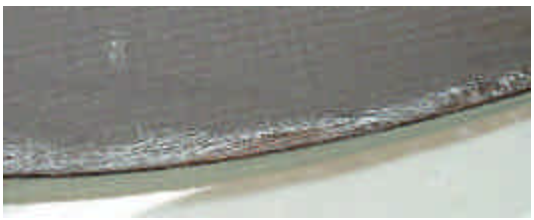
INSTALLING A BOW WITHOUT WINGTIP POCKETS OR A BOW SETTER

Of course you don't need a bow setter or other assistance to precisely install a fighter kite bow. Many fighter kite makers don't use any bow setting assistance. I began making my fighter kites using no bow setting device and today sometimes make them without the aide of a bow setter.

I spray my glass work surface with a fine mist of water, lay and smooth out the cut out skin. Then I apply Weldwood Original contact cement to the portion of the bow that is enclosed by

the kite skin hem and to the hem area of the kite skin. I wait for the glue to dry. At that point I hold an end of the pre-glued bow in each of my hands, place the bow tips on the wingtip location marks I made on the kite skin; then let the bow rotate toward the pre-glued kite skin until it makes complete contact with the glued skin. I press the bow onto the kite skin and presto, the bow is set. It is bonded by the contact cement to the kite skin.

From this point you can either fold the bow hems around the bow and onto the backside of the skin to permanently secure the bow or fold the hem up vertically and trim the excess hem away with a razor blade as shown in the photos.



The photo above on the left shows cutting off excess hem material. You can see in the photo on the right the extra glue on the kite skin that wasn't needed. Dust the exposed glue with cornstarch to remove the stickiness.

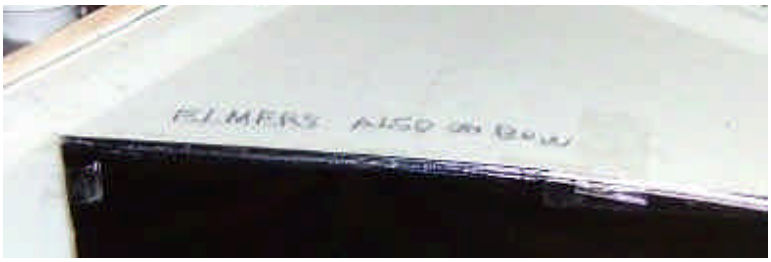
TERRY MCPHERSON'S NO BOW SETTER METHOD OF INSTALLING A BOW
fighterkite@charter.net **In his own words:**
When I first started building fighters I tried just about every method that I could find to install the bow, as I tried to build just about every new kite plan that I saw.

Now that I'm happy with the way my McFireFly, and the new Mc2, (which is a McFireFly only an inch and a half longer) perform. I'm only building these two patterns and I use only one method of setting my bows. I use no bow setter.
This method has worked very well for me.

I do as follows:
The sail is taped to the work surface (face down on glass)
I have my sail marked to show where the ends of the bow are to be positioned.

I apply Elmer's Probond Contact Cement along the fold over hem area of the sail, using a small flat artist brush. I also apply cement to bow; from each end toward the center the length of the bow hem.

When the cement is dry I determine the direction the bow wants to flex, I then align one end of the bow with the sail with one hand while I align the point where the bow comes out of the fold over area of the sail with the other. I make sure that the bow is in contact along the fold over area. I then flip the fold over part of the sail, over the bow and burnish the sail over and around the bow. I then do the same on the other side of the kite. When you know the length of the bow and the final location it needs to be on the kite skin, it's a slick way to set the bow.



This method has worked well for me, I have built over 50 kites and have had only one problem, and that was due to the fact that the bow didn't like the way I had it flexing. I have used this procedure with bows up to .070" diameter.

I have used this same method using double sided seam tape but I like using Elmer's contact cement best of all.

ED SHENK PRE-SHAPES THE BOW BEFORE IT IS INSTALLED IN THE KITE; HERE'S HOW: EdShenkkites@webtv.net **In his own words:**

I use .080" diameter micro carbon rods. With a utility knife I split the rod in half length wise about 4 or 5 inches on each end. This may take a couple tries to get the split visually on center. Start with a rod longer then you need. If the split is not in the center, you just cut it off and try again.

Now take a piece of wood and hammer in some nails in the arc you want the bow. Maybe 8 nails will do the trick. Actually a little sharper arc than you need because the rod will straighten out a little when its done.

Place rod between the first 2 nails and the last 2 nails and see if it will stay in place with the arc you like. You might have to support the other end with some object you have laying around.

