A Guide To Designing Your OWN American Style Fighter Kite

The easiest and quickest way to design a new fighter kite is to start with an existing kite that flies to your liking made by another kite designer/builder. Then modify it in some way, usually ever so slightly, and presto you have a new slightly different kite design.

Another quick and easy way to design a fighter is to use an existing kite or full sized template and enlarge or shrink it to better suit your flying style or wind range. This can be done with a photo copier or electronically if your have a computer file of the template.

Although both methods mentioned above work to produce a 'different' kite than the original, what if you wanted to start from scratch and actually CREATE your own ORIGINAL successful fighter kite that was designed for YOU and your flying style and preferences and one that you could easily control? Where and how do you begin? This article is about how I do it.

THIS IS A GUIDE
This article is one place for you to start your fighter kite designing. It includes a set of ratios on the diagram at the end of the article that I compiled from several successful fighter kites I've made. Using the included ratios to make your kite will produce a very good flying kite and when combined with the information about selecting the correct bow length, the kite will fly well for YOU. However, you will probably want to begin experimenting with these ratios and customizing them to YOU; and that is when you will begin having the most excitement and fun with designing fighter kites!

SOME DESCRIPTIONS AND OBSERVATIONS
To me the most important aspect to a fighter kite design is that the flight of the kite suits me and my flying style. I don't really care if others like the way it flies or not as long as I like its performance. My guess is that's how you feel about it also.

There is a critical aspect to a fighter kite design that varies widely among fighter kite designer/builders and to me is a KEY to having a kite that flies to MY liking. It is **accurately predicting MY personal wind range for the kite.**

What I mean by a personal wind range of a kite can best be illustrated by this scenario- A fighter kite builder/designer gives you a kite to fly and let's say they tell you the kite's wind range is 5-10mph. When you are flying this kite in 6mph winds, you think to yourself that the designer is crazy to think a person could actually control and fly this kite in 5-6mph winds.

Why did the designer/builder tell you it would fly in these winds? The answer is because the kite DOES fly well in that wind range FOR THE DESIGNER/BUILDER THEMSELVES. They often think if the kite flies well for them in a given wind range it will fly well for anyone in that same wind range. The fact is **EACH FLYER HAS THEIR PERSONAL WIND RANGE FOR EACH KITE.**

The reason YOU label this kite as a poor flying kite is because YOU find the kite has a 'mind of its own' and is virtually uncontrollable. It is uncontrollable because the skin is too stiff for the amount of

wind pressure acting on it based on **your style of flying and line handling**. And 'YOUR STYLE OF FLYING AND LINE HANDLING' is the key here.

Accurately predicting the wind range for a specific flyer is one of the most challenging aspects of designing a successful controlable fighter kite. This is a challenge because it must take into account not only the wind speed but even more importantly your flying experience plus the characteristics in a kite that make you feel you have complete control of its behavior in the particular wind you are flying in.

For each flyer, what determines the controllable wind range of a fighter kite is the stiffness of the kite. Control of the kite is provided by the deformation of the kite skin into a 'keel' shape when slightly stronger wind forces act on it and then because of the stiffness of the bow, the skin flattens and reduces or eliminates the deformation of the skin when there is less or no wind pressure acting on the skin.

It is the ability to deform the skin to form a 'keel' with a given wind pressure and then instantly flatten the kite skin, eliminating the 'keel' shape, that makes a fighter kite controllable. It is the designer's job to create the correct stiffness in the kite so it will do exactly that in the wind speed the flyer wants to fly the kite in.

When the kite's bow is too stiff, the amount of wind pressure acting on the skin won't be sufficient to deform the skin into a 'keel' shape when a small amount of extra wind force is applied; the kite will veer off to one side or the other and usually crash but it won't fly straight and it won't be controlable. The kite is too stiff for the wind it's being flown in. It is deflecting off of the wind rather than flying through it.

The stiffer the kite the more wind pressure is required to make the skin deform as it needs to in order to be controllable. The needed wind pressure can come from the wind speed or from the flyer manipulating the flying line or usually it comes from some of both.

The KEY to designing a controllable fighter kite for YOU is finding the balance, for you personally, between how much actual wind speed you need vs the stiffness of your kite. What most influences the stiffness of a kite is the length of the bow and its diameter. This is a critically important concept when you're trying to design a controllable fighter kite for YOURSELF.

THE KITE SKIN'S AFFECTS THE STIFFNESS OF THE KITE IN THE AIR

In addition to the length of a given diameter bow influencing the stiffness of the kite, so does the skin material itself. To have the least stiffening effect use the softest most pliable plastic films or other material you can find for the kite skin.

