Bruce Lambert's suggestions about

HOW TO ADJUST A FIGHTER KITE FOR OPTIMUM PERFORMANCE

Here's the goal or objective for adjusting a fighter kite:

Adjust the kite so its flight characteristics match, as close as possible, the flyer's preferences for flight characteristics.

***NOTE**: I define 'optimum flight performance' as… the kite performs according to the flyer's preferred flight characteristics. There is no 'correct' or 'right' set of flight characteristics; they are all flyers' choices. These choices are usually based on what style of flying a flyer is interested in. For example, if you are interested in winning line-touch competitions you will want different flight characteristics from your kite compared with a flyer who is interested in flying a ballet routine.*

If you are not experienced enough with flying fighter kites to have particular flight preferences here are three important goals to help focus your adjustments; when a kite is adjusted so it will do the following, it's performance is close to being optimized:

1. When you provide strong flying line tension and evenly maintain that tension by pulling in or retrieving flying line, the kite flies in a straight path in the direction the nose of the kite was pointed at the time the line tension was initially applied. AND, as long as you evenly maintain that amount of flying line tension, the kite will continue to fly in that straight path.

2. The kite begins to spin or turn the moment the flying line tension is reduced.

3. During a straight horizontal flight in either direction, when the kite is at or near the edge of the wind window, the nose of the kite will turn upward, towards 12 o'clock, the moment the flying line tension is eased or reduced.

UNFORTUNATELY adjusting a kite doesn't always produce the flight characteristics you want. The kite plan used to make the kite, the materials used in its construction and the building techniques all play a role in the final performance of a kite. What's discussed in this article are adjustments you can make to any diamond shaped fighter kite and when made, may significantly improve the performance of the kite.

THIS ARTICLE IS ABOUT ADJUSTING THE MOST POPULAR STYLE OR SHAPE OF FIGHTER KITE; A DIAMOND OR DIAMOND DERIVATIVE. Optimizing the performance of a rectangular buka, square or other shaped fighter kites may require other adjustments and are not discussed in this article.

THE ADJUSTMENTS

The adjustments discussed in this article are changes you'll make in the kite compared with the kite being flat and un-tuned or un-adjusted. A kite is flat and un-tuned or un-adjusted when it is completed by the kite maker and removed from the kite makers work table.

Each kite adjustment contributes to a kite's behavior. However, all the adjustments must be in the proper relationship with each other in order for your kite to perform the way you want; no one adjustment by itself will make a kite's performance optimized.

Here is a list of adjustments discussed in this article. Each contributes to optimizing a diamond shaped fighter kite's performance. Each adjustment is discussed individually, but ALL of them must be applied to any kite you want optimum performance from.

A. **Static nose to tail balance**
B. **Spine shape**
C. **Dynamic right to left balance**
D. **Tow point location**

STATIC NOSE TO TAIL BALANCE

North American fighter kites fly differently with the nose to tail balance point at one point vs. another. The first thing to do in optimizing a fighter kite's performance is to determine its fore/aft balance point.

The balance point is created when the kite is made. The kite plan, materials and construction techniques determine the kite’s balance point. However, after the kite is made you can add a small amount of putty to the backside of the spine to easily change the balance of the kite.

When you add weight to the kite, add about a pea sized amount then check the balance. If it needs more to move the balance point to where you want it, add a small amount more, etc. Once the balance point is located where you want it, fly the kite and check its spinning characteristics. You may want to readjust the location of the balance point to achieve the performance you want.

To find the fore and aft balance point of a kite place the backside of the kite’s spine on the tip of your finger or a pencil eraser, adjust the kite’s position fore and aft, until it balances. Do this indoors or in no wind. Mark that point on the spine; that’s the static fore and aft balance point.

Now that you located the fore and aft balance point, what value does it have?