Now we are ready to glue. I put a tooth pick in the split about 3/4 of the way down to hold the split open. Apply super glue I use 404, you might try epoxy, to both sides and spread around with another tooth pick . Make sure it gets down to where the split starts. Now take out the spreader tooth pick and put rod in the nail arc form. The two halves must be in good contact. I use 4 small vice grips to ensure good contact. Let rod set at least 12 hours before removing from the form.

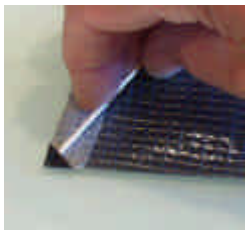
When you remove the rod you can cut some off the top of the glued end to make the arc you want. Then measure and cut to the length to fit the kite.

SO WHY USE A BOW SETTER?

What made me think about a bow setter in the first place was my first fighter kite making workshop. I wanted a method of installing the bow that would produce predictable results even for 'non' kite makers, attendees with no previous kite making experience or skills. This led me to experimenting with various ways to more easily install a fighter kite bow.

POCKETS

Instead of using a bow setting device you can use pockets to secure the ends of the bow at the wingtips of the kite skin. Adhesive backed photo mounting corners provide a very easy quick method of installing a pocket to hold the tip of the bow. Using pockets allows you to easily dry-fit and adjust the length of the bow so its shape fits perfectly to the kite skin. If there is any disadvantage to using a pocket at the wingtips, it is the pocket becomes part of the kite, adding a small amount of weight. When using a bow setting device, there is no added weight to the kite. The other difference is that when the round rod of the bow tip is inserted into a flat pocket, some of the time a small 'pucker' is created at the wingtip. These differences; a tiny amount of added weight and potentially a slight wingtip 'pucker', are slight compromises when compared with the ease and timesaving aspect of using a photo corner pocket.



Although I like using photo corners because it makes kite making so easy and quick, generally, it's beginning kite makers who prefer photo corner pockets because of their ease of use. As these new kite makers progress as kite makers, they seem to want lighter weight kites. To achieve that they eliminate the pockets and use a bow setting device or install the bow directly without the use of a bow setting device.

HOW TO USE A BOW SETTER

Basically there are two ways kite makers use a bow setter. Both methods require a mark to be made on the kite skin to indicate the wingtip locations. These are the locations you align your bow setter to and where you place the ends of the bow.

With the first method you install the pre-glued bow into the bow setter and allow the bow to make direct contact with the pre-glued skin. Then fold over the bow hems to securely bond the skin to the bow. And then remove the bow setter.

The second method is the one I prefer. Once the bow is lying on the kite skin and the bow tips are still in the bow setter, a cut is made in the hem to create a ½",13mm, long wingtip tab. Glue only the wingtip hem tab around the ends of the bow. These tabs will securely hold the bow. REMOVE the bow setter. Removing the bow setter at this time allows the bow to become naturally re-shaped and tensioned based on the way the bow tips are secured by the wingtip tabs. Next glue the rest of the hem around the bow being careful not to distort the shape of the bow in the process. **NOTE:** In this second method, pieces of waxed paper are usually placed on the pre-glued area of the kite skin so the pre-glued bow will rest on the waxed paper. When the wingtip tabs are glued around the bow tips and the bow setter is removed, then the waxed paper is removed; the pre-glued bow and skin hem areas are in direct contact with each other and bonded together on contact. The remaining portion of the bow hem is secured to the bow.

BOW SETTING DEVICES

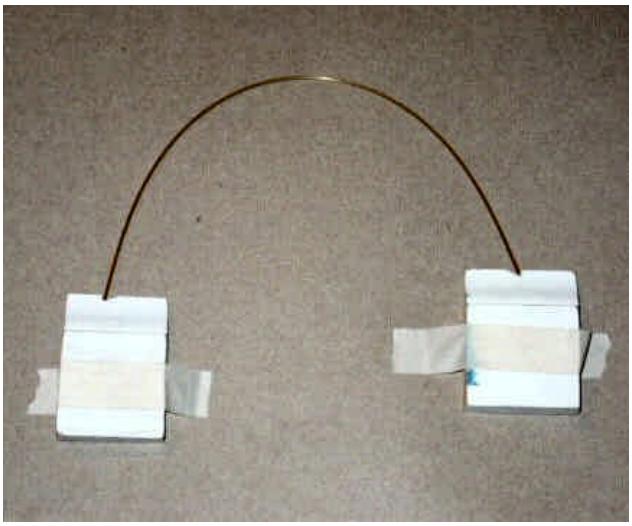
Here's a description and some photos of various bow setting devices contributed by various kite makers for this article. Each does a very good job of securing the bow and maintaining the correct shape and tension.