A material that resists folding when it's bent or a material that is noisy when wrinkled indicates it is a stiff material. You can use these stiffer materials for the kite's skin, but they will cause the kite to act like a stiffer kite than if a softer more pliable material is used. And because the skin material is adding a slight amount of stiffness to that already created by the bow, it will require more wind speed to make it a controllable kite or you'll want to make a larger kite utilizing a longer bow than if making the kite with softer skin material.

The thickest polyfilm that is still reasonably flexible is 1 mil thick; the softest or most flexible are around 0.7-0.8mil thick. Films thicker than 1 mil add noticeable stiffness to the kite.

THE CORRECT BOW LENGTH AND DIAMETER

NOTE: In this article I'm assuming all bows are made of carbon fiber rods.

Determining the correct bow diameter and length is where I begin when designing my kites. From my experience of flying and watching others fly fighter kites, I have developed a 'feel' for what diameter and length of bow will work well in a given wind range for flyers with varying degrees of flying experience. I developed this 'feel' into a guide. As with all guides, it is just that, not an absolute.

After you use this guide in designing a kite or two you may find the wind ranges need to be modified because of your flying line handling style or because you prefer other characteristics of a kite. If that's the case, just make the changes in the guide where you need to and you'll be on your way to creating your personal set of guides for designing successful competition fighter kites for YOU.

This guide includes only 0.05" and 0.06" diameter carbon fiber rods as material for making the bow. These are the most popular sizes and are used by about 98% of all American style fighter kite builders.

I've created 3 different categories of kite stiffness to better focus on the typical needs of 3 separate groups of flyers: Newbies who need the softest or least stiffness in a kite, Flyers with Modest Flying Experience who need medium stiffness kites and Competition Flyers who typically fly the stiffest kites.

As you'll notice the bow lengths get longer for the kites with less stiffness. When the diameter of the bow remains the same, longer bows make larger kites and larger kites are not as stiff as smaller ones. In a given wind speed the larger surface area catches more of the wind and more easily deforms the kite skin into a 'keel' shape. And it does it without much assistance from the flyer's line handling techniques. In my experience newer flyers seem to have the best success learning to control and maneuver fighter kites when the kite they are flying is relatively soft, not stiff.

> **TIP:** When flying a kite, if it acts like a stationary static single line kite most of the time and is difficult to get it to spin, turn or maneuver, even when you release the flying line, it means the bow is too long for the wind speed and your flying style. You will want to shorten the bow slightly to give the kite more stiffness. And lengthen the bow if the kite veers off to one side or the other or turns constantly crashing often and never flying straight.
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> Assuming the kite is tuned properly and built reasonably accurately, the reason a kite would consistently veer to one side or the other, turn instead of flying straight and otherwise exhibit erratic uncontrollable behavior including frequent nosedive crashes is that the kite is too stiff for the wind. By lengthening the bow and making a kite to fit that longer bow, the new kite will be more controllable in that same wind.
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> About 95% of the time when a flyer is having difficulty with controlling their kite, I've found that one of the main reasons is the kite is too stiff for the wind they are attempting to fly it in. The kite has too stiff of a bow. This can be caused from the kite being too small and therefore it has a relatively short and stiff bow or the diameter is too big or both.
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> Each time you change the bow length you should recalculate and draw a kite plan using the ratios in the diagram below to fit that new bow length. This is one way you will begin to clearly identify your personal set of designing guides and learn what works for YOU and what doesn't.

The lengths of bows listed in the guide are in 3 columns based on the stiffness of kite they produce. Basically the range of bow lengths can also relate to flying experience. The more experienced flyers usually have better line handling techniques and because of this can 'create' wind needed to fly stiffer kites by manipulating their flying line.

SOFT – Newer Fighter Kite Flyer
MEDIUM - Modest Flying Experience
STIFF - Competition Line Touch Flyer

Although stiffer kites are faster, it is often the increase in speed that many flyers have difficulty with, especially newer flyers, and find they prefer controllability rather than speed. This is also true with many competition flyers.

Control of the kite is the key, speed is less important. Ideally a kite would have both control and high speed, but so far I'm not aware of one that provides both. So we design fighter kites with compromises that best suit us.