The location of the fore and aft balance point contributes to the way your kite spins. If you want your kite to enter a spin immediately or very quickly after you reduce the flying line tension, you will want the fore and aft balance point located 1" (25.4mm) or less toward the nose from the point where the spine and a line drawn from wingtip to wingtip intersect. The balance point should fall between wingtip/spine intersection and less than 1"(25.4mm) toward the nose from that point. The spin of a kite with the balance point located in this range will tend to have a spin that looks more like a rotation of the kite around the center of the kite rather than a small circle or loop.

***NOTE**: The location of the static balance point is NOT the only adjustment necessary to develop a kite's spin.*

The closer the balance point is to the wingtip/spine intersection the tighter spin or rotation the kite will have and the quicker the spin will be. The tighter or more centered a rotation the spin becomes, the faster the kite can change directions. This is because a rotation or partial rotation of the kite is the shortest distance for the nose of the kite to travel from one direction to another.

If you want your kite to spin more slowly and/or in loops or small circles instead of rotating around its center, you'll want the balance point to be about 1" (25.4mm) to 1-1/2" (38.1mm) toward the nose from the wingtip/spine intersection. With the balance point more forward, the kite will not turn or spin as readily when you reduce the flying line tension. When it does spin or turn, it creates small loops or circles.

With the balance point closer to the nose, the kite will also have a tendency to glide between line pulls. For example, when you pull and release the flying line, the kite will not stop suddenly; it will continue flying for a slightly longer period. Gliding can be a beneficial characteristic especially for indoor flying, but whether it is more important than a different style spin is a personal preference; you should test both spine styles before you decide which you prefer.

If the balance point is toward the tail from the intersection of the spine and wingtip line, the kite will center its spin near the lower bridle connection point. The kite's spin will appear centered near the tail of the kite.

Each of the different spin styles has its advantages depending on your flying style and flying goals. Most line-touch competition flyers prefer their kite's spin centered close to the center of the kite. The reason is a rotation or very tight spin is the fastest way to change kite directions. In competitions, this is very important.

ADJUSTING THE SPINE SHAPE

The first step in adjusting a fighter kite spine is to carefully look at the spine of the kite. Holding the kite so you can sight down the spine from the nose, if correctly adjusted, you should be able to see a slight rocker shaped bend in the spine. The bend should push out toward the front face of the kite.

If the spine doesn't have a bend or has a virtually non-existent one, you may want to create or increase the bend. The bend in the spine significantly contributes to the kite's spin or lack of spin. The greater the amount of bend in the spine, the easier and quicker the kite will spin. If the kite has little or no bend in the spine, the kite will have very little tendency to turn or spin when the flying line tension is reduced.

There is another affect of spine bend; the greater the amount of bend, the slower the forward speed of the kite will be. So the amount of spine bend should be the least possible to provide the amount of spin you want, but not so much as to slow the kite's forward speed.

A couple of frequently asked questions are "How much bend should a spine have? And "Where should the spine bend be located along the spine's length?"

With the kite lying with its front face on a flat surface, press down on the backside of the spine near the lower bridle connection point. This should make the lower or tail portion of the kite's spine flat on the surface. With the tail portion of the spine flat to the surface, measure the distance from the NOSE of the spine to the flat surface.

It should measure between 1/2" (12.7mm) and 1-1/2" (38.1mm). This measurement is telling you the relative amount of bend in the spine. The amount of spine bend you need is partially dependant on your preferences. When flying the kite, if you find the kite spins perfectly for you, then leave the bend as is, if it doesn't spin quickly enough, increase the bend slightly. Each time you increase the bend in the spine, increase it just a small amount; then fly the kite. Each time you fly the kite after adjusting the spine bend you will know by the change in the kite's characteristics if the increase was sufficient to make the kite spin to your liking. Continue increasing the bend, little by little until the spinning characteristic of your kite is as you want it.

The bend should begin at the nose of the kite and extend toward the tail of the spine about 6"-7" (152.4 – 177.8mm). However, the bend should not extend far enough toward the tail of the kite to reach the point where the wingtip line intersects the spine.