RICH HURD'S STRING AND END CAPS OR TUBES BOW SETTER…

r.hurd@comcast.net **In his own words:**

The bow holders are made from .250" OD x .05" wall x 1" long alum. tube. I drove a short plug in one end of each and drilled a hole through it to accept the string and split ring. (my comments follow) This style of bow setter can use vinyl end caps or any other small diameter material to hold the bow ends. This method requires the bow to be longer than is needed for the kite plan. The tubes must be outside the perimeter of the cut out kite skin. The bow is trimmed to the exact size after the bow is installed in the kite.

RICH HURD'S WOODEN BLOCK BOW SETTER
r.hurd@comcast.net **In his own words:**



This one is very basic. 2 piece's of wood molding or other similar material with a notch cut in them, then taped to the table after positioning the bow on the sail. It works, but is VERY basic.
(my comments follow) The bow must be cut long enough so the bow setter can be taped to your work surface outside the perimeter of the cut out kite skin. The bow is cut to the exact length after it is installed in the kite.

MY ALUMINUM YARD STICK WITH FILED NOTCHES BOW SETTER…
This is a simple bow setter to make. Any straight thin material will work such as wood or mat board. I used an aluminum yard or meter stick cut it so it is about 25", 635mm, long. Then I filed notches in one edge that correspond to the wingtip locations of various kite plans I make. To install a bow I mist my glass work surface with water to secure the kite skin, then place pieces of waxed paper on top of the glued hem area except for about 1", 25mm, at the wingtips. I align the bow setter notches to the wingtip marks on the kite skin. Then tape the bow setter to my work surface to secure it and install the bow. I cut and glue the wingtip tabs, then I remove the bow setter. The waxed paper is then removed and the remaining hem is wrapped around the bow.

DENNIS ISCHE'S WOOD BLOCK BOW SETTING METHOD
dische@golden.net **In his own words:**
I have cut out two blocks approx 2" square made from 1/4" plywood. In one corner of each block I make a square notch of 1/8" each way. Because I use full templates I make each with a 3/16" notch in the fold over flap at the wing tips to allow the block to fit around each wing tip.

When I start a fighter I adhere the sail face down on the work table with tape at key points. I them place the template exactly over the sail and tape it to the board also. I then locate the

two bow setter blocks so they sit up against the wing tips and clamp the blocks to the work surface.

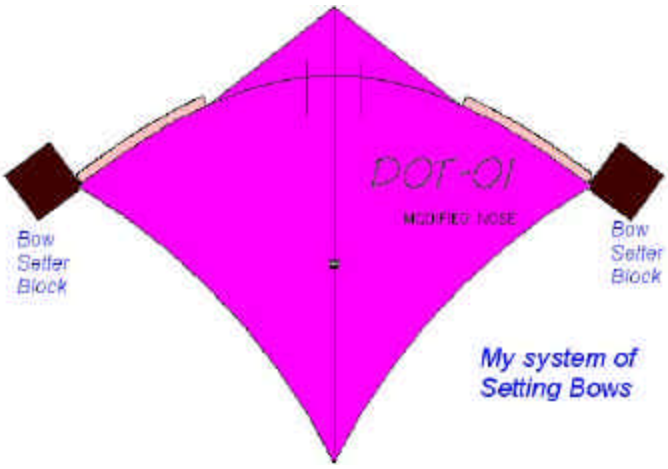
I then make the bow to match the crossing point on the template. Because the template is two halves I can locate the center of the bow and by flipping it over can check to see that the blocks are exactly right. I also at this time glue the front bridle stops to the bow because the locations are on the template and I can accurately locate them.

I remove the template from the board leaving the sail below sitting in exactly the right spot. At this point I can glue the spine and bow in place. It doesn't make any difference which I do first because the sail is free to do either. I lwt the kite dry for a while before removing it from the blocks.

This system takes a bit longer in setting up accurately but produces a nice kite every time. I have complete control over the bow and this allows me to locate it and work with each fold over flap with confidence when gluing the sail to the bow. I can control the wrinkles in a sail better and make smoother sails. I have used this method from the beginning and am very happy with it so far. That is how I do it....

I know from reading the topica fighter kite email list for over 5 years now that everyone has a different way of doing it... I picked mine and I like it...

I included some pictures and a graphic for you to view....



