Chapter 6: The Magician's Tools: High Performance Tuning

How your kite is tuned determines how it flies. You can leave it set on the “regular performance” marks provided by the factory and probably have no problems. But if you want to fly faster or slower than normal, if you want to adjust responsiveness for fancy tricks, or if you need to modify performance for lighter or heavier winds, then you better learn how to tune.

Sport kite tuning most commonly involves adjusting the bridle lines.

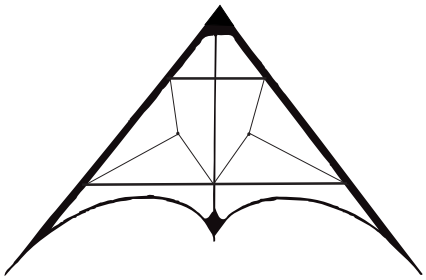
Bridles fulfill three functions on a maneuverable kite. First, they connect the kite to the two flying lines. Those lines, in turn, connect the kite to your handles and then to you. When you pull on a handle, a signal is immediately delivered to the kite at a predetermined point on its frame. Which is a long way of saying that the bridle allows you to control the kite.

The bridle also distributes the force of the wind across a number of points on the kite’s frame. When force is evenly distributed, then damage to the kite can be minimized. If the frame is made of fragile lightweight material, or if heavier wind flying is planned, more connection points can be used to further distribute the load.

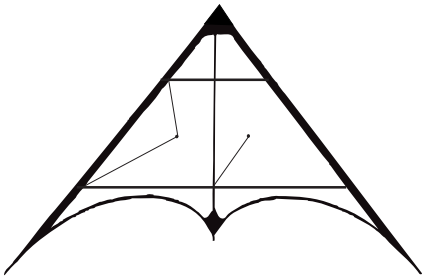
Finally, the bridle determines whether the kite leans into or away from the wind. In technical terms, this is called the “angle of attack”. Because bridles are adjustable, you can change this angle by moving the “tow point” — the place where your flylines connect to the bridle.

So when we talk about bridle tuning, what we are really talking about is shifting the tow point to change the angle of attack.

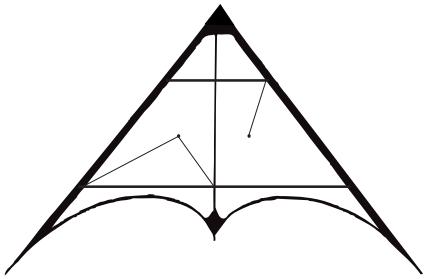
Most sport kites rely on five bridle points. Lines are tied to the frame at the four joints where the spreaders connect to the leading edge. The fifth point is where the bottom spreader contacts the center spine.



Five Point Bridle



Main Line on Leading Edge
Static Line on Center Joint



Main Line on Bottom Spar
Static Line on Top Spar

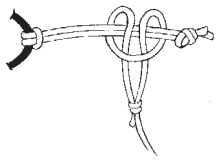
Usually, one long line runs between two connection points on each side of the sail. We call this the “Main Line”. It may go from the bottom to the top leading edge joint, or from the lower leading edge joint to the center spine. Another shorter line connects the remaining bridle point with the Main Line at the tow point. We call this shorter line the “Static Line”.

Another thing to notice is how your flying lines are connected to the tow point. Every sport kite you look at will be a little different. Some use clips and swivels, others provide a loop of line that you can larkshead onto.

Go take a quick look at your kite and this will make perfect sense.

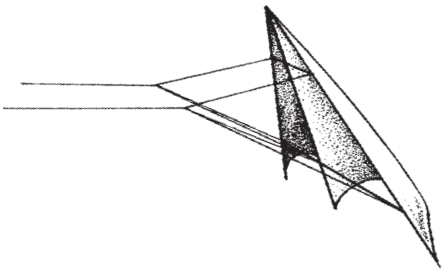
Clip-to-Line Attachment

Line-to-Line Attachment

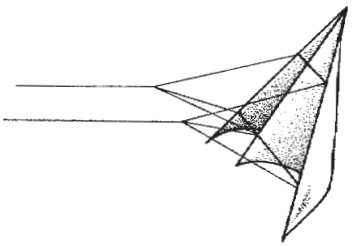


Adjusting for Performance

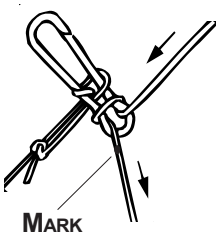
No matter how your bridle is connected to your kite or flying lines, you change the angle of attack by sliding the tow point along the Main Line. Sliding “up” pulls the kite’s nose more into the wind. Sliding “down” allows the kite to lean farther back.