JUST AS IMPORTANT AS HAVING THE CORRECT LOCATION AND AMOUNT OF BEND IN THE SPINE IS HAVING THE TAIL PORTION OF THE SPINE ABSOLUTELY STRAIGHT.
Beginning at the point where the wingtip line intersects the spine and extending to the very tail, the spine should be straight; absolutely straight.

Tips on Bending a Bamboo Spine
To create a bend or increase the bend in a bamboo spine place the kite with its front face against your stomach. Then gently press on the backside of the bamboo spine, pushing it into your stomach while at the same time gently pushing the nose of the kite's spine away from your body.

Press on the backside of the spine at several points, one at a time, pressing the spine into your stomach a little. Begin at a point about 2" (50.8mm) toward the tail from the nose, continue pressing on the spine at about every 1" (25.4mm) and continue to about 5" (127mm) below the point where the bow and spine cross. This entire portion of the spine should have a gentle rocker shaped bend.

The combination of the pressure of your fingers pressing on the back of the spine and the heat from your body is sufficient to gently bend the bamboo spine. At each point where you press on the spine, hold it against the warmth of your body for a few seconds before pressing at a different point. Don't push the nose of the spine more than about 1"-2" (25.4 – 50.8mm) away from your body; otherwise you increase the risk of breaking the bamboo.

CAUTION: Bamboo can be broken by pressing too hard at any one point. Don't try to bend the bamboo sharply, it may break or weaken. *The ideal spine bend is a very gradual curve.*

Tips on Reducing the Bend in a Bamboo Spine
If the spine is bent too severely for your preference of flying, here's how you can reduce the bend. You can also use this technique for straightening the tail portion of the spine.

Place the kite against your body with the backside of the kite facing your stomach. Gently press on the front face of the kite's spine, pushing it VERY gently into your stomach. Press on it in several places, one at a time, along the portion of spine where you want less bend. At each point where you press on the spine, hold it against the warmth of your body for a few seconds before pressing at a different point.

When trying to straighten the bamboo, it is possible to break the bamboo if you put too much pressure at any one spot along the spine……use caution and be gentle.

Carbon Fiber Spines
If your kite has a spine made of carbon fiber rod or flat stock, there is usually a tension line or mechanism that creates the curve or rocker shape in the carbon fiber spine. Adjust the tension mechanism so the spine has a gentle rocker shape from the nose to a point about 5" (127mm) below the point where the spine and bow cross. If the tensioning device creates a bend that extends toward the tail past the wingtip line/spine intersection, you may want to relocate the tensioning device terminations so the bend is created only in the portion of the spine that is toward the nose from the wingtip line/spine intersection.

NOSE TO TAIL BALANCE AND SPINE SHAPE INTERACTION
As you can tell from reading the description of the nose to tail balance and the spine shape adjustments, they both affect the way the kite spins. They are closely interacting during flight. When adjusting one, the affect of that adjustment may be minimized or maximized depending on the adjustment of the other. Both need to be considered when making adjustments for optimizing the spin of your kite.

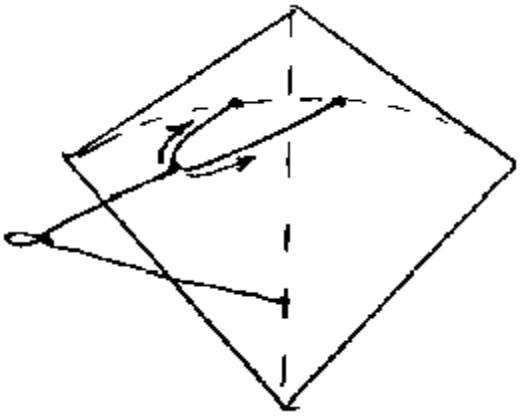
RIGHT TO LEFT BALANCE
Most North American fighter kites are virtually ' balanced', right to left, when they are made by the kite maker. This is due mainly to the use of relatively uniform synthetic materials. However, if for example, a kite builder was sloppy with the use of tape by using significantly more tape on one side of the kite compared with the other side, the kite may be slightly out of balance; slightly heavier on one side than the other.