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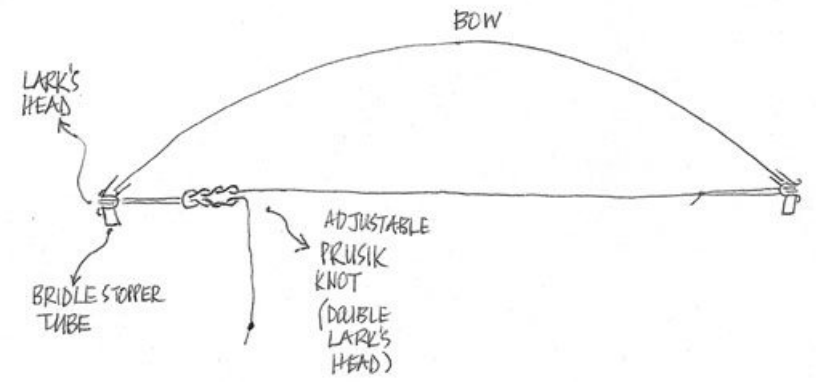
RALPH RESNIK'S SIMPLE & EASILY PORTABLE BOW SETTER

phighter@gralphica.com **In his own words:**

i use a very simple bow setting device ... it is the same as one would use for a bow tensioner on a buka ... see andy selzer's "no sew buka" on the nafka web site ... http://fighterkites.org/plans/andys/nosew_buka.html

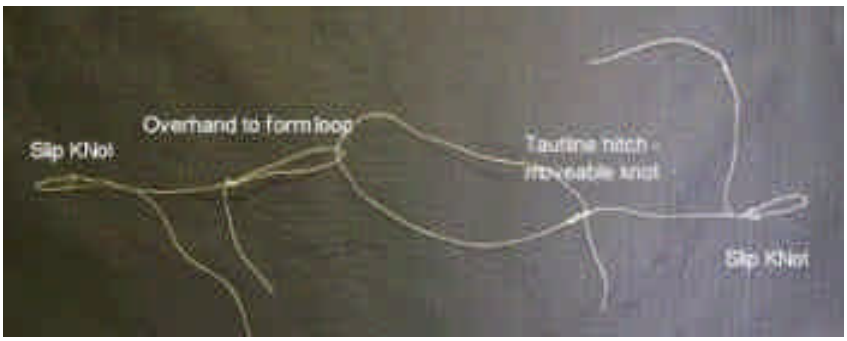
the advantage for me [as a traveler] is that it is portable ... and of course very easy to make and use. i make the bow 0.5 inch [10mm] longer than required for any particular kite [the 0.25inch/5mm ends are trimmed on completion]. first, i spray a fine mist of water on my glass work surface to hold the skin completely flat. i then set the bow using the tensioner and place it on the skin, holding it in place with two small pieces of low tack masking tape. next, i apply contact glue to the wing-tip tabs and allow to set and dry for 30 minutes. finally, i fold the wing-tip tabs around the bow and remove the bow setter. this allows the bow to settle into it's final position and tension ... i'm now ready to apply contact glue to the bow hem and complete the kite. it's really very simple.



PAUL PETER'S VERSION OF A SIMPLE AND VERY EFFECTIVE BOW SETTER

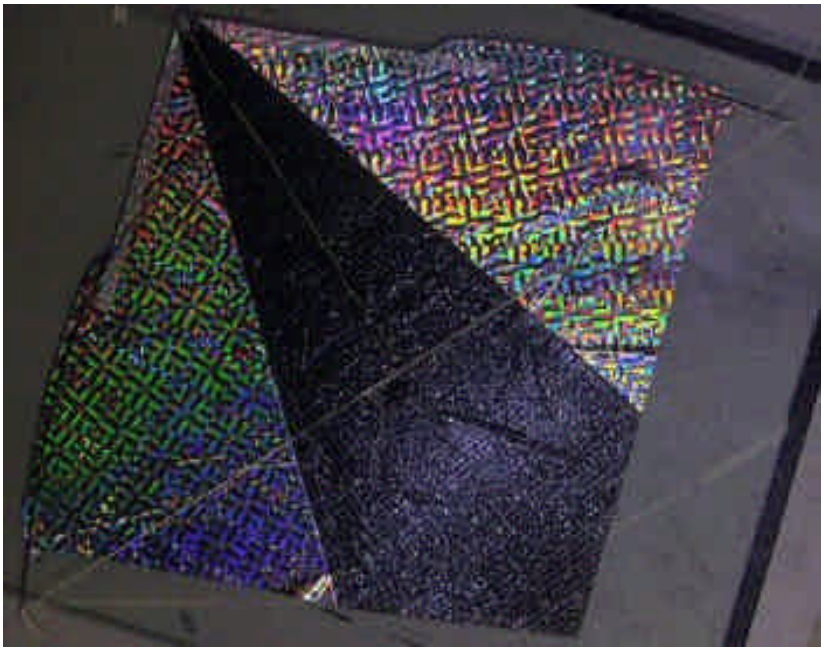
Pjpeter@aol.com **in his own words:**

I use a variation on a Buka bowing technique. This is an idea that Mike Coons suggested to me when he watched my earlier building techniques.