Moving the Tow Point Up
Pulls the Nose Into the Wind



Moving the Tow Point Down
Pushes the Nose Away From the Wind



Some people talk about "moving the mark" when they tune. But obviously, the mark doesn't move since it is a permanent spot on the bridle line. What does move up and down on the line is the tow point.

The distinction may not seem important until you are calling out from the end of your flying lines to someone who is trying to help adjust your tuning. Make sure both of you are talking the same language.

Tuning is an imperfect science and no one setting is ideal for all flying styles and wind conditions. Experiment. Make small adjustments in the tow point setting, and see how it affects performance.

Try moving the tow point up from the mark set by the factory in increments of about one-eighth inch. Test fly the kite each time to see how it performs. At some point, the kite won't fly. Instead, it will flop over, nose first, when you try to launch. We'll call that point "maximum high".

Now move the tow point below the factory mark. Again, experiment one-eighth inch at a time. Eventually, the kite will be unable to lift off the ground. We'll call that point "maximum low".

Adjustment is a matter of personal taste. Between maximum high and low, the kite will fly. How it flies depends on where, within that range, it is adjusted. Some fliers like tight turns, others enjoy floating around the sky. Most like a mix of both. Unfortunately, no one setting will do everything.

As you experiment, here are some things you should notice:

Leaning the nose of the kite forward by sliding the tow point up will increase the angle of attack. The result will be more speed, reduced pull, the ability to fly farther out from the center of the window, and better control in turns.

Leaning the nose of the kite back by sliding the tow point down will decrease the angle of attack. The result will be more pull, less speed, and tighter turns with a tendency to overspin. Because you now have less lift, you should also find it easier to stall and hover, but more difficult to launch straight or fly far out to the edge of the window.

What this means is that fliers interested in flying fast set their tow point high. Fliers who want more pull with average speed and control use the middle range. And those who want to perfect radical maneuvers and tricks or fly fast, tight turns prefer a lower tow point setting.

Over time, the area around the tow point on your bridle may become smooth and slippery. Settings will shift on their own, which will reduce performance and frustrate the heck out of you.

Rubbing beeswax on the line will stiffen it and provide better "grip". A wax coating will also make it easier to undo tow point knots. But make sure you use beeswax and not candle wax. There is a big difference.

Remember that all of these adjustments are small and are made around the mark defined by the kite manufacturer.

Some manufacturers design kites for speed and deliberately set the mark high. Others market kites especially for tricks and set the mark low. So don't be surprised if either maximum high or maximum low is fairly close to the factory mark. The factory mark doesn't really mean anything special. Decide for yourself which position you like and make your own marks.

> *In simple terms, a quad line kite has eliminated the tow point and extended the bridle right down to your flying handles. Instead of setting just one angle of attack, you can adjust the angle in flight. This, of course, allows you to speed up, slow down, and "fall" backwards. And by manipulating the handles so that the angle on one side of the kite is different from the other, you can do some really interesting turns and loops, too.*

Tuning for Wind Changes

The force of the wind on your sail will affect your performance just as much as bridle adjustments will. The kite will move slower and lift less in lighter winds and you'll find it practically impossible to fly at all with a low tow point. In higher winds, your kite may fly too fast to control precisely.

To sustain speed and lift on light wind days, lean the nose of your kite forward by sliding the tow point up.

To reduce speed and power in stronger winds, lean the nose of your kite back by sliding the tow point down.

On particularly high wind days, lean the nose forward to spill wind from the sail and reduce stress on the frame.

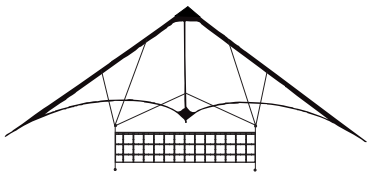
With experience, you can use tuning to expand the practical wind range of your kite, or allow consistent performance in a variety of wind conditions.

Many fliers now carry a variety of kites for different wind conditions. Some use completely different makes or sizes. Others prefer a consistent design but use several versions specially modified for high or low wind flying.

High wind kites use heavier sail fabric, reinforced frames and more bridle points to minimize damage. Often, portions of the sail will be replaced with a nylon mesh which allows the wind to pass through. Lighter wind kites replace virtually everything with components that are thinner, lighter, or smaller. They maintain performance while reducing overall weight.

As you might imagine, kites designed for extreme conditions don't perform as well in "normal" winds. So if you choose to invest in a specialized kite, use it for that purpose. Don't frustrate yourself trying to launch a heavy kite in light winds, or risk damage to a lighter kite in moderate breezes.

There are lots of tricks you can use to slow a "standard" kite in higher winds. The most popular device is an air break, often referred to as a "diaper". This is a long thin strip of nylon mesh which is attached to the tow points. Flying lines are connected to the other side of the brake.