I don't bother checking the static right to left balance. Instead of statically balancing the kite right to left, I ***dynamically*** balance the kite using the right/left bridle adjustment.

If the kite has a 3 or more point bridle, the right left static balance is automatically compensated for when the kite is dynamically balanced. The right/left dynamic balance is the balance of the kite while it's in flight. Dynamic balance takes into account not only the slight differences in weight on the right vs. the left side of the kite, but also compensates for differences in the way the kite's materials act on the right vs. left side of the kite during flight.

The dynamic balance is adjusted by positioning of the lower bridle leg’s larkshead knot along the upper bridle yoke. When flying line tension is strong and the kite is adjusted so it flies straight; **the kite is dynamically balanced right to left**.

NOTE: *The upper bridle loop or yoke is a relatively short line with each end of the line attached to the bow. The upper bridle yoke is on the front face of the kite and it crosses the spine. A larkshead knot connects the lower bridle leg to the upper bridle yoke.*



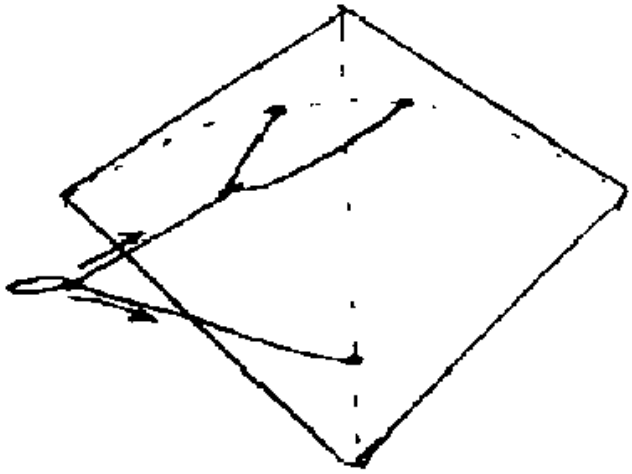
The right/left bridle adjustment is used to get the kite to fly or 'track' straight when you are applying strong tension to the flying line. It is this adjustment that determines the kite's right – left dynamic balance. You adjust it by moving the lower bridle leg's larkshead knot along the upper bridle yoke until the kite flies straight when strong tension is applied to the flying line. When the right/left bridle adjustment is correctly positioned, the kite won't have any tendency to veer or constantly turn to one side or the other!

Tips on adjusting the right/left bridle connection
If your kite is turning, spinning or veering consistently to the right, you would move the lower bridle leg's larkshead knot to the left along the upper bridle yoke. If the kite is veering to the left, you would move the larkshead knot to the right along the upper bridle yoke.

REFERENCE: *Right and left are referred as you are facing the front of the kite; the same as if you were flying the kite.*

This is an extremely sensitive adjustment. I suggest moving the larkshead knot 1/64" (0.39mm) or less and fly the kite to see if it is flying straight. If not, then move it again about 1/64" (0.39mm) and fly again. Repeat this until the kite is flying straight.

TOW POINT LOCATION
A good starting point for positioning the tow connection loop is created by what is called 'Table Tuning' a kite. It's done in no wind, usually indoors. Use a tabletop, floor or flat surface for a reference when table tuning a kite.



Position the tow connection loop at the point along the lower bridle leg that allows the kite to hang at a slight angle. When hanging from the tow connection loop, the kite hangs with its tail touching the tabletop and the nose is about 1"-2" (25.4 – 50.8mm) above the tabletop. Use the table tuning location of the tow connection loop as your starting position when adjusting the kite for normal flying.

When you're flying your kite, here's what to expect when moving the tow connection loop from its table tuning position.