BOW LENGTH GUIDE
Length of carbon fiber bow needed for particular kite stiffness

Wind Range MPH	Bow Diameter	KITE STIFFNESS DESIRED		
		Soft	Medium	Stiff
0 to 4	0.05"	25"- 26"	24"- 25"	23"- 24"
3 to 8	0.05"	23.5"- 25"	22.75"- 23.75"	21.25"- 22.5"
7 to 11	0.06"	25"- 25.75"	24.75"- 25.5"	23.5"- 24.75"
9 to 14	0.06"	23"- 24"	22.75"- 23.5"	22"- 23"

From the above guide choose a bow length in the range given for the stiffness of kite you want in a particular wind range.

WHAT TO DO NEXT
Now that you have chosen the bow length you create a kite to fit it. The following ratios on the diagram below will give you the info you need to draw the kite plan/template. I suggest you start with the ratios given and then as you get more familiar with the results, you can begin customizing the ratios to better suit YOUR flying style just as you will do with the bow length guide above.

Multiply the bow length you have chosen from the above guide by the **Bow Length Multiplier of 0.85** as indicated on the diagram below to find the **wingtip to wingtip dimension** of the kite.

When you have the wingtip to wingtip or wingtip line dimension for your kite, multiply that number by each of the ratios given for the various dimensions needed to draw your kite plan.

HERE'S AN EXAMPLE OF HOW TO APPLY THE INFORMATION

Let's say I'm a Newbie and want to design a kite that is 'soft' for 0-4mph winds, here's what I'd do:

Look on the guide above and see that for 0-4mph wind range a soft kite would use a bow 25"-26" long of 0.05" diameter. For this example I will choose 25.5" as my bow length.

Next I'll need the wingtip to wingtip distance for my new kite. To find it I multiply the bow length by the bow length multiplier on the diagram below which is 0.85 and I get 21.68" as the wingtip to wingtip distance of my kite. (**NOTE:** To convert the decimal to 16ths, multiply the decimal, in this case .68, by 16. This will give you the number of 16ths the decimal is equivalent to and in this case it is 10.88 16ths, I'll round it up to 11/16. So my wingtip line dimension is 21-11/16" or 21.68".)

I always draw full sized plans on an opened priority mail box or other stiff easy to cut material so I will have a usable kite skin template when I'm finished. I start my kite plan or template by drawing a vertical spine line about 20" long and make a mark near the top which I identify as the nose.

As shown on the diagram below, I will multiply the 21.68 wingtip length by 0.395 to find the location on the spine where the perpendicular wingtip line will intersect the spine. In this example it is 8.56" from the nose. Now I'll draw my wingtip line 21.68" long and **center** it on the spine line at the point 8.56" from the nose. Yes you can round the numbers up or down a little to create easy to use numbers.

Now I will multiply the wingtip dimension by each of the other ratios on the diagram below to find the dimensions I need to complete my kite plan. In this example the spine length is 18.43"; I'll round this up to 18.5".

Another reason I always draw full sized kite plans and templates is because to draw the curve for the bow I use the bow itself as a guide. I find it is an easy way to draw it without the need for any calculating.

To create the curve of the leading edge formed by the bow, I place a self adhesive photo corner at each wingtip on my plan/template and insert one end of the cut to length bow into each. (**NOTE:** If you don't have photo corners use a small piece of tape to secure each end of the bow at the precise wingtip points.) I press the curved bow onto my kite plan/template material and draw along both edges of the bow. This creates the shape and position of the bow on my plan/template just as the bow will be installed into the kite.

Now I draw a line parallel to the wingtip line that intersects the bow on the right and left side of the kite at the points where the nose leading edge meets the bow. In this example it is 0.153 x 21.68 = 3.32" from the nose as shown on the diagram. Then measure from the spine to determine the calculated meeting point of the nose leading edge and the bow, in this case it is 0.184 x 21.68 = 3.99" which I'd round to 4". (**NOTE:** Carbon fiber bows of a given diameter and length rarely bend uniformly. The actual bend of the bow is what you want, but it may not perfectly match up with the calculated dimensions of the corner where the nose leading edge meets the bow. This is normal.)

Then I draw the nose leading edge lines. I start at the nose and draw the lines to the points on the bow where the parallel line intersects the bow. This is usually very close to the calculated points and if there is a slight difference, I'll use the points closest to the nose of the kite.