Basically you take two pieces of kite bridle line. With one, you make an overhand knot with the line doubled to form a loop. At the other end of that line you tie a slip knot that is tensioned by the end of the line with the loop. Bring the other line through the loop and back on itself. Using this end of the line, tie a tautline hitch. On the other end of the line, tie another slipknot with the tensioning back along the bow setter. So what you have is a bowsetter with slipknots on each end and two interconnecting loops in the middle. The loop with the tautline hitch is variable in length. (See knots photo above) No end caps to worry about and the bow is laid right down on the surface of the kite skin, the bridle line used is thinner than any end caps would be.

Use a piece of carbon fiber for the bow that is longer by about 1", 25mm, than is needed for the kite plan. Make a notch near the ends of your carbon fiber rod to keep the bow setter slip knots from sliding. I



use something like a quick cut with a hacksaw or even a folded piece of sandpaper to get just a bit of an indentation for the slip knots to grab. (See bowtipnotch photo above) Tighten the slip knots at these two points and move the tautline hitch to shorten or lengthen the bow setter to get the proper fit on the kite skin. You can lay it right down on the skin and move it around to get a proper fit. I have tabs on the wing tips to show the expected placement of the bow.

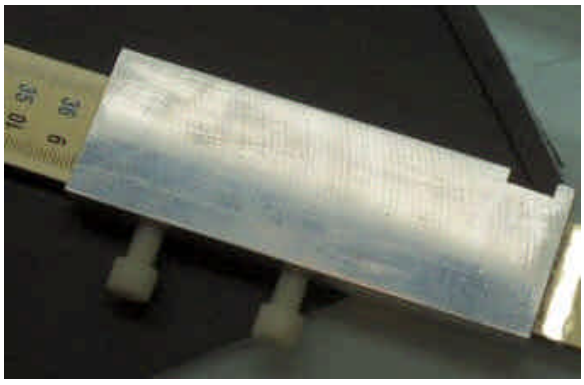
When it is laid out, just right, I tape it in place with several pieces of the blue type making tape. I tape the bow on either side of where the spine will be. The ends of the bow stick well off the ends of the wing tips so taping them is out of the way of the gluing process.

After the bow is set and the spine added, the excess ends of the carbon fiber can be cut off and discarded.

ADJUSTABLE BOW SETTERS

THESE MORE SOPHISTICATED BOW SETTERS ALLOW THE BOW TIP POSITIONS TO BE PRECISELY ADJUSTED FOR EACH DIFFERENT KITE PLAN.

m.alves@cox.net **MANNY ALVES** developed this amazing adjustable bow setter. It is made of machined aluminum. The end pieces move independently. It is designed so the bow can be installed either before or after the spine is installed.



RICH HURD'S CURTAIN ROD ADJUSTABLE BOW SETTER

(I think this is a clever idea) r.hurd@comcast.net **In his own words:**

This bow setter was made from a rectangular curtain rod I found at Jo-Ann Fabrics. I cut and shaped a piece of 1/8" thick hard board and super glued it to the ends of the rods. Also I

glued a piece at the other end of the big rod, to help support the center when it was extended.

Before gluing on the tab on the small rod, I put some electrical tape on the inside long edge of large tube at opposite end of large tube tab and on the out side long edge of small tube at opposite end of tab, then slipped the two tubes together and glue the tab to the small tube. The reason for the tape was to take some of the slack out of the tubes.

The tubes have small detents in them that help hold the tubes some what in position. Once I have the bow cut to length and set into position on the skin, I then tape the tabs to my work table to hold it all in position while I glue the sail to the bow. Once that is done I can then remove the bow setter.

AS YOU CAN SEE from this article there are several ways to approach installing a fighter kite bow. The key is selecting a bow installation method that seems the easiest for you based on your experience, tools available, etc. It may well be that none of the described methods suit your building style exactly, but one or more of them may spark an idea of a method that will be the 'right' one for you! Then get busy and have a ton of fun making lots of great flying fighter kites!

If you have questions about issues in this article, please don't hesitate to email me.

BigGrins,

Bruce Lambert
kitefighter@nwinfo.net