Moving the tow connection loop toward the nose of the kite causes the kite to:

(a) have less pull on your flying line,
(b) fly slightly faster,
(c) spin or turn in wider circles,
(d) be less willing to fly straight or 'track' for long distances,
(e) be more willing to circle, curve or spin,
(f) be less stable.

Moving the tow connection toward the tail of the kite from the initial starting position:

(a) reduces the willingness of the kite to spin,
(b) when the kite does spin, the kite will spin in a tighter circle,
(c) causes the kite to pull harder on your flying line,
(d) causes the kite to fly slightly slower,
(e) enhances the kite's ability to fly straight or 'track',
(f) makes the kite more stable.

However, when the tow connection is moved too close to the tail of the kite, the kite will not fly forward; the kite may just hover, or may even try to fly with the tail pointing up instead of the nose!

If the tow connection loop is at an extreme position near the nose of the kite, the kite will act as though it is being deflected by the wind and will fly in large curves or circles. It won't fly straight no matter how hard you try.

A balance between the extremes is what normally works best. This adjustment is quite sensitive. Each adjustment should be about 1/8"- 1/4" (3.17 – 6.35mm). After each adjustment fly the kite to notice the affect. Stop adjusting when the kite is flying to your liking.

If you are at the flying field and don't have a 'no wind' condition available to 'table tune' the kite to find a good starting point for the tow connection point, here's a good option. Move the tow connection loop to a point on the lower bridle leg where the kite flies very slowly forward. To find this point, fly the kite, then move the tow connection loop about ½" (12.7mm) toward the tail and fly the kite again. Repeat this until you have the kite flying forward, but very slowly, the kite is almost stalled when in this condition. This means the tow connection loop is closer to the tail of the kite than for normal flying.

Once you have the kite slowly flying forward, fly the kite to see if it flies in a straight path or if it veers or turns to one side or the other. If it is flying straight, you don't need any adjustment on the upper bridle and you can skip the next step. If the kite is veering to one side, your next step is to adjust the right-left dynamic balance of the kite as described above.

When you have the kite flying or tracking straight, the last step in the bridle adjustment is to move the tow connection loop toward the nose of the kite. Move it about 1/4" (6.35mm), fly the kite and see if it flies as you want. If not, move the tow connection loop another 1/4" (6.35mm) and fly it again. Repeat this until the kite's flying as you want it to.

NOSE TO TAIL BALANCE, SPINE SHAPE AND TOW POINT LOCATION INTERACTIONS
Although the three adjustments mentioned above are independently adjusted, they all interact with each other during flight. For example, when the tow connection point is moved, it changes the affect of the spine shape and the affect of the kite's nose to tail balance. It is because of the constant interaction of the various adjustments that makes it important for you to consider all adjustments every time you feel an adjustment is needed.

CORRECTLY ADJUSTING THE KITE IS LIKE 'TAMING' IT
The importance of having a correctly adjusted fighter kite can not be over emphasized. Precise adjusting makes an amazing difference in a fighter kite's flight characteristics! When correctly adjusted, the kite is totally in your control, it's predictable and you have confidence when flying it. Making the adjustments is like programming the kite to make predictable responses to the wind and to your flying line manipulations. Without correct adjustments, a flyer may blame the kite for its uncontrolled and erratic performance.

IMPORTANT TRUTHS:
A fighter kite NEVER makes mistakes in flight and it NEVER lies to the flyer!

These may seem like odd statements. But it is important to realize that the kite is never going to make a mistake in its behavior. What often happens is the flyer expects the kite to behave in a specific manner. But the flyer had not correctly adjusted the kite to allow it to behave in the expected manner, or the flyer did not manipulate the flying line in a way to allow the kite to perform as expected. In these situations some flyers blame the kite. Unless the kite is damaged, it's **NEVER** the kite's fault!!

The Wind Conditions
Because a fighter kite's adjustments are partially related to the wind conditions, each time you fly a specific kite, you may need to make minor adjustments to it. This is true even though your kite was perfectly adjusted the previous time you flew it. The difference in wind speed causes this to occur.

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