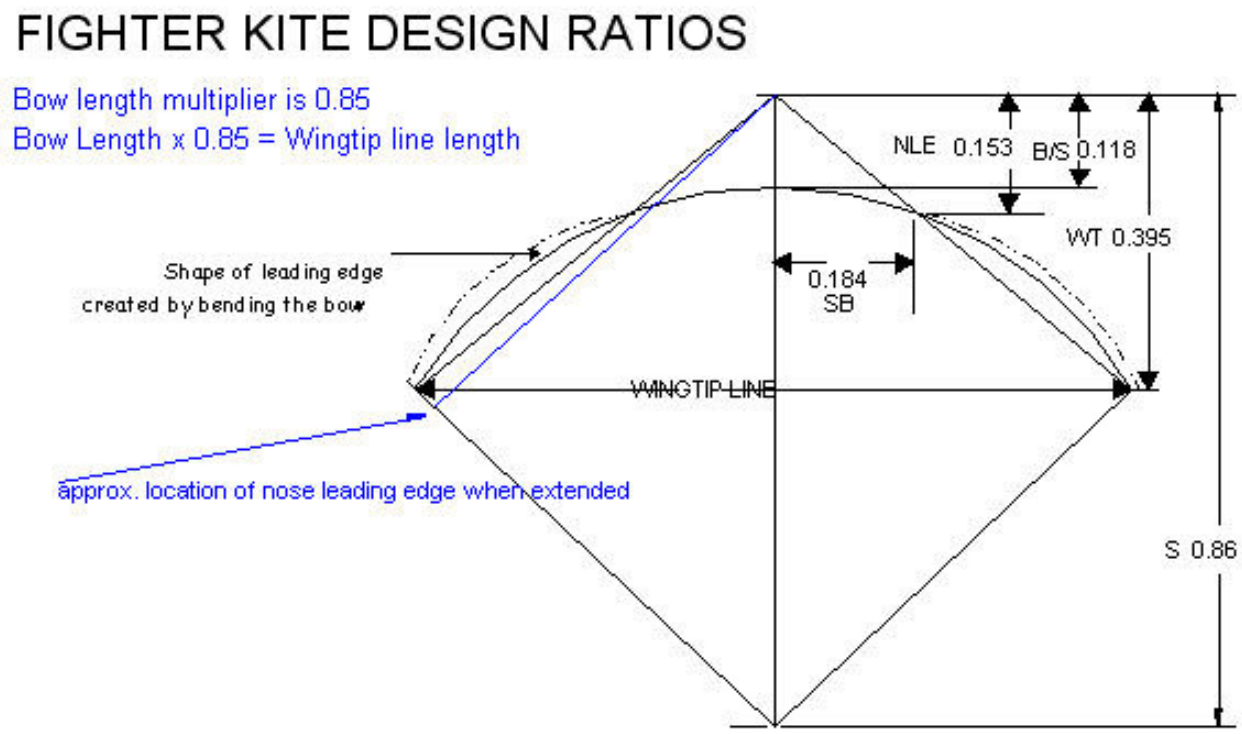
The most important issues are that the points where the nose leading edge meets the bow are exactly the same on each side of the kite. They should be mirror images of one another. AND the meeting points must be located on the noseward edge of the bow.

I then draw the bow hem. It's a line parallel to the curve of the bow beginning at the meeting point of the nose leading edge and extending to the wingtip to create the bow hem as shown on the diagram with a dashed line. The hem is generally about 1/4" wide.

Now I cut out my drawing/template, lay it on top of my skin material and cut around its perimeter to create my kite skin, I already have the bow cut to the correct length so I'm ready to build my kite!

Some kite makers prefer using a 1/2 a full sized template. The full plan is cut along the spine line. They feel by folding the skin material and aligning the spine line on the fold, the skin is more likely to be perfectly symmetrical. If you want to do this, cut the template you've made on the center of the spine line and use 1/2 of your template to cut your kite skin.

Whether you want to add battens, nose leading edge reinforcing and/or stiffening, scallop the leading and/or the trailing edge or other additions or modifications is up to you; the kite is for your enjoyment!



The following chart has the calculated dimensions for the ratios given above for some common bow lengths. This will reduce time you spend with your calculator.

The letters on the diagram above as well as the chart below stand for the following:
S - spine length
WT - distance from nose to the point where the wingtip line intersects the spine

NLE - distance from nose where the nose leading edge meets the bow
SB - spine to bow distance at meeting point of bow and nose leading edge
B/S - bow spine cross point.

This article is intended as a guide and starting point in designing your own original fighter kites that perform like you want them to. I hope it does!