Air brakes limit your ability to fly trick maneuvers but effectively slow kite speed. They are especially useful for precision figures on higher wind days.

Making Your Own

Taking a perfectly good bridle off your kite and making a new one is a drastic step. But it is an experience you can learn from and you can make a good kite into one better suited to your personal taste.

Regular Bridles: From a structural point of view, long bridle lines are better than short ones. Shorter lines pull the leading edge and center spine together placing tremendous stress on the cross spars. In a stronger wind, the spars are likely to break.

Longer lines cause performance problems. They create drag and turbulence close to the kite, which is the worst possible place. Long bridles also have a tendency to tangle around wingtips during ground moves and trick maneuvers.

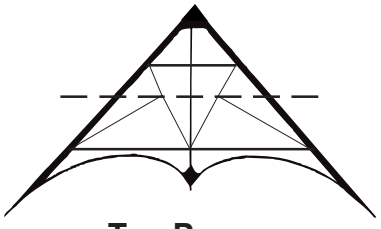
Look for a workable compromise.

Interested in trying longer bridles? Try running a "safety line" along the trailing edge of your frame.

Tie a tight, thin line from the wingtip, to the base of the spine, and then to the opposite wingtip. This simple trick will minimize tangles with spars or whiskers - especially in groundwork or trick maneuvers.

The recommended size for the long Main Line is the length of your leading edge - the distance from the kites nose to wingtip. The length of the shorter Static Line is sixty percent of the Main Line. Install the new bridle and then test it to mark your preferred tow point positions.

Remember that the marks need to be identically placed on both sides of the kite, or performance will be unbalanced.



Tow Points Must be Balanced

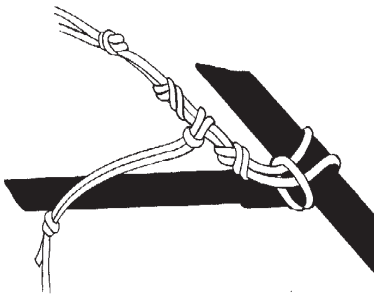
Finally, if you plan to be flying in heavier winds and are concerned about damage to your frame, consider adding a second Static Line to help distribute the force of the wind.

Connect it to the leading edge midway between the joints that attach the cross spars. Make this additional line slightly longer so that it hangs slack when not in use. This way, in normal winds, the extra line won't affect maneuverability. But in stronger winds, it will provide the support you need as the leading edge begins to bend.

The Bridle Adjuster: An alternative to shifting your tow point among various marked spots on the bridle line is to add an "adjuster" to the kite's frame.

An adjuster is a short piece of line filled with knots tied at regular intervals. It is attached to the lower part of the leading edge spar where your main bridle line would normally be tied. Then the bridle is connected to one of the knots with a larkshead. You adjust the bridle by shifting from knot to knot.

Adjust by Shifting from Knot to Knot

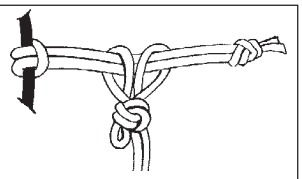


Start with a piece of line eighteen inches long. Fold it in half. Then, starting an inch-and-a-half from the fold, place a knot every half inch. Since you will, of course, need an adjuster for each side of the sail, make another one with knots placed with exactly the same spacing. If spacing is off, then the balance of your kite will be affected.

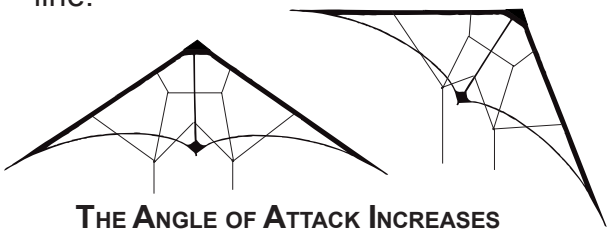
Now experiment with different knot settings for changes in performance or wind conditions. The adjuster will allow you to return to exactly the same tuning for each knot. Just remember to use the same knot on each side of the kite, and to keep your tow points balanced.

Determine the "maximum high" and "maximum low". Then you can remove any unneeded line from the adjuster.

Constantly pulling at larksheads to tie and untie them can be difficult - especially in colder weather. Try tying a knot in the end of the loop you use for each larkshead. This will give you something easier to pull on and make adjustments a snap.



The "Cheater" Bridle: If you are more interested in fast, tight turns than in other tricks, try experimenting with an extra line that connects to the leading edge at the joints where the top cross spar is attached. The rest of your bridle can then larkshead onto this new "cheater" line.



The Angle of Attack Increases As the Kite Turns

We call this a "cheater" because it increases your angle of attack as the kite turns. The kite goes faster and pulls harder. Experiment with different line lengths and see how much more you can do.