BigGrins, bruce
www.fighterkitecentral.com kitefighter@nwinfo.net

Dimensions in Inches and Millimeters for Kite w/.85 Ratio of Bow Length to Wingtip Line Length

Bow Length		Wingtip Line Length		S		WT		NLE		SB		B/S	
inches	mm	inches	mm	inches	mm	inches	mm	inches	mm	inches	mm	inches	mm
19.50	495.30	16.58	421.01	14.25	362.06	6.55	166.30	2.54	64.41	3.05	77.46	1.96	49.68
19.75	501.65	16.79	426.40	14.44	366.71	6.63	168.43	2.57	65.24	3.09	78.46	1.98	50.32
20.00	508.00	17.00	431.80	14.62	371.35	6.72	170.56	2.60	66.07	3.13	79.45	2.01	50.95
20.25	514.35	17.21	437.20	14.80	375.99	6.80	172.69	2.63	66.89	3.17	80.44	2.03	51.59
20.50	520.70	17.43	442.60	14.99	380.63	6.88	174.83	2.67	67.72	3.21	81.44	2.06	52.23
20.75	527.05	17.64	447.99	15.17	385.27	6.97	176.96	2.70	68.54	3.25	82.43	2.08	52.86
21.00	533.40	17.85	453.39	15.35	389.92	7.05	179.09	2.73	69.37	3.28	83.42	2.11	53.50
21.25	539.75	18.06	458.79	15.53	394.56	7.13	181.22	2.76	70.19	3.32	84.42	2.13	54.14
21.50	546.10	18.28	464.19	15.72	399.20	7.22	183.35	2.80	71.02	3.36	85.41	2.16	54.77
21.75	552.45	18.49	469.58	15.90	403.84	7.30	185.49	2.83	71.85	3.40	86.40	2.18	55.41
22.00	558.80	18.70	474.98	16.08	408.48	7.39	187.62	2.86	72.67	3.44	87.40	2.21	56.05
22.25	565.15	18.91	480.38	16.26	413.12	7.47	189.75	2.89	73.50	3.48	88.39	2.23	56.68
22.50	571.50	19.13	485.78	16.45	417.77	7.55	191.88	2.93	74.32	3.52	89.38	2.26	57.32
22.75	577.85	19.34	491.17	16.63	422.41	7.64	194.01	2.96	75.15	3.56	90.38	2.28	57.96
23.00	584.20	19.55	496.57	16.81	427.05	7.72	196.15	2.99	75.98	3.60	91.37	2.31	58.60
23.25	590.55	19.76	501.97	17.00	431.69	7.81	198.28	3.02	76.80	3.64	92.36	2.33	59.23
23.50	596.90	19.98	507.37	17.18	436.33	7.89	200.41	3.06	77.63	3.68	93.36	2.36	59.87
23.75	603.25	20.19	512.76	17.36	440.98	7.97	202.54	3.09	78.45	3.71	94.35	2.38	60.51
24.00	609.60	20.40	518.16	17.54	445.62	8.06	204.67	3.12	79.28	3.75	95.34	2.41	61.14
24.25	615.95	20.61	523.56	17.73	450.26	8.14	206.81	3.15	80.10	3.79	96.33	2.43	61.78
24.50	622.30	20.83	528.96	17.91	454.90	8.23	208.94	3.19	80.93	3.83	97.33	2.46	62.42
24.75	628.65	21.04	534.35	18.09	459.54	8.31	211.07	3.22	81.76	3.87	98.32	2.48	63.05
25.00	635.00	21.25	539.75	18.28	464.19	8.39	213.20	3.25	82.58	3.91	99.31	2.51	63.69
25.25	641.35	21.46	545.15	18.46	468.83	8.48	215.33	3.28	83.41	3.95	100.31	2.53	64.33
25.50	647.70	21.68	550.55	18.64	473.47	8.56	217.47	3.32	84.23	3.99	101.30	2.56	64.96
25.75	654.05	21.89	555.94	18.82	478.11	8.65	219.60	3.35	85.06	4.03	102.29	2.58	65.60
26.00	660.40	22.10	561.34	19.01	482.75	8.73	221.73	3.38	85.89	4.07	103.29	2.61	66.24
26.25	666.75	22.31	566.74	19.19	487.39	8.81	223.86	3.41	86.71	4.11	104.28	2.63	66.88
26.50	673.10	22.53	572.14	19.37	492.04	8.90	225.99	3.45	87.54	4.14	105.27	2.66	67.51
26.75	679.45	22.74	577.53	19.55	496.68	8.98	228.13	3.48	88.36	4.18	106.27	2.68	68.15
27.00	685.80	22.95	582.93	19.74	501.32	9.07	230.26	3.51	89.19	4.22	107.26	2.71	68.79